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Technical data for MISSION™ OS

1 General data

- Request No.:.....051868-1
- Project No./Nos.:.....051868-01-1/2,-02-1/2,-03-1/2,-04-1/2,
- .....-05-1/2,-06-1/2,-07-1/2,-08-1/2
- Hull No./Nos.:.....H2390, H2391, H2392, H2393,
- H2403, H2404, H2405, H2406

2 Dimensions for boiler unit

- Height to smoke outlet:.....6,588 mm
- Diameter incl. insulation:.....2,170 mm
- Extension length of the water level device:.....2650 mm
- Weight of boiler unit excl. water:.....10.6 ton
- Weight of boiler unit incl. water:.....17.1 ton

3 Water/steam process data

- Steam output per included boiler:.....4,000 kg/h
- Working pressure:.....0.70 MPa(g)
- Working temperature:.....170.4ºC
- Max. allowable working pressure:.....0.90 MPa(g)
- Feed water operation:.....Modulating
- Feed water temperature, operation:.....85-95ºC
- Feed water temperature, layout:.....60ºC

4 Data for pressure part

- Boiler type:.....Small oil fired boiler
- Boiler model:.....MISSION™ OS
- Test pressure:.....1.35 MPa(g)
- Protection of boiler body:.....Anti corrosion and heat resistant
- Insulation thickness:.....75 mm

- Cladding type:.....Trapez
- Colour of insulation plates:.....Blue(RAL5002)

5 Combustion process data

- Min. calorific value of diesel oil:.....42,200 kJ/kg
- Min. viscosity of diesel oil:.....3 cSt. at 40ºC
- Max. viscosity of diesel oil:.....12 cSt. at 15ºC
- Density of diesel oil:.....890 kg/m³ at 15ºC
- Min. calorific value of fuel oil:.....40,200 kJ/kg
- Max. viscosity of fuel oil:.....600 cSt. at 50ºC
- Density of fuel oil:.....1010 kg/m³ at 15ºC
- Turn down ratio on fuel oil:.....5:1
- Fuel oil temperature before pre-heater:.....55ºC
- Fuel oil viscosity at burner inlet:.....45-55 cSt.
- Air excess No. at 100% load:.....1.25
- Flue gas temperature (clean boiler):.....356ºC
- Air consumption at 100% load:.....5039 kg/h
- Flue gas flow (approx.):.....5339 kg/h

6 Data for pressure loss layout

- Pressure loss across air duct system, max.:.....10 mmWC

7 Data for burner

- Burner type:.....Rotary cup
- Burner regulation:.....Modulating
- Model:.....KBE 350
- Noise level for fan:.....105 dB(A)
- Primary fuel:.....Heavy fuel oil (HFO)
- Secondary fuel:.....Diesel oil (DO)
- Burner capacity on diesel oil, max.:.....287 kg/h
- Burner capacity on fuel oil, min.:.....60 kg/h
- Burner capacity on fuel oil, max.:.....300 kg/h
- Colour of burner unit:.....Makers standard

8 Data for control system

- Power consumption for boiler plant, approx.:.....Manual 21 kW
- Insulation class:.....F
- Degree of protection:.....IP44
- Colour of boiler control panel:.....Munsell 7.5 BG 7/2

9 Operational data for boiler plant

- Operation:.....24h unattended
- Automatic mode:.....Yes
- Manual mode:.....Yes
- Emergency mode:.....Yes

Technical data for MISSION™ XS-7V

1 General data

- Request No.:.....051868-1
- Project No./Nos.:.....051868-01-1/-2, 02-1/-2, 03-1/-2, 04-1/-2,
- 05-1/-2, 06-1/-2, 07-1/-2, 08-1/-2
- Hull No./Nos.:.....H2390/91/92/93/H2403/04/05/06

2 Dimensions for boiler unit

- Height excl. mountings and insulation:.....2,610 mm
- Diameter excl. mountings and insulation:.....3,770 mm
- Weight of boiler unit excl. water:.....26.2 ton
- Weight of boiler unit incl. water:.....39.3 ton

3 Water/steam process data

- Steam output per included boiler:.....3,500 kg/h
- Working pressure:.....0.70 MPa(g)
- Working temperature:.....170.4°C
- Max. allowable working pressure:.....1 MPa(g)
- Required circulation flow:.....14,000 kg/h
- Circulation water temperature:.....170.4ºC
- Pressure loss across water/steam side:.....50 mmWC

4 Data for pressure part

- Boiler type:.....Vertical smoke tube boiler
- Boiler model:.....MISSION™ XS-7V
- Test pressure:.....1.5 MPa(g)
- Protection of boiler body:.....Anti corrosion and heat resistant
- Insulation thickness:.....75 mm
- Cladding type:.....Trapez
- Colour of insulation plates:.....Blue(RAL5002)

5 Combustion process data

- Main engine:.....8K98MC
- Engine load, design:.....90%MCR
- Design condition:.....ISO
- Exhaust gas flow:.....405,000 kg/h
- Inlet temperature of exhaust gas:.....233,5ºC
- Outlet temperature of exhaust gas:.....213ºC

6 Data for pressure loss layout

- Pressure loss across boiler at design load:.....100 mmWC
- Pressure loss across inlet box:.....0.00 mmWC
- Pressure loss across outlet box:.....0.00 mmWC

7 Expansion joint for safety valve

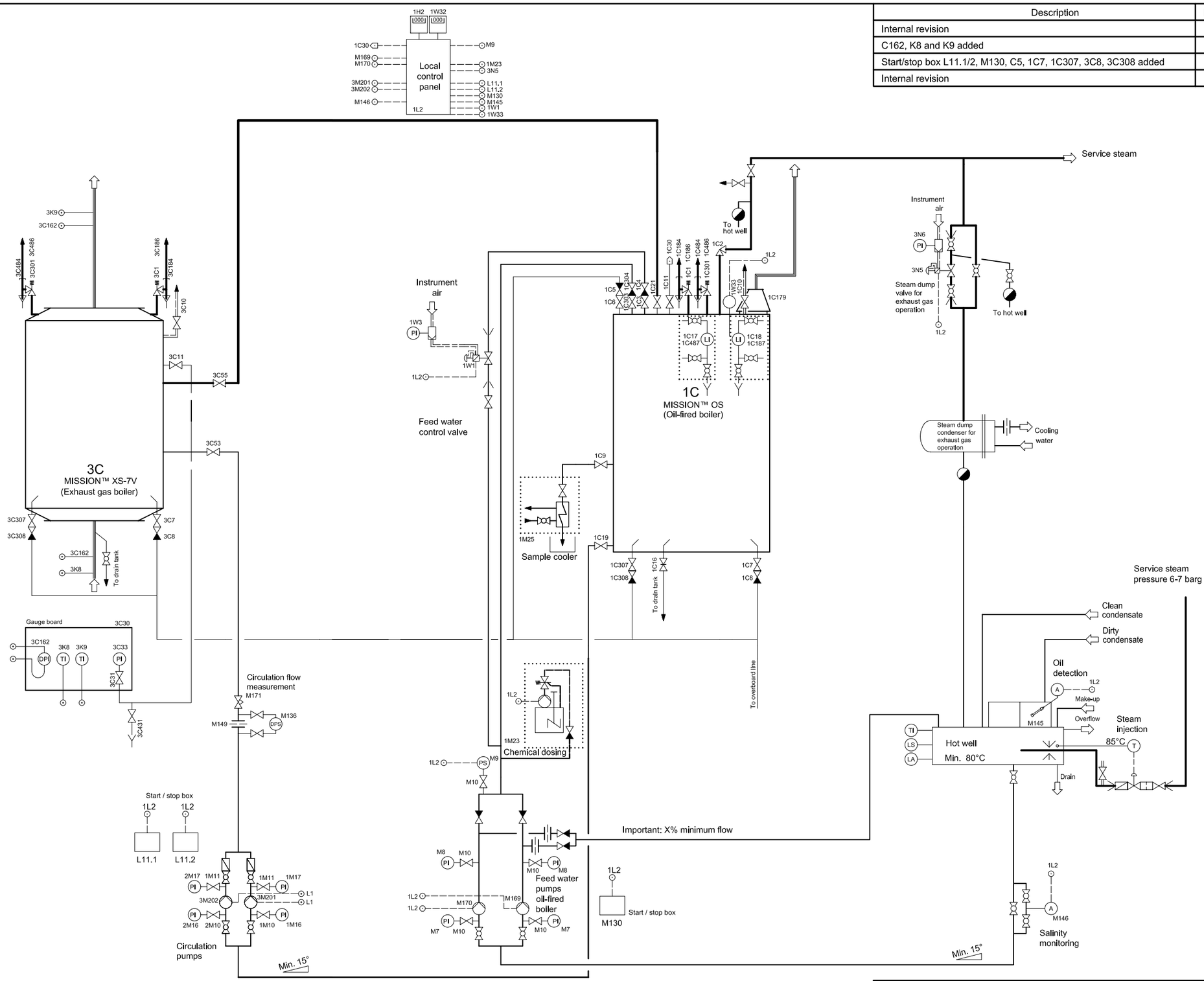
- Drawing.....85Y:013421

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Description	Index	Date	Drawn	Appr.
Internal revision	a	10JUL06	PEA	SZ
C162, K8 and K9 added	b	10OCT06	UMD	STh
Start/stop box L11.1/2, M130, C5, 1C7, 1C307, 3C8, 3C308 added	c	18JAN07	UMD	STh
Internal revision	d	16NOV07	UAP	HL



NOTE:
- Principal diagram only.
- The indicated tag nos. are for reference to part list only.
- Scope of supply is stated in the separate List of parts.
- Components: see separate List of parts.
- For electrical connections, see actual electrical wiring diagrams.

Signatures:

- Steam
- Water
- Chemicals
- Air
- Blow down/ drain lines
- Oil
- Exhaust/ flue gas
- Pre-assembled unit
- External wiring
- Capillary tube
- On page
- Off page
- Reducer
- Open drain
- Check valve
- Globe stop valve
- Gate valve
- Globe stop valve (SDNR)
- Ball valve
- Steam trap

RQ No.	RQ051868		CF No.	CF1				
Customer	Jiangnan Shipyard (Group) Co., Ltd.-Shanghai							
Society	GL + CCS	GL + CCS	CCS	CCS	CCS	CCS	CCS	CCS
Newb. No.	H2390	H2391	H2392	H2393	H2403	H2404	H2405	H2406
Project No.	051868-01-1/-2	051868-02-1/-2	051868-03-1/-2	051868-04-1/-2	051868-05-1/-2	051868-06-1/-2	051868-07-1/-2	051868-08-1/-2
Boiler No.	18111	18112	18113	18114	18115	18116	18117	18118
Boiler No.	18119	18120	18121	18122	18123	18124	18125	18126

AALBORG INDUSTRIES

Plot Date:

Title:
P & ID, Steam/ water system
1 x MISSION™OS + 1 x MISSION™XS-7V
Single service steam line

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Drawn	Date
PEA	10/07/2006
Appr.	Date
SZ	10/07/2006
Weight	Scale: / Size
- / A2	
Article/Drawing No:	Index
X01 : 042279	d

List of parts - steam/water

Boiler plant:..... 1 x MISSION™ OS + 1 x MISSION™ XS
Request No.:.....**051868**
Configuration No.:.....1
Hull Nos:.....H2390, H2391, H2392, H2393, H2403, H2404, H2405, H2406
Project Nos.:..... 051868-01-1/-2, 02-1/-2, 03-1/-2, 04-1/-2, 05-1/-2, 06-1/-2, 07-1/-2, 08-1/-2
P&I Diagram drawing No.:.....X01:042279
P&I Diagram revision.:.....d(*)
Date:.....16. November 2007

Reading guide:

List of Parts reflects parts delivered by Aalborg Industries.

Tag Numbers are given without the index used on the P&I diagram. E.g. “C2” is found on the P&I Diagram as “1C2” and “2C2” for boiler 1 and 2 respectively.

MISSION™ OS boiler

Tag No.	Qty.	Dim (DN)	Application	Type	AI supply	Datasheet or Drawing
Oil-fired boiler - MISSION™ OS (Qty. gives the number of parts *per oil-fired boiler*)						
1C	1	N/A	MISSION™ OS	-	Yes	**X01:042279**
1C1	1	50/80	Safety valve	Safety	Yes	261 1173
1C301	1	50/80	Safety valve	Safety	Yes	261 1173
1C184	1	80	Expansion joint for safety valve	-	TAO	85Y_013425
1C484	1	80	Expansion joint for safety valve	-	TAO	85Y_013425
1C186	1	N/A	Remote pull for safety valve	-	Yes	K03_032121
1C486	1	N/A	Remote pull for safety valve	-	Yes	K03_032121
*1C2	1	150	Main steam valve, angel	Stop	Yes	6010 000255
*1C3	1	50	Feed water valve	Stop	Yes	6010 000235
*1C303	1	50	Feed water valve	Stop	Yes	6010 000235
*1C4	1	50	Feed water valve	Stop SDNR	Yes	6030 000075
*1C5	1	32	Scum valve	Stop SDNR	Yes	6030 000073
*1C304	1	50	Feed water valve	Stop SDNR	Yes	6030 000075
*1C6	1	32	Scum valve	Stop	Yes	6010 000233
*1C7	1	32	Blow down valve	Stop	Yes	6010 000233
*1C307	1	32	Blow down valve	Stop	Yes	6010 000233
*1C8	1	32	Blow down valve	Stop SDNR	Yes	6030 000073
*1C308	1	32	Blow down valve	Stop SDNR	Yes	6030 000073
1C9	1	1/2"	Sample valve	Stop	Yes	6220 000002
1C10	1	1/2"	Air escape valve	Stop	Yes	6220 000002
1C11	1	1/2"	Gauge board valve	Stop	Yes	6220 000002
1C16	1	50	Furnace drain valve	Gate	Yes	253 1005
*1C17	1	25 / lenght 1450	Water level gauge left	Reflective	Yes	7010 000476

Tag No.	Qty.	Dim (DN)	Application	Type	AI supply	Datasheet or Drawing
*1C18	1	25 / lenght 1450	Water level gauge right	Reflective	Yes	7010 000475
1C187	1	N/A	Remote pull for water level gauge	-	Yes	K03_032122
1C487	1	N/A	Remote pull for water level gauge	-	Yes	K03_032122
*1C19	1	80	Circ. outlet valve	Stop	Yes	6010 000237
*1C21	1	150	Circ. inlet valve	Stop	Yes	6010 000240
*1W33	1	150	Water level meas. electrode	-	Yes	8125 000015
Other Parts						
Feed water regulation - MISSION™ OS (Qty. gives the number of parts *per oil-fired boiler*)						
1W1	1	25	Feed Water Control Valve with pneumatic actuator	Control	Yes	6050 000125
1W3	1	1/4	Filter regulator with automatic drain	0-10 barg	Yes	291 5101
Feed water pump – MISSION™ OS (Qty. gives the number of parts *per oil-fired boiler)*						
*M169	1	40	Feed water pump	-	Yes	5541 002037
*M170	1	40	Feed water pump	-	Yes	5541 002037
M7	2		Pressure gauge		Yes	663 3118
M8	2		Pressure gauge		Yes	663 2973
M9	1	3/8"	Pressure switch	10-30 bar	Yes	631 0303
*M10	5	3/8"	Instrument valve	-	Yes	87D3050
Chemical dosing – MISSION™ OS(Qty. gives the number of parts *per oil-fired boiler*)						
*1M23	1	N/A	Chemical dosing – oil-fired boiler	-	Yes	9296 006004
Sample coolers – MISSION™ OS (Qty. gives the number of parts *per oil-fired boiler*)						
1M25	1	N/A	Sample cooler – oil-fired boiler	SCS20	Yes	875 0005
Remote indication – Steam pressure and Water level - MISSION™ OS						
*H2	1	N/A	Remote indication of Steam pressure	Digital	Yes	8000 000071
*W32	1	N/A	Remote indication of Water level	Digital	Yes	8000 000071
Smoke Outlet - MISSION™ OS (Qty. gives the number of parts *per oil-fired boiler*)						
1C179	1	400	Smoke outlet	-	Yes	**01Y:042283**
Gauge board - MISSION™ OS (Qty. gives the number of parts *per oil-fired boiler*)						
1C30	1	N/A	Gauge board (Specified on Burner Unit Diagram - therefore not shown on Water/Steam P&I-diagram)		Yes	-
Local control panel - MISSION™ OS (Qty. gives the number of parts *per oil-fired boiler*)						
1L2	1		Local Control panel	-	Yes	-

MISSION™ XS-7V boiler

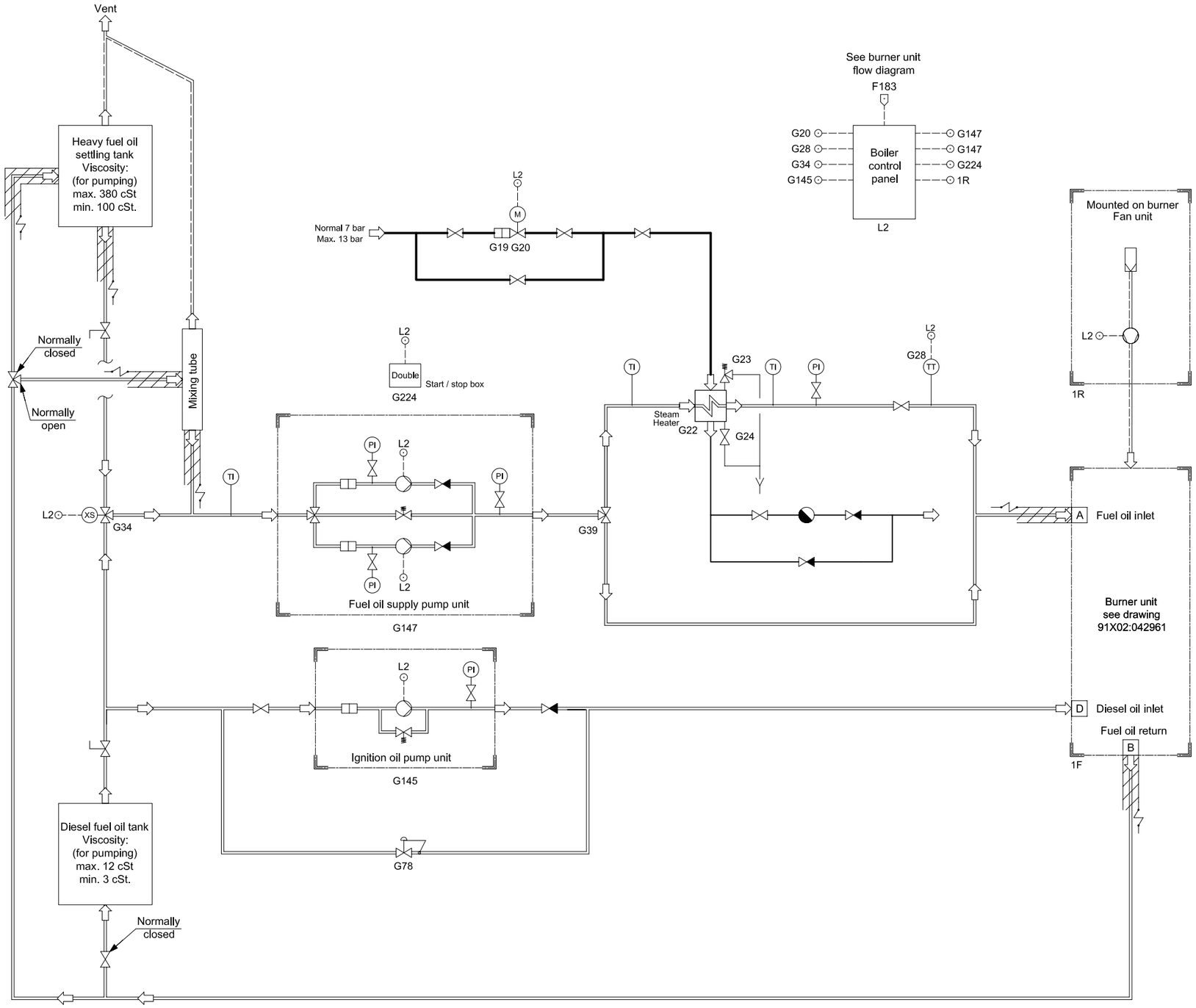
Tag No.	Qty.	Dim (DN)	Application	Type	AI supply	Datasheet or Drawing
Exhaust gas fired boiler – MISSION™ XS (Qty. gives the number of parts *per exhaust gas boiler*)						
3C	1	N/A	MISSION™ XS-7V	-	Yes	**X01:042279**
3C1	1	32/50	Safety valve	Safety	Yes	261 1171
3C301	1	32/50	Safety valve	Safety	Yes	261 1171
3C184	1	50	Expansion joint for safety valve	-	TAO	85Y_013421
3C484	1	50	Expansion joint for safety valve	-	TAO	85Y_013421
3C186	1	N/A	Remote pull for safety valve	-	Yes	K03_032121
3C486	1	N/A	Remote pull for safety valve	-	Yes	K03_032121
*3C7	1	32	Blow down valve	Stop	Yes	6010 000233
*3C307	1	32	Blow down valve	Stop	Yes	6010 000233
*3C8	1	32	Blow down valve	Stop SDNR	Yes	6030 000073
*3C308	1	32	Blow down valve	Stop SDNR	Yes	6030 000073
3C10	1	1/2"	Air escape valve	Stop	Yes	6220 000002
3C11	1	1/2"	Gauge board valve	Stop	Yes	6220 000002
*3C53	1	65	Circulation valve	Inlet	Yes	6010 000236
*3C55	1	150	Circulation valve	Outlet	Yes	6010 000240
Gauge board – MISSION™ XS (Qty. gives the number of parts *per exhaust gas boiler*)						
3C30	1	N/A	Gauge board	-	Yes	61Z:047034
3C33	1	1/2	Steam pressure gauge	-	Yes	663 2998
3C31	1	1/2	Instrument stop valve for C33	-	Yes	6220 000002
3C162	2	400 mm	Differential pressure indicator (Exhaust gas side)	U-tube manometer	Yes	649 9731
3C431	1	1/2"	Drain valve	-	Yes	6220 000002
3K8	1	100	Temperature indicator	Exhaust Inlet	Yes	8080 000017
3K9	1	100	Temperature indicator	Exhaust outlet	Yes	8080 000017
Circulation flow measurement – MISSION™ XS (Qty. gives the number of parts *per exhaust gas boiler*)						
M149	1	50	Orifice – for circulation flow	-	Yes	K18_010669
M171	1	32	Reducing valve	Stop	Yes	6010 000041
M136	1	0-1	Differential pressure switch	-	Yes	8040 000004
Circulation pump – MISSION™ XS (Qty. gives the number of parts *per exhaust gas boiler*)						
3M201	1	40/25	Circulation pump	-	Yes	5540 002004
1M10	1		Needle valve			254 1002
1M11	1		Needle valve			254 1002
1M16	1		Pressure gauge			663 3118
1M17	1		Pressure gauge			663 3121
3M202	1	40/25	Circulation pump	-	Yes	5540 002004
2M10	1		Needle valve			254 1002
2M11	1		Needle valve			254 1002
2M16	1		Pressure gauge			663 3118
2M17	1		Pressure gauge			663 3121
Steam Dump Valve						
3N5	1	80	Steam dump control valve with pneumatic actuator	Control	Yes	6050 000247
3N6	1	1/4"	Filter regulator with auto. drain	-	Yes	291 5101

Tag No.	Qty.	Dim (DN)	Application	Type	AI supply	Datasheet or Drawing
L11.1	1		Remote stop			8000 000016
L11.2	1		Remote stop			8000 000016
*M130	1		Remote start/stop			8000 000011

Boiler Plant - Common

Tag No.	Qty.	Dim (DN)	Application	Type	AI supply	Datasheet or Drawing
Hotwell – Oil Detection						
M145	1		Oil detection equipment	-	Yes	
*M145.2	1	3/4	*Sensor- 6 m cable*	-	Yes	8310 000005
*M145.1	1	N/A	*Control unit*	-	Yes	8210 000025
Salinity Control						
M146	1	N/A	Salinity control	-	Yes	
M146.1	1	N/A	*Conductive electrode*	*SL 700 E*	Yes	8620 000082
M146.2	1	N/A	*Control device*	*SL 700*	Yes	8210 000032
M146.3	1	25	*T-piece*	-	Yes	8500 000115
Boiler water test kit						
M77	1	N/A	Boiler water test kit (not shown on the diagram)	-	Yes	880 0050
Water hose and spray gun						
C191	1	N/A	Water hose and spray gun (not shown on the diagram)	-	Yes	294 1001

Description	Index	Date	Drawn	Appr.
Steam heater added.	A	12.01.07	SLJ	SøK
G18, G99, G45, G45.1 & XS for G39 removed.	B	22.10.07	SLJ	HOv
PT and TS removed.	C	22.10.07	SLJ	AP
LIst of parts updatede	d	12NOV07	UAP	HL



Notes

- Components specified by tag nos. are supplied by Aalborg Industries.
- Tag nos. : See separate list of parts.
- Electrical connections : See actual electrical wiring diagrams.
- Welding details : See drawing no. 90K:030430.
- Connections marked ☒: See burner arrangement drawing .
- All piping carrying heavy fuel oil must be heat traced (steam or electrical) and insulated.
- Insulation & heat tracing : Yard supply.

Material for piping system

TYPE	MATERIAL	STANDARD
Pipes > ø12 (Main pipes)	St. 35.8 I / St. 37.8 I	DIN 17175 / 17177 / 1630
Pipes ø12 (Instrument pipes)	St. 37.4	DIN 1630
Reducers > ø12 (Butt weld)	St. 35.8 I / St. 37.8 I	DIN 17175 / 17177
Elbows > ø12 (Butt weld)	St. 35.8 I / St. 37.8 I	DIN 17175 / 17177
Tee-piece > ø12 (Butt weld)	St. 35.8 I / St. 37.8 I	DIN 17175 / 17177
Connectors (Cutting ring)	Steel DIN 3859	DIN 2353 / ISO 8434-1 & 4
Flanges (PN40)	C22.8	DIN 17243
Threaded sockets	St. 35.8 I	ISO 228-1 (Cyl. Male threads)

Technical Data

MEDIUM	WORKING PRESS. (BARG)	DESIGN PRESS. (BARG)	DESIGN TEMP. (° C)	TEST PRESS. (BARG)
FUEL OIL (suction side)	0 - 2	7	120	10.5
FUEL OIL (delivery side)	2 - 5	10	120	15
STEAM	6 - 16	16	SAT.	28.5

Signatures

Steam
Water
Chemicals
Air
Blow down/drain lines
Heat tracing
Oil
Exhaust gas
Insulation

Globe stop valve (SDNR)
Globe stop valve
On page electrical connection
Off page electrical connection
Water seperator
Ball valve
Strainer

Customer	Jiangnan Shipyard							
Society	GL&CCS	GL&CCS	CCS	CCS	CCS	CCS	CCS	CCS
Newb. No.	H2390	H2391	H2392	H2393	H2403	H2404	H2405	H2406
Project No.	051868-01-1	051868-02-1	051868-03-1	051868-04-1	051868-05-1	051868-06-1	051868-07-1	051868-08-1
Boiler No.	18111	18112	18113	18114	18115	18116	18117	18118

AALBORG INDUSTRIES

Plot Date:

Title: P & ID, Fuel oil supply system
1 x KBE 350
Flow diagram

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Drawn	Date
SLJ	12.09.2006
Appr. JMN	Date 12.09.2006
Weight	Scale: - / Size A2
Article/Drawing No: 91X02 : 042965	Index d

List of parts - Fuel Oil Supply

Boiler plant concept:.....1 x MISSION™ OS
Request:.....**RQ051868**
Hull No.(s):.....H2390, H2391, H2392, H2393, H2403, H2404, H2405, H2406
Order(s):.....051868-01-1, 051868-02-1, 051868-03-1, 051868-04-1,
.....051868-05-1, 051868-06-1, 051868-07-1, 051868-08-1
P&I Diagram drawing No.:.....**91X02:042965**
P&I Diagram revision.:.....d
Date:.....16. November 2007

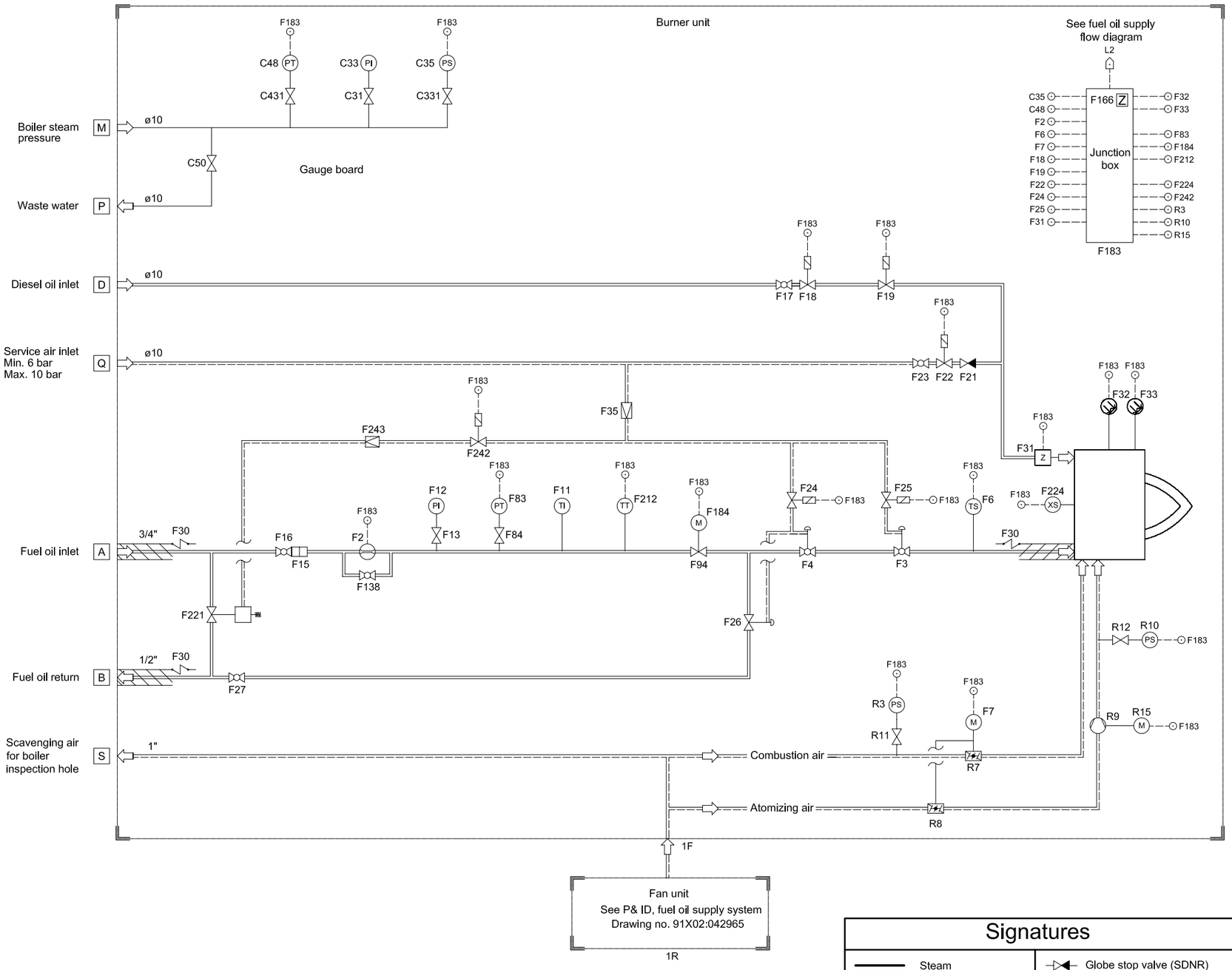
Reading guide :

N/A : Not Applicable.

1 KBE

Tag No.	Qty.	Dim (DN)	Application	Material	Datasheet or Drawing
1F	1	KBE350	Burner unit	-	91Y:042963
G19	1	15	Strainer	-	7040 000041
G20	1	15	Steam regulating valve	-	6050 000144
G22	1	N/A	F.O. heater	-	8640 000181
G23	1	1/2"	Safety valve	-	87S0032
G24	1	1/2"	Drain valve	-	666 6106
G28	1	N/A	Temperature transmitter	-	8060 000023
G34	1	32	Three-way valve (incl. micro switches)	-	6070 000013
*G39	1	20	Three-way valve	-	6070 000059
G78	1	1/2"	Pressure relief valve DO	-	87S0031
G145	1	ø10 tube	Ignition oil pump	-	4800 000063
G147	1	DS1/750.32	Fuel oil supply pump unit	-	5750 000724
G224	1	N/A	Remote start/stop box	-	8001 002002
L2	1	N/A	Boiler control panel	-	-
1R	1	N/A	Fan unit	-	5550 000252

Description	Index	Date	Drawn	Appr.
El-heater removed.	A	12.01.07	SLJ	SøK
Item F243 + F242 added.	B	15.11.07	SLJ	STh



Notes

- Components specified by tag nos. are supplied by Aalborg Industries.
- Tag nos. : See separate list of parts.
- Electrical connections : See actual electrical wiring diagrams.
- Welding details : See drawing no. 90K:030430.
- Connections marked ☒: See burner arrangement drawing .
- All piping carrying heavy fuel oil must be heat traced (steam or electrical) and insulated.
- Insulation : Yard supply.

Material for piping system

TYPE	MATERIAL	STANDARD
Pipes > ø12 (Main pipes)	St. 35.8 I / St. 37.8 I	DIN 17175 / 17177 / 1630
Pipes ø12 (Instrument pipes)	St. 37.4	DIN 1630
Reducers > ø12 (Butt weld)	St. 35.8 I / St. 37.8 I	DIN 17175 / 17177
Elbows > ø12 (Butt weld)	St. 35.8 I / St. 37.8 I	DIN 17175 / 17177
Tee-piece > ø12 (Butt weld)	St. 35.8 I / St. 37.8 I	DIN 17175 / 17177
Connectors (Cutting ring)	Steel DIN 3859	DIN 2353 / ISO 8434-1 & 4
Flanges (PN40)	C22.8	DIN 17243
Threaded sockets	St. 35.8 I	ISO 228-1 (Cyl. Male threads)

Technical Data

MEDIUM	WORKING PRESS. (BARG)	DESIGN PRESS. (BARG)	DESIGN TEMP. (° C)	TEST PRESS. (BARG)
FUEL OIL (suction side)	0 - 2	7	120	10.5
FUEL OIL (delivery side)	2 - 5	10	120	15
STEAM	6 - 16	16	SAT.	28.5

Signatures

Steam	Globe stop valve (SDNR)
Water	Globe stop valve
Chemicals	On page electrical connection
Air	Off page electrical connection
Blow down/drain lines	Water seperator
Heat tracing	Ball valve
Oil	Strainer
Exhaust gas	
Insulation	

Customer	Jiangnan Shipyard							
Society	GL&CCS	GL&CCS	CCS	CCS	CCS	CCS	CCS	CCS
Newb. No.	H2390	H2391	H2392	H2393	H2403	H2404	H2405	H2406
Project No.	051868-01-1	051868-02-1	051868-03-1	051868-04-1	051868-05-1	051868-06-1	051868-07-1	051868-08-1
Boiler No.	18111	18112	18113	18114	18115	18116	18117	18118

AALBORG INDUSTRIES

Plot Date:

Title:
1 x KBE 350
Burner unit
Flow diagram

THIS DRAWING AND DESIGN SHOWN HEREIN IS THE PROPERTY OF AALBORG INDUSTRIES AND MUST NOT BE USED BY OR REPRODUCED FOR THIRD PARTY

Drawn	Date
SLJ	12.09.2006
Appr. JMN	Date 12.09.2006
Weight	Scale: - / Size A2
Article/Drawing No: 91X02 : 042961	Index B

List of Parts – KBE burner

Boiler plant concept:.....**1 x MISSION™ OS**
Request:.....**RQ051868**
Hull No.(s):.....**H2390, H2391, H2392, H2393, H2403, H2404, H2405, H2406**
Order(s):.....**051868-01-1, 051868-02-1, 051868-03-1, 051868-04-1, 051868-05-1, 051868-06-1,**
P&I Diagram drawing No.:.....**91X02:042961B**

Reading guide :

N/A : Not Applicable

1 KBE burner

Tag No.	Qty.	Dim (DN)	Application	Material	Datasheet or Drawing
1F	1	350	Rotary Cup Burner	-	91Y:042963
F2	1	3/4"	Oil flowmeter	-	6634047
F3	1	3/4"	Shut off valve – 2 way with actuator	-	6010000054+6638650
F4	1	3/4"	Shut off valve – 2 way with actuator	-	6010000054+6638650
F6	1	N/A	Temp switch – elec. Tracing	-	6639041
F7	1	N/A	Servo motor – for air damper	-	5530000069
F11	1	N/A	Temperature indicator	-	6633008
F12	1	1/4"	Pressure gauge, FO pressure	-	6633119
F13	1	1/4"	Instrument valve	-	6666006
F15	1	3/4"	Strainer – FO	-	7040000063
F16	1	3/4"	Stop valve – FO inlet	-	6010000054
F17	1	N/A	Stop valve, ball, oil ign. burner	-	6666006
F18	1		Solenoid valve – oil ign. Burner	-	6638146
F19	1		Solenoid valve – oil ign. Burner	-	6638146
F21	1	12mm	Non return valve	-	6638103
F22	1		Solenoid valve	-	6638146
F23	1	1/4"	Stop valve	-	6666006
F24	1		Solenoid valve, air for F4	-	6666232
F25	1		Solenoid valve, air for F3	-	Part of F24
F26	1	1/2''	Stop valve with actuator (normal open)	-	6638152
F27	1	1/2''	Stop valve – Fuel oil return	-	6641120
F30	1		Electrical tracing	-	6639099
F31	1	N/A	Ignition burner	-	6638126
F32	1	N/A	Flame scanner	-	6639045
F33	1	N/A	Flame scanner	-	6639045
F35	1	1/8''	Filter regulator for valve actuator	-	6639046
F83	1	½"	Pressure transmitter – fuel oil	-	8010000012
F84	1	½"	Instrument stop valve	-	87D3050

F94	1	3/4''	Flow control valve	-	6050000376
F138	1	3/4"	Stop valve	-	6010000054
F166	1	N/A	Ignition transformer 1 x 230V	-	6638148
F183	1	N/A	Junction box	-	6605410
F184	1	N/A	Servo motor - oil flow valve	-	5530000069
F212	1	N/A	Temp. transmitter 0 – 100 ºC, 4- 20 mA	-	8060000029
F221	1	1/2"	Control valve – fuel oil pressure	-	6050000355
F224	1	N/A	Limit Switch – burner in position	-	6638145
F242	1	1/8"	Solenoid 3/2	-	6666230
F243	1	1/4"	Pressure reduction station	-	8000000031
R3	1	N/A	Pressure switch	-	6639010
R7	1	N/A	Air damper for combustion air	-	Part of 1F
R8	1	N/A	Air damper for atomising air	-	Part of 1F
R9	1	N/A	Fan – atomising air	-	Part of 1F
R10	1	N/A	Pressure switch	-	6639010
R11	1	1/4"	Stop valve	-	6666006
R12	1	1/4"	Stop valve	-	6666006
R15	1	N/A	Fan/burner motor 3x440V, 60Hz	-	5530000088
C31	1	1/2"	Instrument valve	-	87D3050
C33	1	N/A	Pressure gauge	-	6632898
C35	1	N/A	Pressure switch – max steam pressure	-	6310330 / 6310310
C48	1	N/A	Pressure transmitter	-	6638232
C50	1	3/8"	Drain valve	-	2573307
C331	1	3/8"	Instrument valve	-	87D3050
C431	1	1/2"	Instrument valve	-	87D3050

Note : C35 6310330 society CCS & 6310310 society GL

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MISSION™ OS boiler

1 Description

The MISSION™ OS boiler is a vertical oil-fired auxiliary marine boiler, insulated and assembled as a unit with the boiler mountings mounted on the boiler body. The boiler mountings are mainly mounted on top of the boiler body in order to allow a simple connection to the piping systems on board the ship. The burner is ready for mounting in the furnace and connection of pre-marked electric wiring. The control system supplied with the MISSION™ OS boiler unit provides fully automatic operation of the boiler and burner.

1.1 Boiler pressure part

The pressure part of the MISSION™ OS boiler is shown in Figure 1. Basically, the boiler is designed as a vertical cylindrical boiler with a shell surrounding a cylindrical furnace, and a convective section consisting of pin tube elements.

Principle drawing of the MISSION™ OS boiler

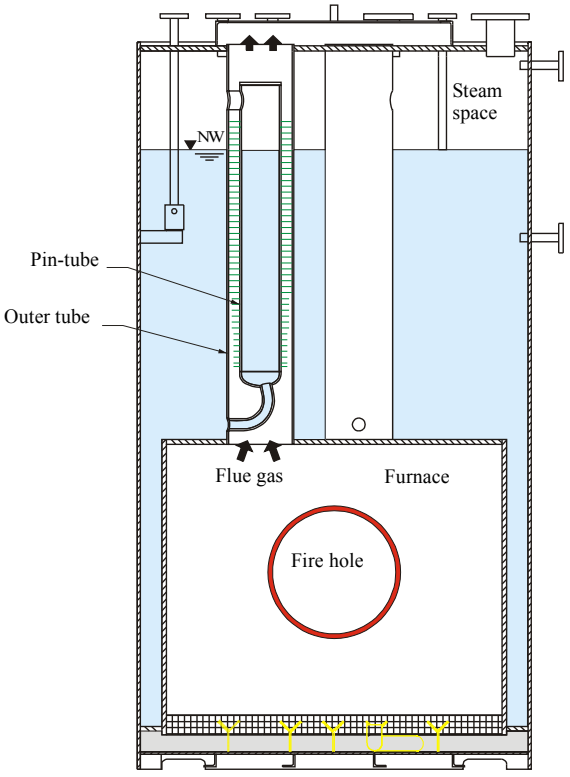


Figure 1 **sd9210_01_os_001x0063650en.wmf**

The pin tube elements consist of an outer tube enclosing the pin tube. The pin tube is a plain seamless steel tube provided with an inlet pipe at the bottom and an outlet pipe at the top. A large number of pins are welded around the outside of the tube creating an extended heating surface. This extended heating surface transfers heat from the flue gas to the steam/water mixture in the pin tube.

The furnace floor consists of a steel plate protected from radiation of heat by refractory.

The furnace bottom is provided with a socket for drain of washing water.

As shown in Figure 1, the boiler mountings such as safety valves, steam outlet valve and water level electrode are mainly mounted on top of the boiler body in order to allow a simple connection to the piping system on board the ship.

1.2 Heat transfer and water circulation

Oil ignition and combustion take place in the furnace. The produced heat is transferred mainly by radiation from the flame to the furnace shell. Leaving the furnace the flue gases flow through the vertical uptakes where heat is transferred to the pin-tube elements mainly by convection.

On the water side the heat is transferred by evaporation of the saturated water adjacent to the furnace shell or tube wall where steam bubbles are formed. As the steam bubbles have a much lower specific density than the water, they will rise rapidly to the steam space where water and steam are separated.

The natural circulation in the pin-tube element occurs because the density of water is higher than the density of steam. The density of the water outside the pin-tube element is higher than the steam/water mixture inside the pin tube element. The difference in the static pressure at the lower connection to the pin tube creates the driving force for the circulation. The steam/water mixture is discharged into the steam space where the heavier water particles separate from the steam and flow back into the water.

The boiler is designed so that approximately half of the steam is generated in the pin-tube elements and the rest by radiation in the furnace.

1.3 Steam space

The steam space in the oil fired boiler is designed to absorb the shrink and swell volumes. However, it is advisable to avoid sudden and large load variations as this might create instability in the steam system, and cause level alarms.

It is very important to note that a boiler plant consisting of one or more exhaust gas boiler(s) using the steam space in the MISSION™ OS boiler is not designed for simultaneous operation in its basic design. In some cases the volume of the steam space should be enlarged.

Boiler mountings

1 Mountings

The following is a brief description of the most important items of the boiler mountings. The components mentioned in this section are referring to the general arrangement drawing of the boiler.

Safety valves

Two safety valves are fitted to the pressure vessel of the boiler. They are installed for security reasons, and designed to prevent the boiler pressure from rising above the design value.The safety valves must be supplied with waste steam pipes and either expansion devices or bellows.

Main steam valve

The main steam valve is a shut off/non-return valve. When closed, it isolates the boiler from the main steam line. When open, it prevents steam from flowing backwards into the boiler.

Feed water valve / feed water valve (sdnr)

Two groups of feed water valves are provided in the boiler. Each group comprises a shut-off valve and a non-return valve.The shut-off valve in the ordinary group must be open when the boiler is in operation, or if the boiler is used as a steam drum.The shut-off valves should be closed when the boiler is not in use.

Water level gauges

Two local water level gauges are connected to the front of the boiler, each gauge being provided with two shut-off valves and a drain valve.The shut-off valves, fitted at the top and bottom of the sight glass, have a quick-closing mechanism to be used in case of broken glass.The pipes from the drain cocks on the water level gauge must lead to an open drain, visible for inspection.

Blow-down valve / blow-down valve (sdnr)

One or two blow-down valves are mounted at the bottom of the boiler body. If connected to a separate drainage system the valves are of the ball type. When connected to a common drainage system two valves are provided in each group, one shut-off valve and one shut-off/non-return valve. The shut-off function is for security and the non-return function prevents steam/water from flowing into an empty boiler by mistake.

Air valve

The air/ventilation valve located on top of the boiler is a shut-off valve. It is normally closed except when the boiler is being filled or completely drained. The end of the drain pipe from the air valve must be visible in order to determine when water or steam is coming out.

Scum valve

The scum valve is mounted at the top of the boiler body. In the event of scum in the boiler, this scum can be blown off from the water surface by opening this valve. If connected to a separate drainage system the valve is of the ball type. When connected to a common drainage system two valves are provided, one shut-off valve and one shut-off/non-return valve.

Valves for WHR inlet and outlet

The boiler is provided with two circulation valves for inlet and outlet connections to the exhaust gas boiler(s).The valves should be shut-off valves, and depending on deviations in the system, these valves can also have a non-return function.

Sample valve

A sample valve is installed enabling connection to a sample cooler for taking test samples to perform boiler water analyses.

Inspection hole

A small inspection hole is provided in the furnace wall to enable inspection of the burner flame. A proportion of the air supply is bled off from the burner fan to cool the window of the inspection hole, and prevent soot deposits.

Manhole

A manhole at the boiler top allows inside inspection of the pressure vessel.Access to the furnace is gained by swinging out or removing the burner unit.

Handholes

A number of handholes are distributed regularly around the circumference of the boiler and at the bottom of the shell. These hand-holes enable inspection of the bottom part of the boiler between furnace and boiler shell.

Drain for furnace

The furnace bottom is provided with a socket for drain of the washing water.

Water level control

1 Description

The water level control is a modulating system at this type of boiler. The system is illustrated in Figure 2. The system consists of one independent safety device electrode for too low water level shut down and burner stop. For measuring and control of the water level, one capacitance level electrode is provided, and it is used to give water level alarms/shut downs and control of the regulating feed water valve.

Water level control system

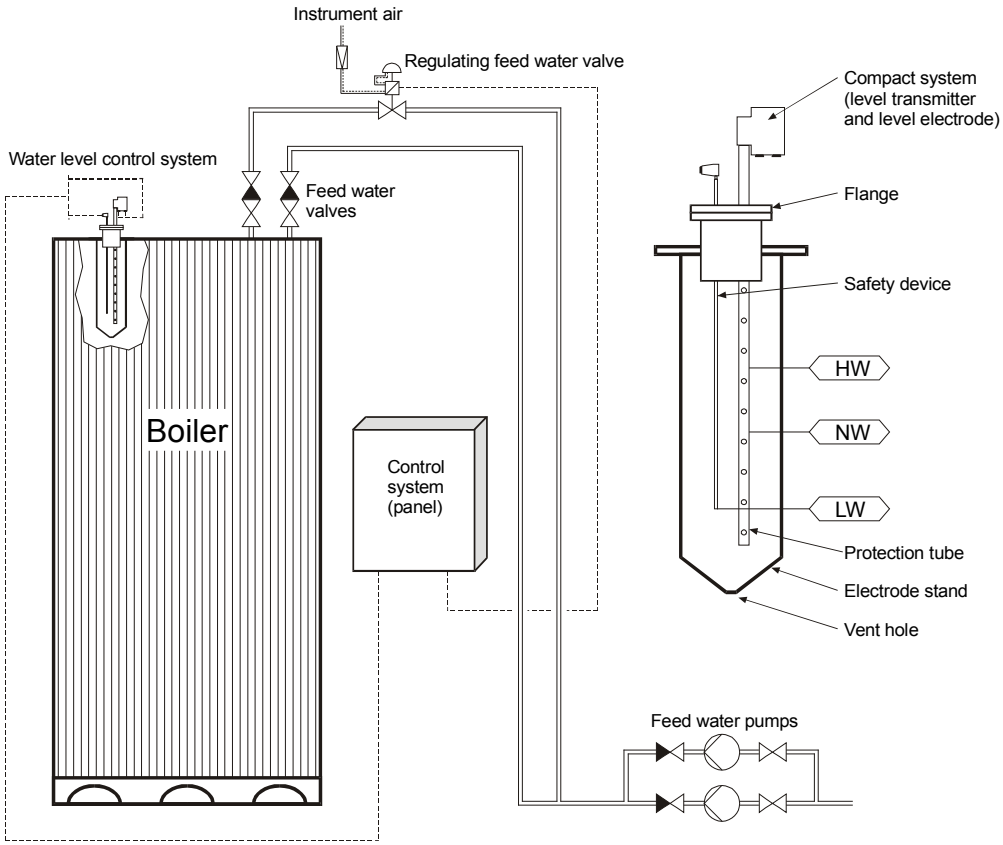


Figure 1 **sd9230_12_ges_1_x0063950en.wmf**

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Start/stop of the boiler

1 General

The following chapters of the instruction manual describe the operation and maintenance of the pressure part. As this is only a part of the complete boiler plant, it is important to study the remaining chapters in this manual very thoroughly. It is especially important that the operator of the boiler plant becomes familiar with the operation instructions of the burner and the control panel.

Important: To ensure a safe and reliable operation of the boiler plant, all operation and/or maintenance of the boiler should be carried out only by skilled personnel.

2 Start-up

When the boiler is started, the lighten-up rate of the boiler must not be accelerated too much as this might cause an unnecessary overstrain of the boiler material by quick and uneven temperature rises. It might be necessary to perform a number of start/stop sequences to reduce the lighten-up rate.

Attention: At the commissioning start-up of the boiler and after any repair work of the refractory, it is very important to further reduce the lighting-up rate. This is because the new refractory still contains a small amount of water. When heated the water vaporises and expands which might cause fissures and cracks in the refractory. The burner must therefore only be operated at minimum load and in intervals of 1-2 minutes for the first hours. Between each operation interval the burner should remain stopped for approximately 8-10 minutes.

Before start-up of the boiler plant, some general work and check procedures must be considered.

Step A: Check that the main steam valve, by-pass valve and circulation valves if provided, scum valve, and blow-down valves are closed.

Step B: Open the feed water valves and the air valve. Fill the boiler with feed water to approximately 50 mm below normal water level. The water level rises due to expansion when the boiler is heated. If the temperature difference between the boiler and feed water exceeds approximately 50ºC, the boiler must be filled very slowly.

Note: When filling a pressure less boiler, the shut-off valve after the feed water pump must be throttled. Otherwise the pump motor will be overloaded.

Step C: Check the water level in the water level gauges. Check frequently during the complete start-up. The water level gauges should be blown down several times to ensure a correct indication.

Step D: Check that the water level control system is connected and operational.

Step E: Check the oil system and start the fuel oil supply pump. Pre-heat the fuel oil if the burner should operate on heavy fuel oil.

Step F: Check the burner and the safety functions according to the separate instruction.

2.1 Start and pressure rise

The following work procedures must be followed during start-up of the boiler.

Step A: Check that the gauge board valve and pressure gauge valves are opened.

Step B: Check that the air valve is open if the boiler pressure is below 1.0 barg.

Step C: Start the burner on manual control and on low load. Check that the water level does not rise too high during the pressure rising period.

Step D: Drain via the blow down valves if the water level is too high.

Step E: If the air valve was opened close it when only steam blows out. A pressure reading should be indicated on the boiler pressure gauge before the air valve is closed.

Step F: Tighten all covers such as manholes, hand holes, inspection doors, etc. during the pressure rising period. If required, check all flange joints on the plant.

Step G: Change to automatic control of the burner when the boiler pressure is 0.5 barg lower than the working pressure of the boiler.

Step H: Open the by-pass valve slowly to heat-up and pressurise the steam system. If the boiler is not provided with a by-pass valve, the main steam valve should be used to heat-up and pressurise the steam system.

Step I: Open the main steam valve and close the by-pass valve.

Step J: Open the valves to the steam consumers carefully in order to avoid water chocks.

Step K: When the boiler is in normal operation, check that the water level control system and the gauge board functions are fully operational.

Note: After 3-4 weeks in operation, mud and deposits in the piping system may have accumulated in the boiler water. This may cause level variations which disturb the steam generation, and it is therefore recommended to blow down the boiler. It should then be inspected, cleaned, and refilled with boiler water.

3 Boiler stop

3.1 Normal boiler shut down

If necessary, the boiler can be shut down at any load without special preparations.

Note: When the boiler is stopped, sudden temperature and pressure drops should be avoided as they might expose mountings, pipe lines, and the boiler plant to inadmissible temperature gradients.

Step A: When minimum load is obtained, stop the burner.
Step B: Keep the water level at normal level until the boiler stops producing steam.
Step C: Stop the feed water pump and close the feed water valves.
Step D: Close the main steam valve.

3.2 Emergency shut down

The boiler must be taken out of service immediately if:

- parts of the heating surface have been glowing or the boiler shows recognisable deformations. The supervising authorities must be informed, and the boiler must not be used until approval from these authorities is available
- a substantial loss of water is noted
- the feed water system is unable to provide the necessary amount of feed water, e.g. due to failure of parts
- the safety valve cannot function
- sudden cracks or damage are noted in the refractory, and if steam or moisture is coming out of the refractory
- oil in the feed water is detected
- too high salinity level is detected

If an emergency shut down must be carried out, the fuel supply should be stopped. The main steam valve should be closed gradually, and the boiler must be cooled. The safety valves must not be operated. Parallel working boilers should be disconnected at once.

3.3 Stop for repair or inspection

The following describes the measures to be taken when the boiler is shut down for repair or inspection.

Step A: Clean the boiler from soot with water.
Step B: Operate the burner for at least 15 minutes after the soot removal to dry out the remaining water.
Step C: Stop the boiler as mentioned previously.
Step D: Check the furnace and the pin tubes with regard to cleanliness.
Step E: Empty the boiler from water and clean it. Check if lime stone appears.
Step F: Check and clean the outer fittings. Change gaskets where required.

Step G: Clean the feed water tank and feed water pipes.

Step H: Clean and grease the bearings of motor, pump, and fan.

Step I: Check and align the burner, if necessary.

Step J: If the boiler is shut down for a long period of time, the pin tubes must be thoroughly cleaned.

Step K: Check that the necessary spare parts are available. Order complementary parts in time.

Warning: It is of extreme importance that the boiler is NOT operated without water when the oil burner is in operation, e.g. due to disconnection of the water level safety devices. This will immediately cause complete break down of the boiler.

Boiler maintenance

1 Boiler maintenance

The boiler maintenance should always be executed with skill and in accordance with valid rules and regulations from the authorities, and below are given some recommendations for periodical inspections and maintenance.

1.1 Daily operation

During normal operation of the boiler some work and check procedures have to be considered every day.

Step A: Check the boiler steam pressure and the water level.

Step B: Check that the feed water control system is operational, see separate instructions.

Step C: Check the boiler water condition and make necessary countermeasures with regard to the feed and boiler water treatment. If necessary blow-down the boiler.

Step D: Check the function of the oil burner at different capacities through the inspection holes on the boiler.

Step E: Check the flue gas temperature after and/or the draft loss across the boiler. If either the temperature or the draft loss is too high, the pin-tube section must be cleaned.

1.2 Weekly routine checks

Step A: Drain each water level glass for about 10-15 seconds.

In case of contaminated boiler water or insufficient water treatment, the draining of the water level glasses must be done more often.

Step B: Check the safety water level device.

Step C: Depending on the boiler water tests blown-down the boiler. Open the blow-down valves quickly for a few seconds, and then close and open again for about 5-10 seconds.

Repeat this operation when required according to the boiler water tests.

Step D: Perform scum blow out by means of the scum valve when required. The scum blow out must be carried out until the drained water is clean.

1.3 Monthly routine checks

Step A: Test all stand-by pumps.

Step B: Check all boiler mountings for damage or leaks and repair/replace if necessary.

Step C: Check the function of the high steam pressure switch by lowering the set point or by raising the steam pressure, e.g. by closing the main steam valve slowly.

The burner must stop automatically.

2 Inspection of the boiler

2.1 Inspection of furnace

The furnace should be inspected at least twice a year. During this inspection the following issues should be taken into consideration:

- Check for cracks at the refractory lining and that the furnace walls are free from excessive soot deposits.
- Examine carefully the area opposite the burner. Too much soot deposits indicate that the burner should be adjusted.
- Check that the pin-tube elements are intact and that soot deposits are within normal limits.

2.2 Inspection of burner throat

In case of boilers with refractory in the burner opening the throat should be inspected at least once a year. During this inspection the following issues should be taken into consideration:

- Check for wear and cracks at the refractory area.
- Check for wear on ceramic felts, if fitted.
- Check for wear and cracks on burner stones, if fitted.

2.3 Inspection of boiler water side

The boiler water side (interior) must be carefully inspected at least twice a year. This inspection of great importance and without a doubt the most important of all the maintenance measures, since it has a direct influence on the boiler longevity and on the security.

At these inspections, hard deposits, corrosion and circulation disturbances can be found at an early stage, and preventive measures must be taken to avoid unexpected material damage and boiler breakdown.

Presence of hard deposits at the furnace wall and the pin-tubes reduces their heat transfer properties and decrease the capacity of the boiler.

Further, it is possible to make out if the feed water treatment has been satisfactory and if the blow-down has been carried out sufficiently.

Incorrect feed water treatment is commonly causing hard deposits or corrosion.

Insufficient blow-down will cause sludge deposits in the tubes and accumulation of sludge in the bottom of the boiler.

If hard deposits are not removed, it may lead to overheating in the boiler plate material which is exposed to the flame in the furnace wall area. This may cause material damages.

Incorrect feed water treatment does not always lead to hard deposits. For example, a too low or too high a pH-value may give an electrolytic reaction, causing corrosion in the boiler.

When the boiler interior is inspected, examine all parts carefully and be attentive to deposits, corrosion and cracks. It is advisable to pay special attention to this inspection. If any unusual signs are found, contact Aalborg Industries at once for advice.

2.4 Procedure and remarks for inspection

Step A: Shut off the boiler and allow it to cool (below 100°C).

Note: The boiler should NOT be depressurised by lifting the safety valves and then filled with cold feed water since the stress induced by too rapid cooling may cause damage.

Step B: Empty the boiler and close all valves.

If the boiler is connected to a second boiler, check that the valves between them are closed.

Step C: Unscrew and remove the manhole hatch(s) on the boiler and enter the boiler when it is sufficiently cold.

Check the welding in the boiler. A careful examination should be carried out with respect to any possible corrosion or crack formation.Special care should be taken to the water line area in the pressure vessel where oxygen pitting may occur.If deposits are found to be forming in the boiler tubes, the boiler should be chemically cleaned.It is advisable to consult a company of cleaning specialists who will examine the boiler deposits and treat the boiler accordingly.

Note: After chemical treatment the boiler should be blown-down at least twice a day for approximately one week. This will ensure that excessive sludge deposits due to chemical treatment do not collect in the bottom of pressure vessel.

2.5 Contamination

If the boiler is contaminated with foreign substances like oil, chemicals, corrosion products etc., it is very important to act immediately to avoid damages to the boiler.

Layers of thin oil films, mud, etc. exposed to the heating surfaces causes a bad heat transfer in the boiler, leading to overheating followed by burned out pressure parts. In order to remove such contamination, a boiling out or acid cleaning have to be performed immediately.

Note: Corrosion products from the pipe system or insufficient boiler water treatment may result in corrosion in the boiler itself. It is therefore important to observe that such circumstances do not occur in the system.

Boiling out

1 Boiling out

Before putting the boiler into operation for the first time, it should be boiled out to remove all protecting remedies and impurities on the boiler waterside.

The boiling out procedure is recommended to be carried out as described below:

Caution: Extreme care should be taken while handling the chemicals. The person handling the chemicals/solution should be properly dressed/protected.

Step A: Fill the boiler with a solution consisting of 4-5 kg trisodiumphosphate Na_3PO_4 per 1000 kg water. The chemicals can be added through the man-hole.

Step B: Add feed water until the solution is visible in the water gauges above "lower water level".

Step C: Close the feed water valve (pump stopped).

Caution: Do never fill feed water into the boiler if the temperature difference between boiler and feed water exceeds 50°C.

Step D: Raise steam pressure slowly to working pressure, and keep the pressure for approx. 3-4 hours with closed main steam valve.

Step E: Scum until water level is between "Normal water level" and "High water level".

By this procedure grease and other impurities are removed from the internal surfaces of the boiler.

Step F: Start skimming by opening the scum valve, and lower the water level to lower edge of "Normal water level" mark.

Step G: Close the scum valve.

Step H: Refill the boiler with feed water and start skimming again in intervals of 30 minutes for a period of two hours.

Step I: Stop the boiling out procedure by switching off the burner.

Step J: Let the boiler water rest for about five minutes.

Step K: Carry out a final skimming.

Step L: Blow off the boiler water by opening the blow down valves.

Step M: Remember to open the air escape valve, to avoid a vacuum in the boiler when the boiler pressure decreases to approx. depressurised/atmospheric pressure.

Step N: Open the manhole and let the boiler cool down to approx. 100°C.

Step O: The boiler is to be flushed with clean water on the boiler waterside, when the temperature has decreased. The flushing removes remaining impurities.

Step P: Dismantle the bottom blow down valves, for cleaning and inspection because deposits/foreign substances will usually be accumulated in these valves and cause leaking if not cleaned.

Step Q: Inspect the boiler and remove any remaining deposits and foreign substances.

Step R: Finally, new gaskets to be fitted in all hand- and manholes before refilling the boiler with water to upper edge of "Low water level".

The boiler is now ready to be taken into service.

Note: During the first two weeks in operation we recommend to carry out frequently skimming and bottom blow down to remove impurities entering the boiler from the pipe system.

Manhole gaskets and hand hole gaskets

1 Gaskets

The gaskets are of a high-tech, compressed fibre material which makes them ideal for steam.

1.1 Storage and handling

The gaskets should always be stored horizontally to avoid tensions. Also, they should be stored in clean condition and in a dark storage room.

Ideal temperature: < 25˚C.
Ideal air humidity: 50-60%.

Never bend the gaskets or damage their surfaces.

1.2 Installation

Note: For safety reasons, never re-use a gasket.

Make sure that all sealing surfaces are clean and dry. Be sure not to damage/scratch sealing surfaces while cleaning. Also check that sealing surfaces are parallel and free of damages and cracks.
All gaskets should be installed clean and dry. No form of gasket compounds can be used for installation. These might damage the gaskets and result in possible blowouts of the gaskets. The gaskets are coated with a non-sticking film.
Ensure that bolts and nuts are clean and free of corrosion and apply lubricant on the threads.The lubricant must not contaminate gaskets or sealing surfaces. Insert the gaskets carefully in the covers and place the covers with the new gaskets in the manholes/ hand holes. Ensure that the coversare centralized in the manholes/hand holes.

Make at least 4 stages to the required torque.
- Finger-tighten the bolts.
- Use 30% of the required torque.
- Use 60% of the required torque.
- Use the required torque.

1.3 Recommended torque

- Manhole : 250 Nm.
- Hand hole: 500 Nm.

1.4 Re-tightening

Re-tightening must be done in hot condition during the first 24 hours of the starting-up of the plant. Re-tightening of high-tech, compressed fibre gaskets under pressure and after a long period of operation might lead to leaking gaskets and possible blow-outs.

Cleaning pin-tube elements

1 General

In order to keep the heat transfer area sufficiently clean, the boiler has been designed with a high flue-gas velocity through the pin-tube elements. Therefore fouling will be minimised, under normal circumstances, with a correct combustion.

After a certain time in operation, soot deposits are however accumulated inside the boiler. The quantity of soot and the time of forming it, depends on factors such as oil quality, boiler load, and burner adjustment. It is impossible to specify exact time intervals in which the boiler should be soot cleaned. However, some general guidelines are given below.

There are three methods to check if soot cleaning is necessary:

- Inside inspection.
- Check of the flue gas temperature. The boiler should be cleaned if the flue gas temperature is approximately 20°C above the temperature for a clean boiler.
- Check of the pressure loss. The boiler should be cleaned if the pressure loss is approximately 20 mm WC above the pressure loss for a clean boiler.

It is recommended to keep a consecutive record of the flue gas temperature and the pressure loss related to different boiler loads for a clean boiler. These original data should be used for comparison, and it is recommended to plot the measurements in a chart like the one shown in Figure 1. In this way it is possible to monitor the fouling condition of the pin-tubes and determine when they need to be cleaned.

Checkscheme for flue gas measurement

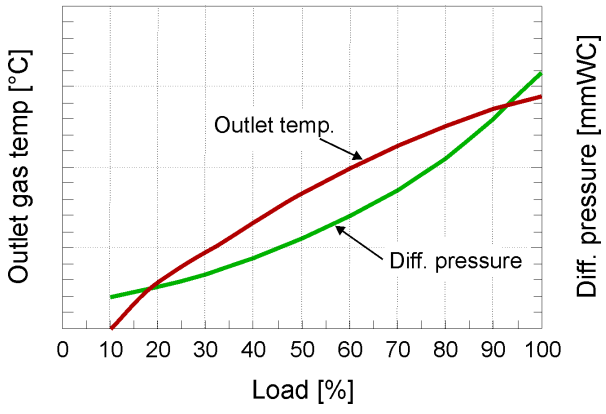


Figure 1 **om9210_12_dp_tubx0059610en.wmf**

2 Water washing procedure

The most effective way of soot cleaning is water washing, as most of the deposits consist mainly of non-soluble particles held together by a water soluble bonding material. Water washing will have the following benefits:

- Dissolves the bonding material.
- Washes the loosened insoluble deposits away.

Water washing must be carried out when the oil burner is stopped and the boiler has been cooled down. However, the boiler should be warm enough for the water to evaporate so that the pin-tube elements and furnace will not remain moist after washing.

Both fresh and sea water can be used. However, if sea water is used, the boiler must be thoroughly washed afterwards with fresh water in order to remove all salt deposits. Where deposits are highly corrosive or bonded, a soaking spray with a 10% soda ash solution is advisable before washing.

Step A: Ensure that the oil burner is stopped and remains stopped.

Step B: Wait a minimum of time allowing the boiler to cool (below 100°C).

Step C: Unlock the burner unit and swing it out of the furnace.

Step D: If loose particles or soot are found on the furnace floor remove these.

Step E: Open furnace drain valve and check that the pipe is not blocked. If the drain pipe at the furnace bottom is provided with a plug this must also be removed.

Step F: Unlock and remove the inspection hatches of the smoke outlet box located on top of the boiler.

Step G: Start water washing using a hand water lance or fire hose inserted through the inspection hatch of the smoke outlet box and direct the jet of water directly at each of the vertical uptakes. In the beginning the water supply should only be slightly opened, just enough to have a small amount of water to ensure that the drain is working properly.

Warning: When the pin-tube elements are water washed, there is a risk of generating steam. It is therefore very important that all of your body is outside the smoke outlet box in order not to get your skin burned by the steam.

Step H: When it has been ensured that the washing water is running freely down through the drain system, increase the water flow and flush carefully over each tube for 20-30 seconds. The water flow should be approximately 50 l/min at a water pressure between 4-6 bar.

Note: Care should be taken not to let water get in contact with the burner throat refractory.

Step I: It is important to check that the drain and soot collecting system are working properly during the whole water washing procedure.

Step J: When the water washing has begun, it must be completed until the pin-tube elements are thoroughly washed and all deposits are removed. This is due to the fact that some types of coatings harden and accordingly get very difficult to loosen when they have been saturated and then dry out.

Step K: When the water washing has been completed, the pin-tube elements and furnace floor must be cleaned with alkaline water because the washing water is very corrosive.

Step L: It must be ensure that all the washing water is drained away and loosened deposits are removed from the furnace floor by looking into the furnace.

Step M: Mount the inspection hatches on the smoke outlet box and secure them.

Step N: Swing the burner back into position and dry out the boiler by starting the burner fan in manual operation for approximately 15 minutes. It is essential that the boiler is dried out immediately after water washing. This is because soot formations produced by an oil burner, contains sulphur compounds. Any residual soot and water will therefore react chemically to form a highly corrosive sulphuric acid.

Step O: Check that the furnace drain pipe has not become blocked and close the drain valve. If the drain pipe at the furnace bottom is provided with a plug it will be necessary to swing out the burner again to insert the plug.

Important: The refractory in the furnace must be heated slowly up in order to let the water absorbed by the refractory evaporate slowly.

Step P: Within the first hour; start the burner at minimum load for one (1) minute. Then stop it and wait for three (3) minutes before restarting it again.

Step Q: Within the second hour; start the burner at minimum load for two (2) minutes. Then stop it and wait for two (2) minutes before restarting it again.

Step R: Within the third hour; start the burner at minimum load for two (2) minutes. Then stop it and wait one (1) minute before restarting it again.

Step S: Finally start the burner at minimum load and let it operate at that load for the next two hours.

Step T: The boiler can now be brought back into normal service. During normal operation check that the flue gas temperature is now within the correct limits.

Preservation

1 Preservation of the boiler

If the boiler is to be shutdown for a period of 1-30 days, it should be top filled to prevent corrosion. Before top filling, it should be cleaned from soot deposits.

If the boiler is to be shut down for more than one month, different methods to prevent corrosion can be applied:

- Dry preservation.
- Wet preservation.
- Nitrogen preservation.
- VCI preservation.

The work procedures related to each of these preservation methods are described in the following:

1.1 Dry preservation

When this method is applied the boiler should be totally emptied off water and dried out.

Step A: Empty the water/steam contents inside the boiler by means of the bottom blow down at a boiler pressure of 3-5 barg. Open the boiler when it is depressurised and drain offany remaining water.

Step B: Manhole doors and hand hole covers should be opened when the boiler is still hot. If there is water left in the bottom of the boiler it must be removed, e.g., by using a vacuum cleaner.

Step C: If the boiler is cold, drying of the boiler can be done by either circulating dried air from a fan or by placing bags of silicagel inside the boiler.

Step D: Before the manhole doorsand hand hole covers are closed, place a tray with burning charcoal to remove oxygen. As soon as the tray with charcoal is in position, close the manhole doors and hand hole covers using new gaskets.

Step E: Alternatively, a small steam phase inhibitor can be added to the boiler after cooling and careful draining. Afterwards the boiler should be closed completely.

1.2 Wet preservation

While dry preservation is a question of draining off water to avoid corrosion, the principle of wet preservation is to prevent oxygen from entering the boiler.

This method can be used for a short period of ‘lay-up’ (1-3 months).

Step A: The boiler is filled with treated boiler water and hydrazine is added until an excess of 100-200 ppm is obtained.

Step B: The water should be circulated continuously or at least once per week to avoid corrosion from any penetration of oxygen, and it is necessary to check the hydrazine concentration and add the necessary amount to have an excess of 100-200 ppm. Other oxygen binding agents can also be used.

The pH-value should be 9.5-10.5.

Note: If there is any risk of the temperature falling back below 0˚C, this method should not be used to avoid frost damages.

As this preservation method involves applying hydrazine to the water inside the boiler, the boiler must be completely drained and refilled with fresh water before taken into service again.

1.3 Nitrogen preservation

The boiler should be drained, dried and sealed in the same way as mentioned in section "1.1,Dry preservation".

Step A: Make a connection point to the bottom of the boiler and open the air escape valve on top of the boiler.

Step B: Connect cylinders with nitrogen to the bottom connection point via a reduction valve and purge the boiler until there is no oxygen left.

Step C: Close the air escape valve.

Step D: Leave a cylinder with nitrogen connected to the boiler via a reduction valve and keep an overpressure of approximately 0.2 bar inside the boiler.

1.4 VCI preservation

An alternative to the above mentioned preservation methods may be the use of a so-called volatile corrosion inhibitor (VCI).

The VCI is a water soluble chemical which partly evaporates and protects both the water and steam spaces of the boiler. It should be able to eliminate the need for complete drainage and/or application of nitrogen, and may in particular be interesting when a forced circulation type exhaust gas boiler is installed in the steam system. The boiler must be effectively sealed from the atmosphere to maintain the corrosion protection.

The VCI is offered by various chemical companies and must be used in accordance with their recommendations.

Boiler repair - pin-tube element

1 Repair of a pin-tube element

In the unlikely event of a leaking pin-tube element, the burner and feed water pump must be stopped and the boiler depressurised.

Step A: Open the blow-down valves and drain the boiler for water.
Step B: Removed the manhole cover.
Step C: The boiler should now be inspected in order to locate the damaged pin-tube element.

1.1 In case of a damaged pin-tube element

The pin-tube element must be blocked by welding circular plates, with the same diameter as the outer tube, at the inlet and outlet of the outer tube (see Figure 1).

The circular plates must be made of boiler plate and should be approx. 15 mm thick.

The welding must be performed by skilled personnel with knowledge and qualifications to perform certified welding.

Step A: Gain access to the damaged tube through the smoke outlet box, furnace, and/or manhole.
Step B: Before repairing a damaged pin-tube element the inner and outer tube should be cleaned.
Step C: Cut two holes in the outer tube prior to mounting the circular plates, as shown in Figure 1.
Step D: Fit and weld the circular plates at the inlet and outlet of the outer tube. After completion of the repair work clean the working area.
Step E: Close all access doors and mount the manhole cover. Replace the gasket if necessary.
Step F: Refill the boiler with feed water and check for leaks before starting up.
Step G: Start the boiler and check for leaks when the boiler is pressurised.

Note: When a pin-tube element has been plugged as described above, a new pin-tube element should be mounted as soon as possible. The boiler should NOT be operated with more than one blocked pin-tube element, without approval from the supplier.

Attention: The classification society should be notified about the repair work and a schedule must be made for exchange of the damaged tubes.

Temporary repair of pin-tube elements has naturally an influence on the efficiency since the heating surface is reduced. It can therefore be expected that the flue gas temperature will rise. It should be noted that the flue gas temperature never must exceed 400°C. If the temperature exceeds 400°C the burner must be stopped or fired at a low firing rate.

Note: Temporary repairs require more attention than a normal working boiler.

Illustration of how to block a pin-tube element

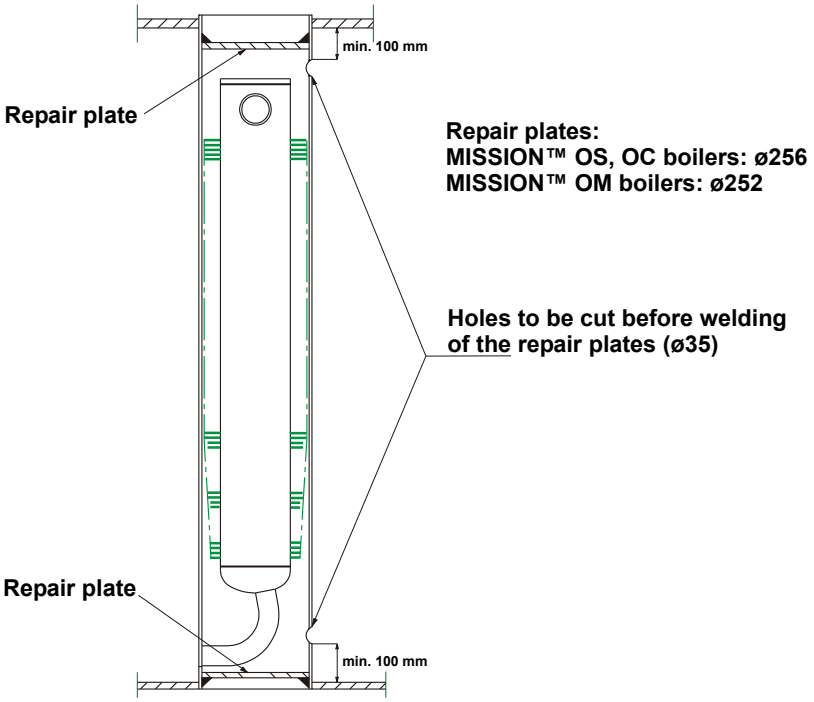


Figure 1 **om9210_20_pin_rex0059690en.wmf**

Boiler repair - refractory

1 Refractory repair

The furnace floor is lined with an insulating material (Verilite R6), close to the casing covered with a layer of castable refractory (Plicast 31).

The refractory is made with expansion joints, which should under no circumstances be blocked or filled on purpose.

Even though the refractory is made with expansion joints, it will tend to make additional natural expansion joints, which will be seen as fissures. However, the fissures will generally close when the boiler is put into service. Please note the following guidelines when examining the fissures:

- white/light fissures, which are getting darker over the time and are closing when the boiler is in service and opening in cold condition, need no further attention.
- dark/black fissures suddenly occurred, seen in cold condition and are not closing when boiler is in service need to be repaired/filled up with refractory (Plicast 31).

All refractory subjected to wear will, eventually, need to be repaired. This can be done as a temporary repair or on a permanent basis.

1.1 Temporary repair

Smaller areas can be temporarily repaired making use of the repair mix Plistix 14, supplied separately with the boiler equipment.

The durability of such a repair depends on the location, but the more exposed to heat, the shorter lifetime. Generally, it is recommended to replace a temporary repair with a repair on a permanent basis within one year.

Temporary repairs in vertical places ought to be made “swallow tailed”, see Figure 1, if possible. This secures a better attachment to the existing refractory.

Sketch indicating a "swallow tail" repair

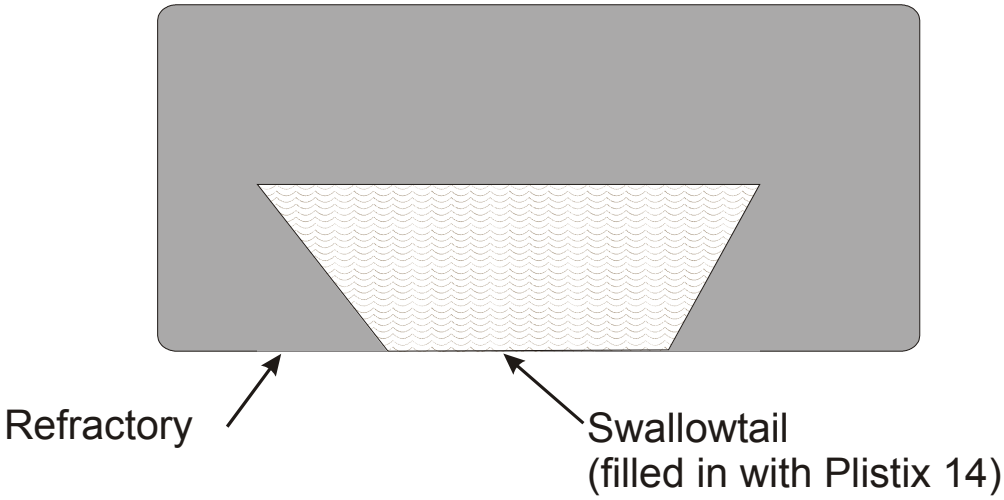


Figure 1 **om9210_25_swaltax0059780en.wmf**

The surface to which the temporary repair is performed, must always be clean, dry and rugged.

Mixing instructions for the castable refractory appears from the instruction on the plastic bucket.

Note: Plistix 14 must be applied to the site immediately when mixed.

The boiler can be lightened-up approx. 1 hour after the refractory has been applied. The refractory needs no further time for hardening.

If the boiler is pressurized, the lighting-up should be started with the burner in "on" position for one (1) minute and then in "off" for two (2) minutes, during the first half (½) hour. Then it can be started up according to the ordinary lighting-up procedure.

Note: Observe the safety rules regarding the refractory which can be seen on the plastic bucket.

1.2 Permanent repair

Major repairs and renewal of temporary repairs shall always be carried out and supervised by maker's specialists, among other things securing that correct drying-out time and lighting-up is observed.

1.3 Boilers with membrane furnace wall

The refractory applied to a damaged membrane furnace wall must be carried out as shown in Figure 2.

Refractory applied to a membrane furnace wall

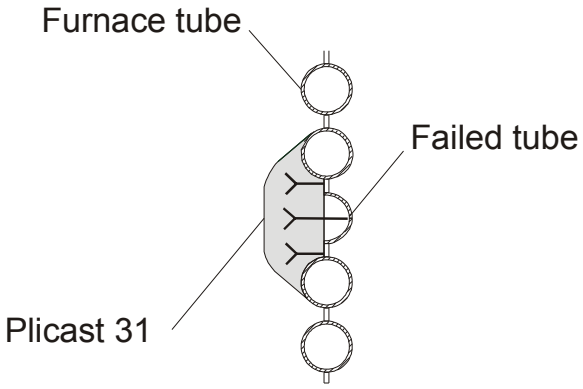


Figure 2 **om9210_25_plugrex0059770en.wmf**

Warning: Failed Y-anchors must only be replaced by Y-anchors made from heat resistant steel. Y-anchors made from incorrect materials will cause damage to the refractory.

2 Maintenance of refractory

Note: The refractory should be inspected once a year for shape and wear. It is recommended to carry out an inspection in due time prior to long repair periods such as dry docking, etc. Should a repair be required castable refractors and bricklayers can then be ordered on short notice.

If the refractory has been exposed to water, the refractory should be dried out as soon as possible. The drying out can be done by hot air (approx. 50°C) or by operating the oil burner.

Warning: However, if the burner is being used, the burner should be operated with great care.

Warning: Generated steam evaporated from water absorbed into the refractory might cause fissures and cracks when expanding, if the heat input from the oil burner is too heavy.

2.1 Typical refractory data

Below in Table 1 is a list of typical refractory data shown.

Refractory data			
	Verilite R6	**Plicast 31**	**Plistix 14**
Al_2O_3	32%	44%	48%
SiO_2	24%	46%	43%
Fe_2O_2	12%	1%	1%
TiO_2	1.6%	1%	1.9%
CaO	23.3%	6.5%	4.8%
MgO	6.1%	0.5%	0.2%
Alkanes	1%	1%	-
Na_2O	-	-	0.1%
K_2O	-	-	0.2%
Operating range	100-1000°C	20-1450°C	100-1420°C

Table 1

Lighting-up curve

1 Lighting-up curve for MISSION™ boilers

Figure 1 shows the lighting-up curve for MISSION™ boilers. When the burner is started the firing capacity must be adjusted to match the lighting-up curve. Further start/stop instructions are described in the chapter “Start/stop of the boiler”.

Lighting-up curve for MISSION™ boilers

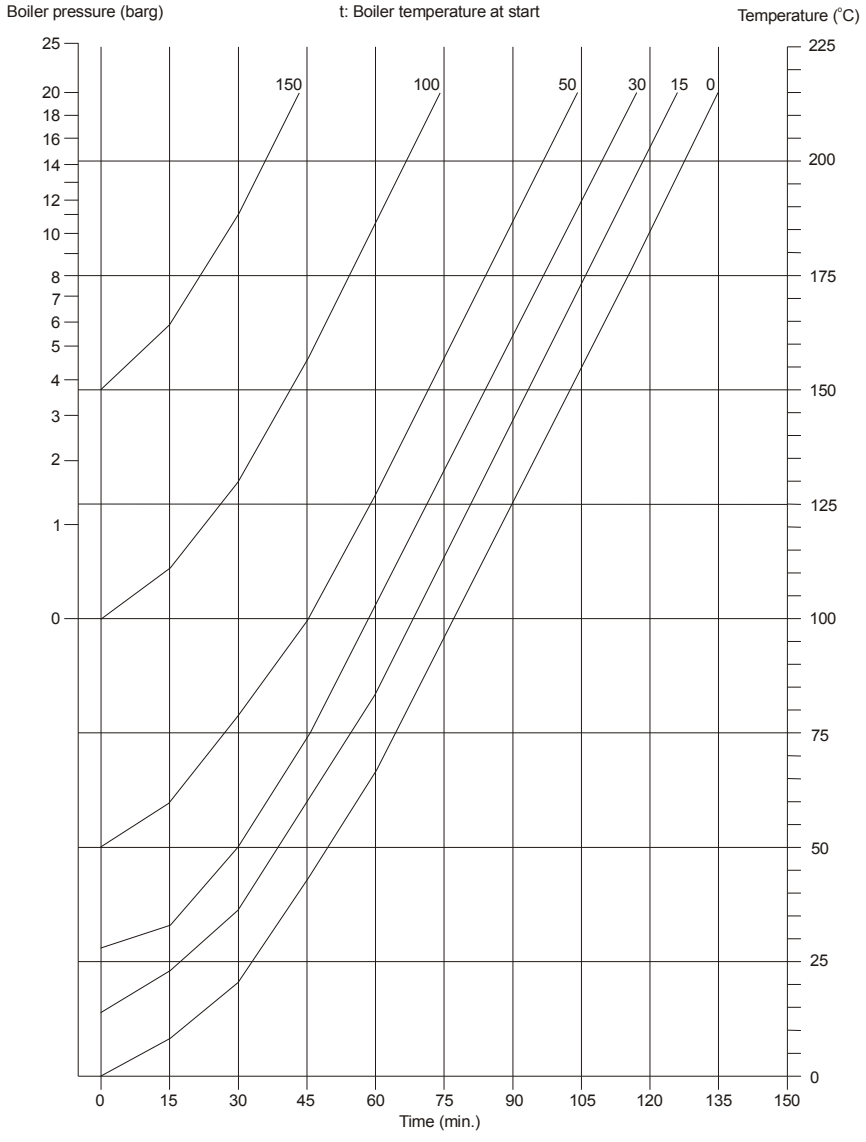


Figure 1 **om9210_31_startcx0059840en.wmf**

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Feed and boiler water

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Feed and boiler water

1 General

Note: The recommended feed and boiler water characteristics are only valid for boilers with a working pressure below 20 barg.

There is a number of ways to produce good quality feed water for boiler plants. Methods such as e.g. reverse osmosis plants or ion exchange plants produce good quality distillate. Also evaporators generally produce good distillate. The important thing is that the distillate used should be clean and without foreign salt contamination.

In practice most distillates used contain minor parts of various salt combinations which can and must be chemically treated away. Furthermore, the distillate may contain dissolved gases like for example oxygen (O_2) and carbon dioxide (CO_2) which may lead to corrosion in the boiler, steam, and condensate system.

Important: Boiler and feed water must be chemically treated in order to avoid corrosion and scaling in the boiler.

2 Layout of the treatment system

The condition of the feed and boiler water is an essential part of the boiler operation and operation philosophy. The design and construction of the treatment system should therefore be considered carefully during layout of the plant. Aalborg Industries gives some general requirements and recommendations regarding the conditions of the feed and boiler water. However, there is several ways to obtain this results, or similar, by using different treatment systems. The following should therefore be considered already at the layout stage:

- Choose the treatment system that should be used.
- Present the condensate and feed water system to the supplier of the treatment system and inform about the operation philosophy of the plant.
- Let the supplier indicate where the injection points should be located and also inform if special equipment is required.
- Let the supplier inform about which test facilities is needed.
- Purchase the recommended equipment and install it in the correct way.
- Use the treatment system as soon as the boiler is taken into operation.

3 Feed and boiler water characteristics

The following text regarding feed and boiler water treatment is the normal recommendations given by Aalborg Industries. These recommendations should be followed strictly in order to have the best working conditions for the boiler plant and to extend the working life of the plant. The requirements/recommendations of the various values for feed and boiler water are listed in Table 3 below.

Requirements for feed and boiler water			
	Unit	**Feed water**	**Boiler water**
Appearance	-	Clear and free of mud	Clear and free of mud
Hardness	ppm $CaCO_3$	0 - 5	-
Chloride content	ppm Cl^-	<15	<100
"P" alkalinity	ppm $CaCO_3$	-	100 - 150
Total (T) alkalinity	ppm $CaCO_3$	-	<2 x "P" - Alkalinity
PH-value at 25°C	-	8.5 - 9.5	10.5 - 11.5
Hydrazine excess	ppm N_2H_4	-	0.1 - 0.2
Phosphate excess	ppm PO_4	-	20 - 50
Specific density at 20°C	Kg/m^3	-	<1.003
Conductivity at 25°C	µS/cm	-	<2000
Oil content	-	NIL	NIL

Table 1

If hydrazine (N_2H_4) is not used, sodium sulphate (Na_2SO_3) can be used instead, and the excess should be 30 - 60 ppm.

In cases where other kinds of oxygen binding agents are used, it is recommended that an excess of oxygen binding agents can be measured and indicates that no oxygen has been dissolved in the boiler water.

If it is requested to measure the content of dissolved oxygen directly, it is recommended to keep the value < 0.02 ppm.

In addition to the above values, the various water treatment companies will add further demands, depending on the method used for treatment of feed and boiler water.

However, the most important point is that the above values or their equivalents are observed and that a regular (daily) test of feed and boiler water is carried out.

3.1 Units of measurement

Concentrations are usually expressed in "ppm" i.e. parts solute per million. Concentrations for parts solution by weight are the same as "mg/litre".

3.1.1 Specific gravity

As guidance the following conversion can be used:

- 1 Be° = 10.000 mg/l total dissolved solids (TDS)
- 1 mg/l total dissolved solids = 2 µS/cm
- 1 µS/cm = 1 µmho

4 Feed and boiler water maintenance

The following are recommended water maintenance instructions. More exact details concerning analyses and blow downs should be set up together with the supplier of chemicals for water treatment.

4.1

4.1.1 Daily

Step A: Analyses of feed and boiler water.

4.1.2 Weekly

Step A: Skimming (surface blow down) according to analyses, but at least once per week (2 minutes with fully open valve).

Step B: Blow down (bottom blow down) according to analyses, but at least once per week (each blow down valve 1 minute in low load condition).

4.1.3 Monthly

Step A: Check the functions for salinity and oil detection systems.

4.1.4 Every six months

Step A: The boiler water side (interior) must be carefully inspected at least twice a year.

4.1.5 Yearly

Step A: Check of the water side of the boiler and hotwell/deaerator for corrosion and scaling.

Step B: Check the chemical pump unit.

5 Treatment systems / injection points

In the following tables and illustrations a number of different feed and boiler water treatment systems are shown together with the recommended location for the injection point of the individual chemicals as stated by the manufacturer. The general information regarding the injection point principle can be used as guidelines for the most common systems. But should there be any doubt for a specific system the manufacturer/ supplier should be consulted in order to obtain the correct result.

Notes for tables/illustrations:

- Note No. 1: the preferred injection point of chemicals stated by the manufacturer/ supplier.
- Note No. 2: the alternate injection point of chemicals stated by the manufacturer/ supplier.
- Note No. 3: Valid for modulating feed water systems.
- Note No. 4: valid for on/off operating feed water systems. The chemical pump starts/stops together with the feed water pump.
- Note No. 5: valid for two boiler installation. Control of the chemicals in question work properly at an equal load condition (feed water flow) on the two boilers.

How to use the tables:

The tables can be used in different ways but the main idea is to do following:

Step A: Discover which manufacturer and type of chemicals that should be used for the actual boiler plant.

Step B: Use the name of the manufacturer and type of chemicals to select which tables that can be used.

Step C: Check the flow diagrams (Figure 4, Figure 4, or Figure 4) to find a diagram that matches the actual boiler plant.

Step D: Find in the selected tables the table which includes the matching diagram.

Step E: If more than one table is found to match the actual boiler plant in question it is recommended to use the method/table which includes note No. 1.

Step F: If no table is found to match the actual boiler plant in question it is recommended to seek assistance by the chemical manufacturer/supplier.

Chemical injection points

Manufacturer / supplier:		Ashland Chemical / Drew Marine Division			Table No. 1
Product name / method:		**Standard with Drewplex OX**			
Chemical name	**Injection point No.**	**Continuous**	**Batch**	**Note No.**	**Valid flow diagram No.**
Adjunct B	3, 3a, 3b		X	1	1, 2, 3
GC	3, 3a, 3b		X	1	
SLCC-A	3, 3a, 3b		X	1	
Drewplex OX	2, 2a, 2b	X		1, 3, 4	

Chemical injection points (continued)

Manufacturer / supplier:		Ashland Chemical / Drew Marine Division			Table No. 2
Product name / method:		**Standard with Amerzine**			
Chemical name	**Injection point No.**	**Continuous**	**Batch**	**Note No.**	**Valid flow diagram No.**
Adjunct B	3, 3a, 3b		X	1	1, 2, 3
GC	3, 3a, 3b		X	1	
SLCC-A	3, 3a, 3b		X	1	
Amerzine	2, 2a, 2b	X		1, 3, 4	

Chemical injection points (continued)

Manufacturer / supplier:		Ashland Chemical / Drew Marine Division			Table No. 3
Product name / method:		**Standard with Amerzine**			
Chemical name	**Injection point No.**	**Continuous**	**Batch**	**Note No.**	**Valid flow diagram No.**
Adjunct B	3		X		1
GC	3		X		
SLCC-A	3		X		
Amerzine	1	X		2, 3, 4	

Chemical injection points (continued)

Manufacturer / supplier:		Ashland Chemical / Drew Marine Division			Table No. 4
Product name / method:		**Standard with Amerzine**			
Chemical name	**Injection point No.**	**Continuous**	**Batch**	**Note No.**	**Valid flow diagram No.**
Adjunct B	3a, 3b		X		2, 3
GC	3a, 3b		X		
SLCC-A	3a, 3b		X		
Amerzine	1	X		2, 3, 4, 5	

Chemical injection points (continued)

Manufacturer / supplier:		Ashland Chemical / Drew Marine Division			Table No. 5
Product name / method:		**Drewplex AT / OX**			
Chemical name	**Injection point No.**	**Continuous**	**Batch**	**Note No.**	**Valid flow diagram No.**
Drewplex AT	3, 3a, 3b	X		1	1, 2, 3
Drewplex OX	2, 2a, 2b	X		1, 3, 4	

Chemical injection points (continued)					
Manufacturer / supplier:		**Ashland Chemical / Drew Marine Division**			**Table No. 6**
Product name / method:		**Drewplex AT / OX**			
Chemical name	**Injection point No.**	**Continuous**	**Batch**	**Note No.**	**Valid flow diagram No.**
Drewplex AT	2, 2a, 2b	X		2, 3, 4	1, 2, 3
Drewplex OX	2, 2a, 2b	X		3, 4	

Chemical injection points (continued)					
Manufacturer / supplier:		**Ashland Chemical / Drew Marine Division**			**Table No. 7**
Product name / method:		**Drewplex AT with Amerzine**			
Chemical name	**Injection point No.**	**Continuous**	**Batch**	**Note No.**	**Valid flow diagram No.**
Drewplex AT	3, 3a, 3b	X		1, 3, 4	1, 2, 3
Amerzine	2, 2a, 2b	X		1, 3, 4	

Chemical injection points (continued)					
Manufacturer / supplier:		**Ashland Chemical / Drew Marine Division**			**Table No. 8**
Product name / method:		**Drewplex AT with Amerzine**			
Chemical name	**Injection point No.**	**Continuous**	**Batch**	**Note No.**	**Valid flow diagram No.**
Drewplex AT	2, 2a, 2b	X		2, 3, 4	1, 2, 3
Amerzine	2, 2a, 2b	X		3, 4	

Chemical injection points (continued)					
Manufacturer / supplier:		**Ashland Chemical / Drew Marine Division**			**Table No. 9**
Product name / method:		**Drewplex AT with Amerzine**			
Chemical name	**Injection point No.**	**Continuous**	**Batch**	**Note No.**	**Valid flow diagram No.**
Drewplex AT	2, 2a, 2b	X		2, 3, 4	1, 2, 3
Amerzine	1	X		2, 3, 4, 5	

Chemical injection points (continued)					
Manufacturer / supplier:		**Ashland Chemical / Drew Marine Division**			**Table No. 10**
Product name / method:		**AGK-100 with Amerzine**			
Chemical name	**Injection point No.**	**Continuous**	**Batch**	**Note No.**	**Valid flow diagram No.**
AGK-100	2, 2a, 2b	X		1, 3, 4	1, 2, 3
Amerzine	2, 2a, 2b	X		1, 3, 4	

Chemical injection points (continued)

Manufacturer / supplier:	Ashland Chemical / Drew Marine Division				Table No. 11
Product name / method:	**AGK-100 with Amerzine**				
Chemical name	**Injection point No.**	**Continuous**	**Batch**	**Note No.**	**Valid flow diagram No.**
AGK-100	2, 2a, 2b	X		3, 4	1, 2, 3
Amerzine	1	X		2, 3, 4, 5	

Chemical injection points (continued)

Manufacturer / supplier:	Ashland Chemical / Drew Marine Division				Table No. 12
Product name / method:	**AGK-100 with Amerzine**				
Chemical name	**Injection point No.**	**Continuous**	**Batch**	**Note No.**	**Valid flow diagram No.**
AGK-100	1	X		2, 3, 4, 5	1, 2, 3
Amerzine	1	X		2, 3, 4, 5	

Chemical injection points (continued)

Manufacturer / supplier:	Marichem				Table No. 13
Product name / method:	**Standard**				
Chemical name	**Injection point No.**	**Continuous**	**Batch**	**Note No.**	**Valid flow diagram No.**
Alkalinity control	3, 3a, 3b		X	1, 3, 4	1, 2, 3
Phosphate	3, 3a, 3b		X	1, 3, 4	
Oxycontrol	2, 2a, 2b	X		1, 3, 4	
Marichem CCI	2, 2a, 2b	X		1, 3, 4	

Chemical injection points (continued)

Manufacturer / supplier:	Marichem				Table No. 14
Product name / method:	**Standard**				
Chemical name	**Injection point No.**	**Continuous**	**Batch**	**Note No.**	**Valid flow diagram No.**
Alkalinity control	1		X	2, 3, 4	1
Phosphate	1		X	2, 3, 4	
Oxycontrol	2	X		3, 4	
Marichem CCI	2	X		3, 4	

Chemical injection points (continued)

Manufacturer / supplier:	Marichem				Table No. 15
Product name / method:	**BWT new formula**				
Chemical name	**Injection point No.**	**Continuous**	**Batch**	**Note No.**	**Valid flow diagram No.**
BWT new formula	2, 2a, 2b	X		1, 3, 4	1, 2, 3
Marichem CCI	2, 2a, 2b	X		1, 3, 4	

Chemical injection points (continued)					
Manufacturer / supplier:		**Marichem**			**Table No. 16**
Product name / method:		**BWT new formula**			
Chemical name	**Injection point No.**	**Continuous**	**Batch**	**Note No.**	**Valid flow diagram No.**
BWT new formula	1		X	2, 3, 4, 5	1, 2, 3
Marichem CCI	2, 2a, 2b	X		3, 4	

Chemical injection points (continued)					
Manufacturer / supplier:		**Marichem**			**Table No. 17**
Product name / method:		**BWT**			
Chemical name	**Injection point No.**	**Continuous**	**Batch**	**Note No.**	**Valid flow diagram No.**
BWT powder	2, 2a, 2b	X		1, 3, 4	1, 2, 3
Marichem CCI	2, 2a, 2b	X		1, 3, 4	

Chemical injection points (continued)					
Manufacturer / supplier:		**Marichem**			**Table No. 18**
Product name / method:		**BWT**			
Chemical name	**Injection point No.**	**Continuous**	**Batch**	**Note No.**	**Valid flow diagram No.**
BWT powder	1		X	2, 3, 4, 5	1, 2, 3
Marichem CCI	2, 2a, 2b	X		3, 4	

Chemical injection points (continued)					
Manufacturer / supplier:		**Ashland Chemical / Drew Marine Division**			**Table No. 19**
Product name / method:		**I**			
Chemical name	**Injection point No.**	**Continuous**	**Batch**	**Note No.**	**Valid flow diagram No.**
Hardness control	3, 3a, 3b		X	1	1, 2, 3
Alkalinity control	3, 3a, 3b		X	1	
Oxygen control	2, 2a, 2b	X		1, 3, 4	
Condensate control	2, 2a, 2b	X		1, 3, 4	

Chemical injection points (continued)					
Manufacturer / supplier:		**Unitor Chemicals**			**Table No. 20**
Product name / method:		**I**			
Chemical name	**Injection point No.**	**Continuous**	**Batch**	**Note No.**	**Valid flow diagram No.**
Hardness control	1		X	2	1
Alkalinity control	1		X	2	
Oxygen control	2	X		3, 4	
Condensate control	2	X		3, 4	

Chemical injection points (continued)					
Manufacturer / supplier:		**Unitor Chemicals**			**Table No. 21**
Product name / method:		**II**			
Chemical name	**Injection point No.**	**Continuous**	**Batch**	**Note No.**	**Valid flow diagram No.**
Hardness control	3, 3a, 3b		X	1	1, 2, 3
Alkalinity control	3, 3a, 3b		X	1	
Cat sulphite L (CSL)	2, 2a, 2b	X		1, 3, 4	
Condensate control	2, 2a, 2b	X		1, 3, 4	

Chemical injection points (continued)					
Manufacturer / supplier:		**Unitor Chemicals**			**Table No. 22**
Product name / method:		**II**			
Chemical name	**Injection point No.**	**Continuous**	**Batch**	**Note No.**	**Valid flow diagram No.**
Hardness control	1		X	2	1
Alkalinity control	1		X	2	
Cat sulphite L (CSL)	2	X		3, 4	
Condensate control	2	X		3, 4	

Chemical injection points (continued)					
Manufacturer / supplier:		**Unitor Chemicals**			**Table No. 23**
Product name / method:		**Liquitreat**			
Chemical name	**Injection point No.**	**Continuous**	**Batch**	**Note No.**	**Valid flow diagram No.**
Liquitreat	3, 3a, 3b		X	1	1, 2, 3
Condensate control	2, 2a, 2b	X		1, 3, 4	
(Oxygen control)	2, 2a, 2b	X		1, 3, 4	

Chemical injection points (continued)					
Manufacturer / supplier:		**Unitor Chemicals**			**Table No. 24**
Product name / method:		**Liquitreat**			
Chemical name	**Injection point No.**	**Continuous**	**Batch**	**Note No.**	**Valid flow diagram No.**
Liquitreat	1		X	2	1
Condensate control	2, 2a, 2b	X		3, 4	
(Oxygen control)	2, 2a, 2b	X		3, 4	

Chemical injection points (continued)					
Manufacturer / supplier:		**Unitor Chemicals**			**Table No. 25**
Product name / method:		**Combitreat**			
Chemical name	**Injection point No.**	**Continuous**	**Batch**	**Note No.**	**Valid flow diagram No.**
Combitreat	3, 3a, 3b		X	1	1, 2, 3
Condensate control	2, 2a, 2b	X		1, 3, 4	
Oxygen control	2, 2a, 2b	X		1, 3, 4	

Chemical injection points (continued)					
Manufacturer / supplier:		**Unitor Chemicals**			**Table No. 26**
Product name / method:		**Combitreat**			
Chemical name	**Injection point No.**	**Continuous**	**Batch**	**Note No.**	**Valid flow diagram No.**
Combitreat	1		X	2	1
Condensate control	2	X		3, 4	
Oxygen control	2	X		3, 4	

Chemical injection points (continued)					
Manufacturer / supplier:		**Unitor Chemicals**			**Table No. 27**
Product name / method:		**I**			
Chemical name	**Injection point No.**	**Continuous**	**Batch**	**Note No.**	**Valid flow diagram No.**
Hardness control	3, 3a, 3b		X	1	1, 2, 3
Alkalinity control	3, 3a, 3b		X	1	
Hydrazine	2, 2a, 2b	X		1, 3, 4	
Condensate control	2, 2a, 2b	X		1, 3, 4	

Chemical injection points (continued)					
Manufacturer / supplier:		**Uniservice Group**			**Table No. 28**
Product name / method:		**I**			
Chemical name	**Injection point No.**	**Continuous**	**Batch**	**Note No.**	**Valid flow diagram No.**
Hardness control	1		X	2	1
Alkalinity control	1		X	2	
Hydrazine	2	X		3, 4	
Condensate control	2	X		3, 4	

Chemical injection points (continued)					
Manufacturer / supplier:		**Uniservice Group**			**Table No. 29**
Product name / method:		**II**			
Chemical name	**Injection point No.**	**Continuous**	**Batch**	**Note No.**	**Valid flow diagram No.**
Hardness control	3, 3a, 3b		X	1	1, 2, 3
Alkalinity control	3, 3a, 3b		X	1	
Oxygen control	2, 2a, 2b	X		1, 3, 4	
Condensate control	2, 2a, 2b	X		1, 3, 4	

Chemical injection points (continued)					
Manufacturer / supplier:		**Uniservice Group**			**Table No. 30**
Product name / method:		**II**			
Chemical name	**Injection point No.**	**Continuous**	**Batch**	**Note No.**	**Valid flow diagram No.**
Hardness control	1		X	2	1
Alkalinity control	1		X	2	
Oxygen control	2	X		3, 4	
Condensate control	2	X		3, 4	

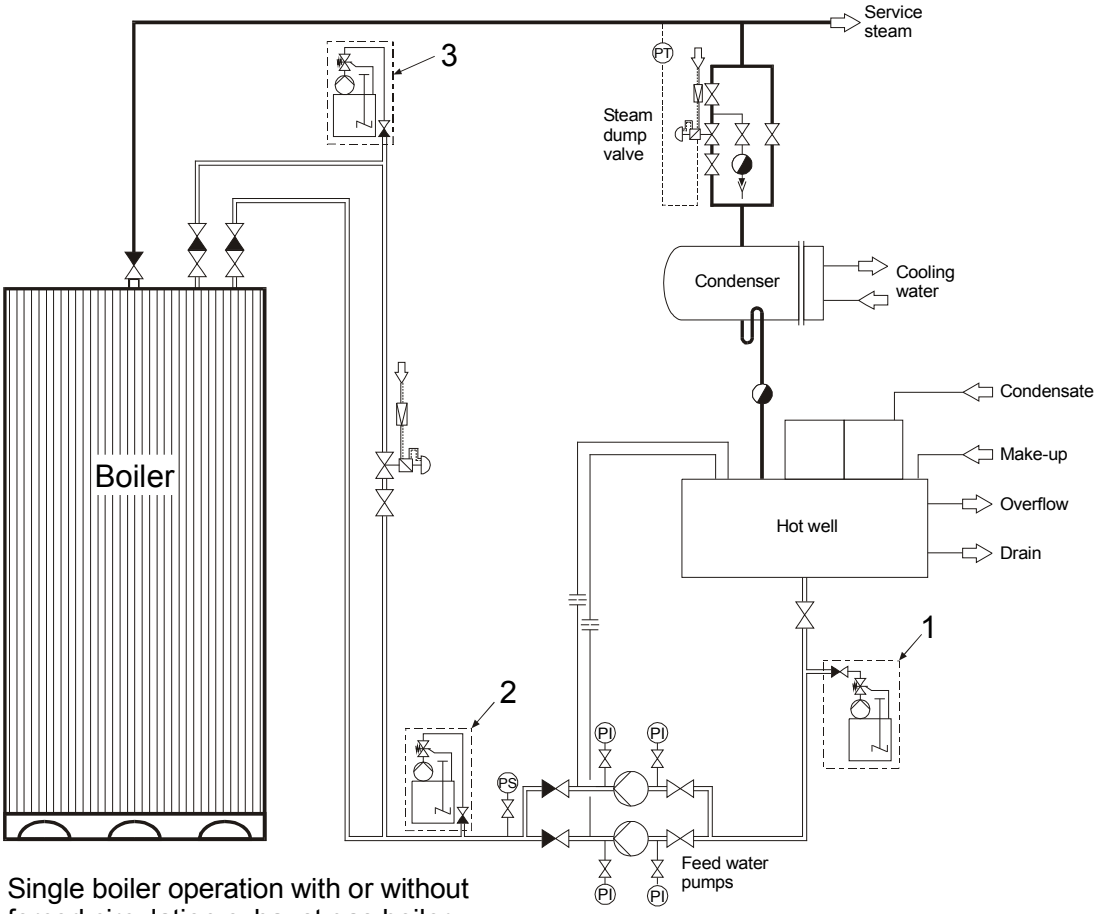
Chemical injection points (continued)					
Manufacturer / supplier:		**Uniservice Group**			**Table No. 31**
Product name / method:		**One Shot**			
Chemical name	**Injection point No.**	**Continuous**	**Batch**	**Note No.**	**Valid flow diagram No.**
BWT One Shot	3, 3a, 3b		X	1	1, 2, 3
Alkalinity control	3, 3a, 3b	X		1, 3, 4	
(Hydrazine)	2, 2a, 2b	X		1, 3, 4	

Chemical injection points (continued)					
Manufacturer / supplier:		**Uniservice Group**			**Table No. 32**
Product name / method:		**One Shot**			
Chemical name	**Injection point No.**	**Continuous**	**Batch**	**Note No.**	**Valid flow diagram No.**
BWT One Shot	1		X	2	1
Alkalinity control	2, 2a, 2b	X		3, 4	
(Hydrazine)	2, 2a, 2b	X		3, 4	

Chemical injection points (continued)					
Manufacturer / supplier:		**Uniservice Group**			**Table No. 33**
Product name / method:		**Organic Treatment**			
Chemical name	**Injection point No.**	**Continuous**	**Batch**	**Note No.**	**Valid flow diagram No.**
OBWT 3	3, 3a, 3b	X		1	1, 2, 3
OBWT 4	2, 2a, 2b	X		1, 3, 4	

Table 2

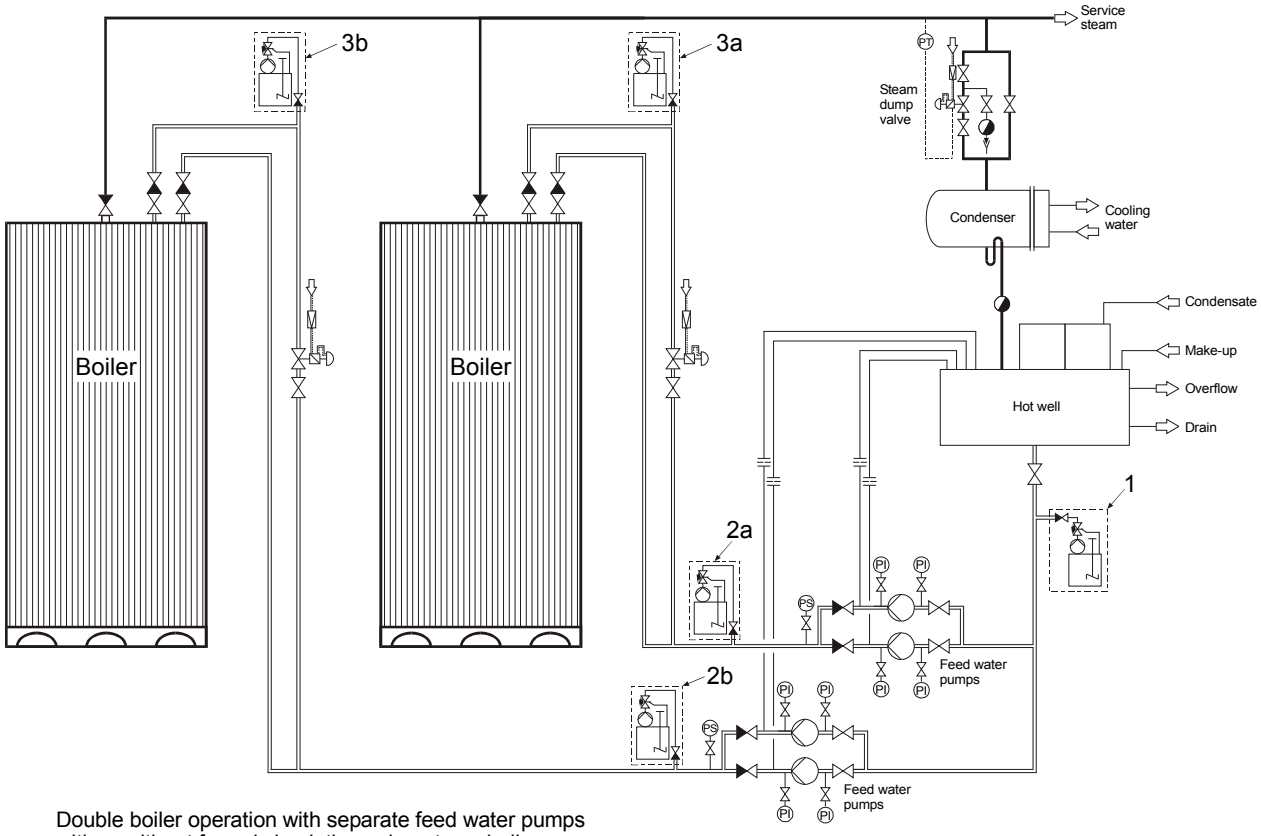
Flow diagram No.: 1



Single boiler operation with or without forced circulation exhaust gas boiler

Figure 1 **om9210_99_flowdix0060010en.wmf**

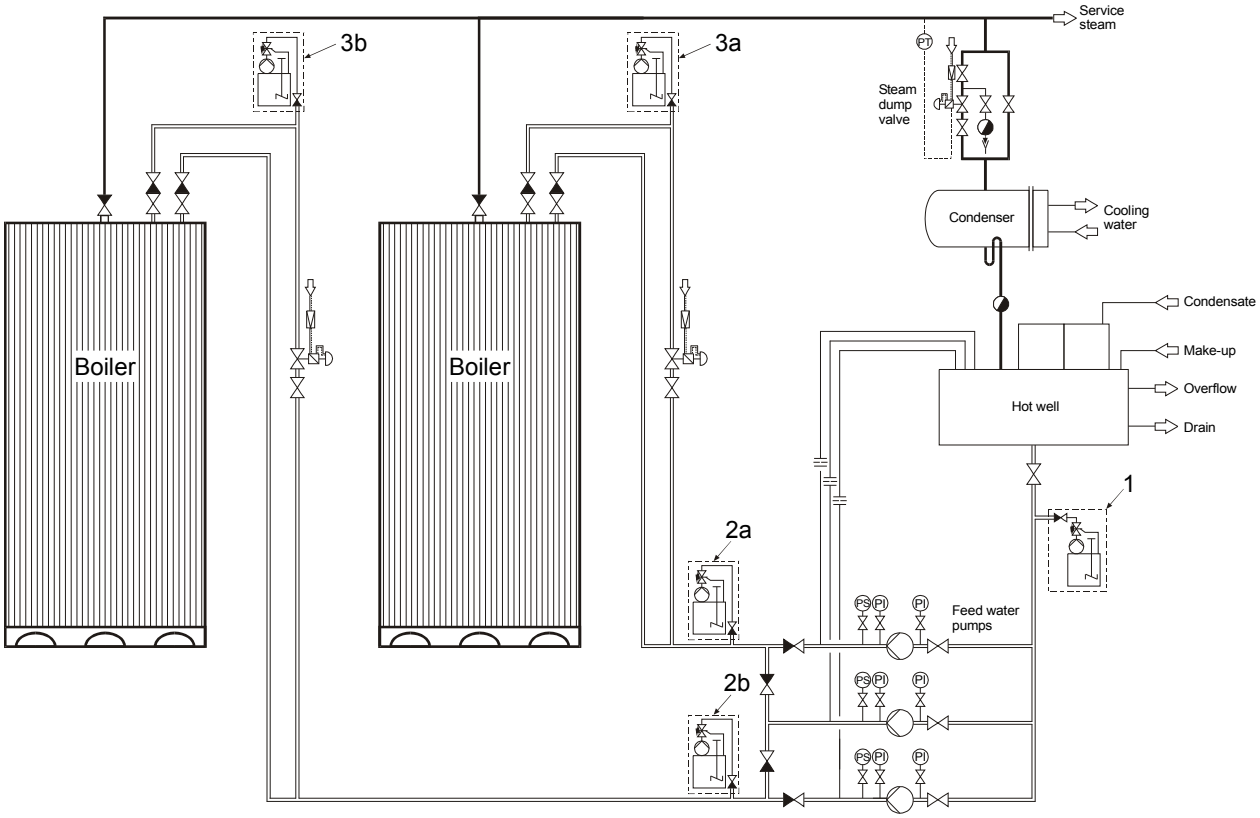
Flow diagram No.: 2



Double boiler operation with separate feed water pumps with or without forced circulation exhaust gas boiler

Figure 2 **om9210_99_flowdix0060020en.wmf**

Flow diagram No.: 3



Double boiler operation with common feed water pumps
with or without forced circulation exhaust gas boiler

Figure 3 **om9210_99_flowdix0060030en.wmf**

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Water level gauge

IN7010_01 Water level gauge.....6-2
OM7010_01 Water level gauge.....6-4

Water level gauge

1 Mounting on boiler

This section describes how to mount the water level gauge on the boiler side.

Water level gauge on boiler side

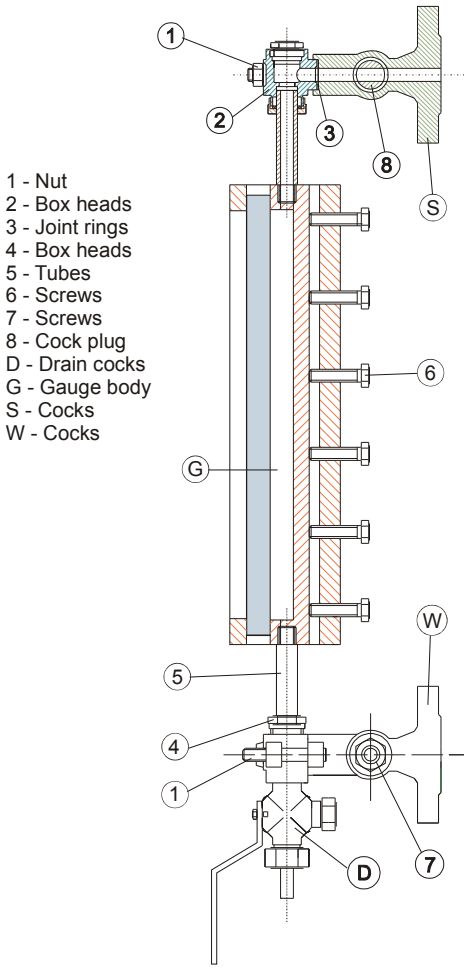


Figure 1 **in7010_01_kli_01x0052180en.wmf**

Step A: Remove nuts (1) and lift off stuffing box head (2) from cock.

Step B: Insert gaskets between cock flanges and boiler flanges and bolt up the cocks S and W on to the boiler flanges.

Step C: Place the stuffing box heads (4) on the end tubes (5) - insert joint rings (3) in the recess of each cock.

Step D: Press the stuffing box heads (4) together with the gauge body (G) on the gauge cocks S and W.

Step E: Tighten units (1) to form a pressure tight seal.

Step F: Turn the gauge body (G) to the required position and tighten the union nuts (4).

Step G: Open the cocks.

Water level gauge

1 Maintenance and service instructions

This section describes the maintenance and service instructions for the water level gauge.

Illustration of the water level gauge

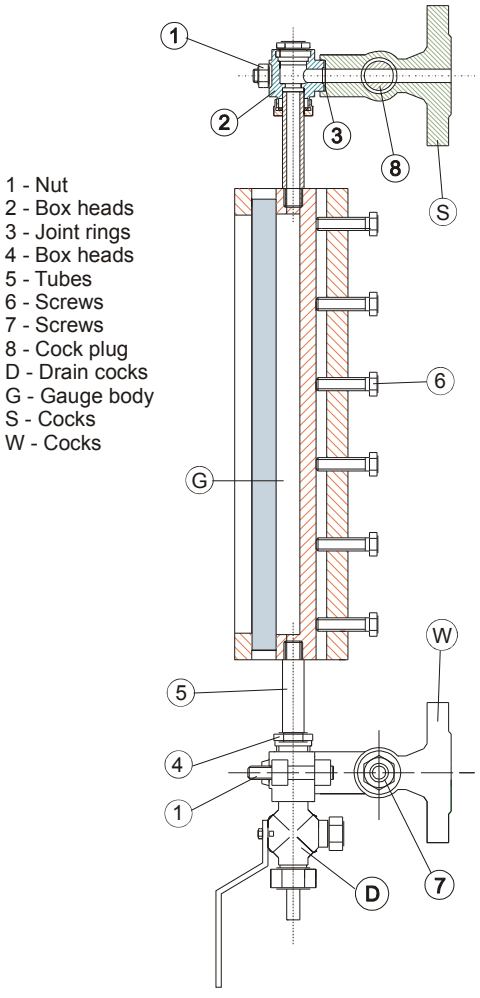


Figure 1 **om7010_01_kli_01x0056990en.wmf**

1.1 Maintenance

The item nos. mentioned in the following maintenance instructions refer to Figure 1.

When out of service with the gauge body in cool and depressurised condition the hexagon screws (6) can be re-tightened.

Step A: Start at the centre, working to opposite sides alternately. Max torque: 26 Nm in cold and under working conditions.

1.1.1 Maintenance during service check-up

Step A: Tighten the nuts (1).

Step B: Bolts on boiler flanges.

Step C: Union nuts (4).

Step D: Bolt form screws (7) with cocks in open positions.If a leak cannot be stopped by tightening the bottom screws (7), the sealing surface of the cock plug (8) may be damaged or corroded. It can also be necessary to change the packing (3).

1.2 Blowing down

The item nos. mentioned in this following blowing down procedures refer to Figure 1.

Step A: The gauge should be blown down before lighting up the boiler and just before closing down the boiler.

1.2.1 Cleaning the water side:

Step A: Shut the cock S and open the cock W.

Step B: Open the drain cock D for a short time. This sucks the water out of the glass without, however, totally depressurising the gauge body.

Step C: Shut the cock D and then water is forced upwards into the glass again.

Step D: Repeat this procedure several times, opening and shutting the cock D. The water level in glass rises and falls.

1.2.2 Cleaning the steam side:

Step A: Shut the cock W.

Step B: Open the cock S.

Step C: Blow through the steam side and gauge body by opening the drain cock D for 1-2 seconds.

Step D: A steam blowing of longer duration is not advisable considering the service life of glass.

Step E: Turn the cocks to operating position.

1.3 Dismantling

The following dismantling instructions refer to Figure 1 and Figure 2.

Sectional view of the water level gauge

6 - Screws
9 - Wedge piece
10 - Centre piece
11 - Reflex
12 - Sealing gasket
13 - Cushion gasket
14 - Cover plate

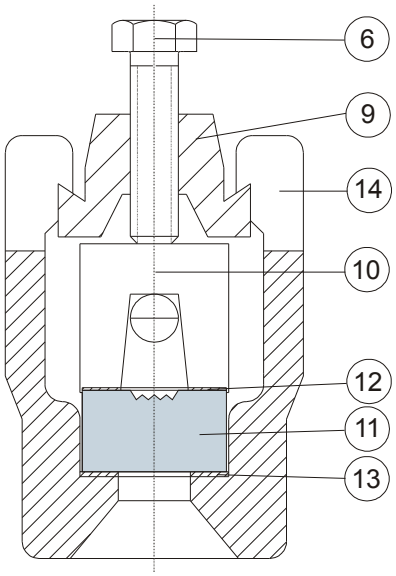


Figure 2 **om7010_01_kli_05x0057000en.wmf**

Step A: Shut the cocks S and W.

Step B: The drain cock D to be opened until the glass is completely emptied.

Step C: Remove nuts (1) and lift off stuffing box heads (2) together with the gauge body from the cocks S and W.

Step D: Slacken the union nuts (4) and pull off the stuffing box head (2).

Step E: Place the gauge body (G) horizontally with the screws (6) turning upwards and loosen the screws.

Step F: Move the wedge piece (9) length wise and lift upwards.

Step G: Lift off centre piece (10) reflex glass (11) and gaskets (12 and 13).

Step H: Clean sealing surface of cover plate (14) and centre piece (10) and examine for through going scars.

1.4 Assembling

The following assembling instructions refer to Figure 2.

Step A: Insert following items into the centre piece (10): sealing gasket (12) reflex glass (11) cushion gasket (13).

Step B: Place cover plate (14) on top.

Step C: Insert wedge piece (9) and move length wise for correct position.

Step D: Tighten screws (6) evenly starting at the centre, working to opposite alternately. Max torque: 26 Nm in cold and under working conditions.

Step E: When the boiler is started again and normal working pressure has been reached re-tighten the screws (6) once again.

1.5 Maintenance of the straight-through cock

1.5.1 Operation principle and maintenance

The following assembling instructions refer to Figure 3.

Detail drawing of the straight-through cock

15 - Screw
16 - Split ring
17 - Packing sleeve
18 - Plug
19 - Bottom screw

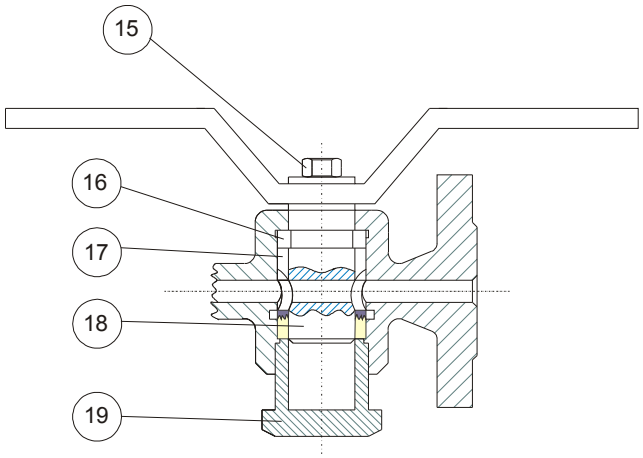


Figure 3 **om7010_01_kli_06x0057010en.wmf**

The cylindrical plug (18) is sealed with a resilient packing sleeve (17).

Should leakage arise during service the packing sleeve must be further compressed by tightening the bottom screw (19) until the leakage is stopped. This must only be done with the cock in open position.

1.5.2 Dismantling

Step A: Remove bottom screw (19).
Step B: Remove screw (15), washer and handle.
Step C: Knock the plug (18) together with split ring (16) and packing sleeve (3) out of the cock body by means of a soft mandrel.
Step D: Remove split ring and knock plug out of the packing sleeve.
Step E: Clean all sealing surfaces carefully and lubricate threads with a high temperature grease before installation.

1.5.3 Assembly

Step A: Place the split ring (16) in the recess of the plug (18).
Step B: Push new packing sleeve onto plug.
Step C: Press the complete unit into cock body.

Note: Turn the packing sleeve until the ridge fits with the groove in the cock body. The eyelets of the packing sleeve must neither protrude nor be tilted.

Step D: Screw in bottom screw (19).
Step E: Place the handle and washer on the plug and fit screw (15).
Step F: Tighten the bottom screw (19) and check if the plug can be turned.

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Safety valves

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Safety valves

1 Installation

In the following the measures required to achieve a safe and reliable installation of the safety valves will be described. If the installation is subject to approbation from special authorities, their requirements must be observed.

1.1 Mounting of safety valves

Figure 1 shows an installation example of the safety valves.

Note: Safety valves should be handled carefully. Any rough treatment can cause damage to the seating surfaces.

Mounting of safety valves, example

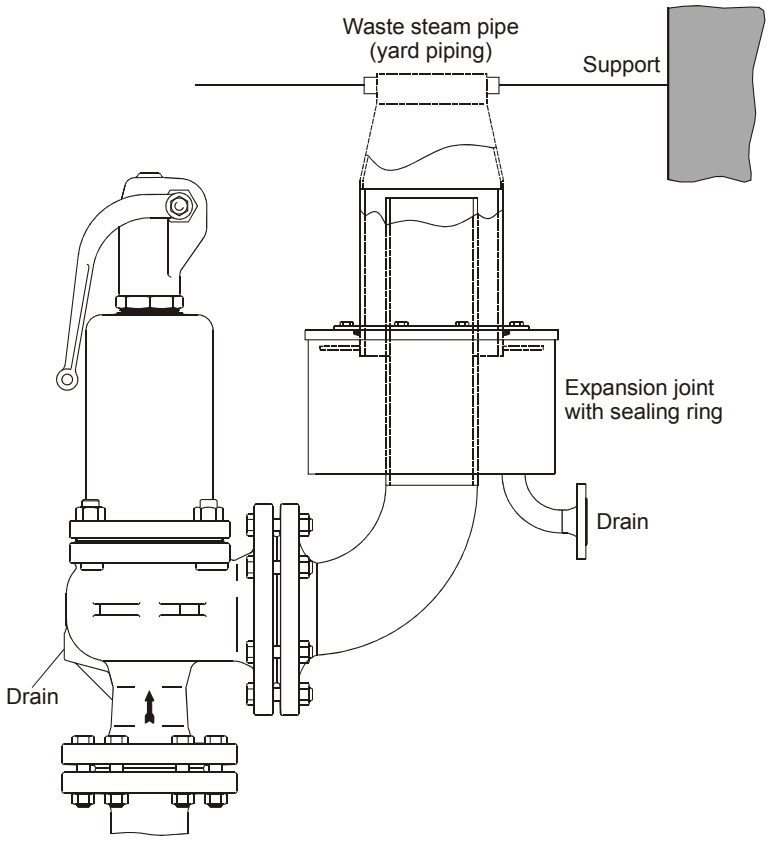


Figure 1 **in6040_01_safe_0x0052160en.wmf**

It is recommended to provide each safety valve with a separate waste steam pipe, which must have a sufficient inside diameter determined by the full exhaust quantity of the valve as well as the resistance of the pipe (pressure loss) and must be at least one dimension larger than the outlet flange.The pressure loss in the escape pipe including the exhaust loss should not be higher than 10% of the set pressure for the valve.

The vertical pipe must run as straight as possible and be thoroughly anchored and supported to the structure of the vessel to withstand the reaction during blow out. A long escape pipe with more bends may necessitate that a pipe with a larger inside diameter is chosen in order to secure that the back pressure will not be too high.

It is necessary to install a horizontal expansion device between the valve outlet and the escape pipe or in other ways. This is to secure that forces from the latter are not transferred to the safety valve body with subsequent tensions and dislocation of the body resulting in leakage or, at the worst, destruction of the valve. Aalborg Industries recommends an expansion device as shown in Figure 1.The escape pipe will normally expand about 2.5 mm per metre of pipe from the valve to the fixed point.

The distance between the centre lines of the safety valve and expansion joint must be as short as possible. A large horizontal length increases the risk of tensions in the valve body during blow out, and in such cases a support is required to avoid forces/tensions are transferred to the safety valve and boiler.

Note: It is very important that the gaskets used have the correct dimensions compared to the inlet and outlet flanges, and that the hole is big enough to allow free passage. The bolts must be tightened equally all the way round the flange to avoid unequal tensions.

1.2 Drain

The drain from the drip tray must be led separately to an open outlet to prevent penetration of steam from other sources involving a risk of blocking the valve.

The outlet may be covered by a ‘splash-cover’ to avoid splashing to the surroundings when a safety valve is blowing.

1.3 Lifting device

The safety valve can be equipped with a lifting device.Any extensions from the lifting lever of a safety valve to the operating stand must be arranged in such a way as not to transmit any force to the lever when at rest, see Figure 2.

By securing a steel wire to the lifting device, it is possible to operate the safety valve in a safe distance. The safety valve can be operated by means of the lifting lever at 85% of the set pressure.

Warning: It is very important to make sure that no restrictions obstacle the operation of the lifting device and steel wire.

Arrangement of lifting device for safety valve, example

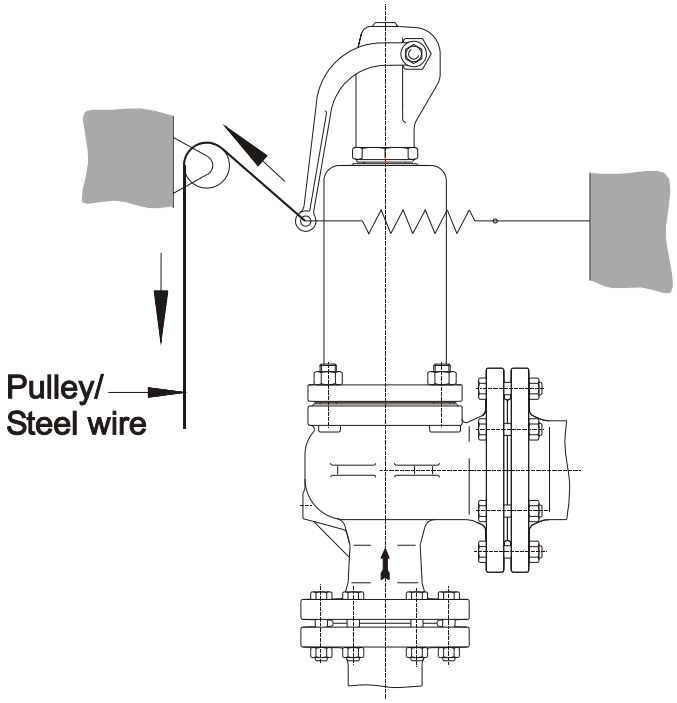


Figure 2 **in6040_01_safe_0x0052170en.wmf**

Safety valves

1 General

In the following the measures required to achieve a safe and reliable operation as well asmaintenance of the safety valves will be described, together with adjustment and dismantling instructions.An installation example of the safety valve is shown in Figure 3.

Mounting of safety valves, example

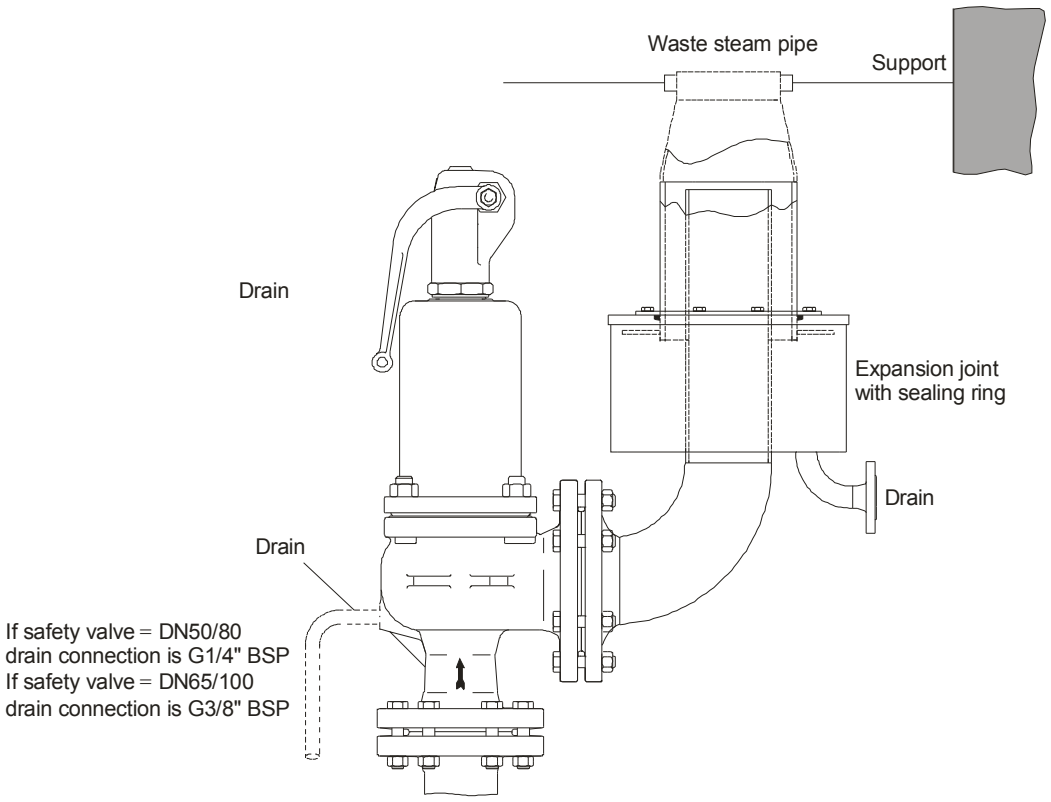


Figure 1 **om6040_01_safe_0x0056591en.wmf**

2 Maintenance and start-up of boiler

A regular inspection of the safety valve is recommended at least once a year. Some media and appliances require a more frequent inspections, this is according to the experience of the supplier.

Warning: Prior to any handling and dismantling of the safety valve ensure that the system is depressurised.

Before lighting-up the boiler, pipe connections must be thoroughly cleaned for dirt and foreign bodies.If the valve is not completely tight, which often is the case after start up of the plant, this is usually caused by impurities between the seat and the cone. In order to remove these impurities the valve must be heavily blown out by means of the lifting device. If the valve is not tight after several blows, it may be due to the fact that a hard foreign body has got stuck between the cone and the seat, and it will then be necessary to dismount the valve for overhaul.

Warning: In case of a leaking safety valve the valve must be inspected and overhauled as soon as possible. It must be ensured that the boiler is totally depressurised before dismounting the valve.

Note: Before dismantling the safety valve in the workshop the position of the adjusting screw must be measured and noted which will facilitate the adjustment later when the valve is to be adjusted when in service.

In case the facings between the cone and the seat have been damaged, they must be grinded.

Step A: The cone can be grinded against a cast iron plate, using a fine grained carborundom stirred in kerosene.

Step B: The seat in the valve body can be grinded in the same way by using a cast iron punch of suitable size.

Note: Never use the cone itself when grinding the seat.

Warning: The spindle and the valve cone must always be secured against turning as the seat and the cone may thus be damaged.

Step C: Before assembly the valve must be thoroughly cleaned, and all traces of grinding material and impurities must be removed.

Step D: When the valve has been mounted and the boiler is commissioned, the valve must be checked for leakage and adjusted to the set pressure.

Step E: The adjustment screw is secured by means of its lock nut, and the valve is sealed.

2.1 Routine check

The following should be regarded as recommendations of routine checks on the safety valves, in order to secure a correct function:

Monthly

Step A: Examine the safety valves for any leaking, such as:
- Is water seeping from the drain plug at the valve body?
- Is the escape pipe hot due to seeping steam from the valve seat?

Step B: Examine the drain and expansion device at the escape pipe.

Step C: Examine the lifting gear device, i.e. clean up and grease all sliding parts.

Yearly

Step A: The safety valve should be tested in operation by raising the boiler pressure.

Step B: Expansion and exhaust pipe should be examined at the same time.

3 Adjustment and dismantling

Safety valves are delivered with the required spring setting and sealed against unauthorised adjustment.Adjustments are only allowed in the spring margins. Outside the margin a new spring is required. The pressure in a system should not exceed 90% of the set pressure.

All item numbers mentioned in the following sections refer to Figure 3.

3.1 Dismantling of lifting device

Safety valve with open cap:

Step A: Remove bolt(39) and remove lift lever (41)

3.2 Set pressure change without spring change

Note: Pay attention to spring range.

Step A: Spindle (14) must be held fast by all alterations.

Step B: Loosen lock nut (21).

Step C: Turn the adjusting screw (17) clockwise for higher and anticlockwise for low set pressures.

Step D: Secure the new setting with the lock nut (21) and reassemble lifting device.

3.3 Spring change

Step A: Spindle (14) must be held fast by all alterations.

Step B: Loosen lock nut (21) and turn adjusting screw (17) anticlockwise, then the spring (37) is not under tension.

Step C: Loosen the nuts (8) and remove the bonnet (42).

Step D: Remove the upper spring plate (26), spring (37), spindle (14) with disc (12), guide plate (4), and lower spring plate (26).

Step E: Clean the seat (2) and disc (12).

Step F: Remount the spindle unit with the new spring and upper spring plate.Assemble bonnet (42) and adjust to the spring range.

Step G: Secure the spring setting through the lock nut (21) and remount lifting device.

Assembling drawing of safety valve

47 Ball
42 Bonnet
41 Lifting lever
40 Split pin
39 Bolt
38 Screw
37 Spring
29 Cap
27 Gasket
26 Springplate
23 Lead seal
22 Drain screw
21 Lock nut
18 Ball
17 Adjusting screw
16 Slotted pin
15 Gasket
14 Spindle
13 Lift aid
12 Disc
10/25 Split cotters
9 Lift limitation ring
8 Hex. nut
7 Gasket
4 Spindle guide
3 Stud
2 Seat
1 Body

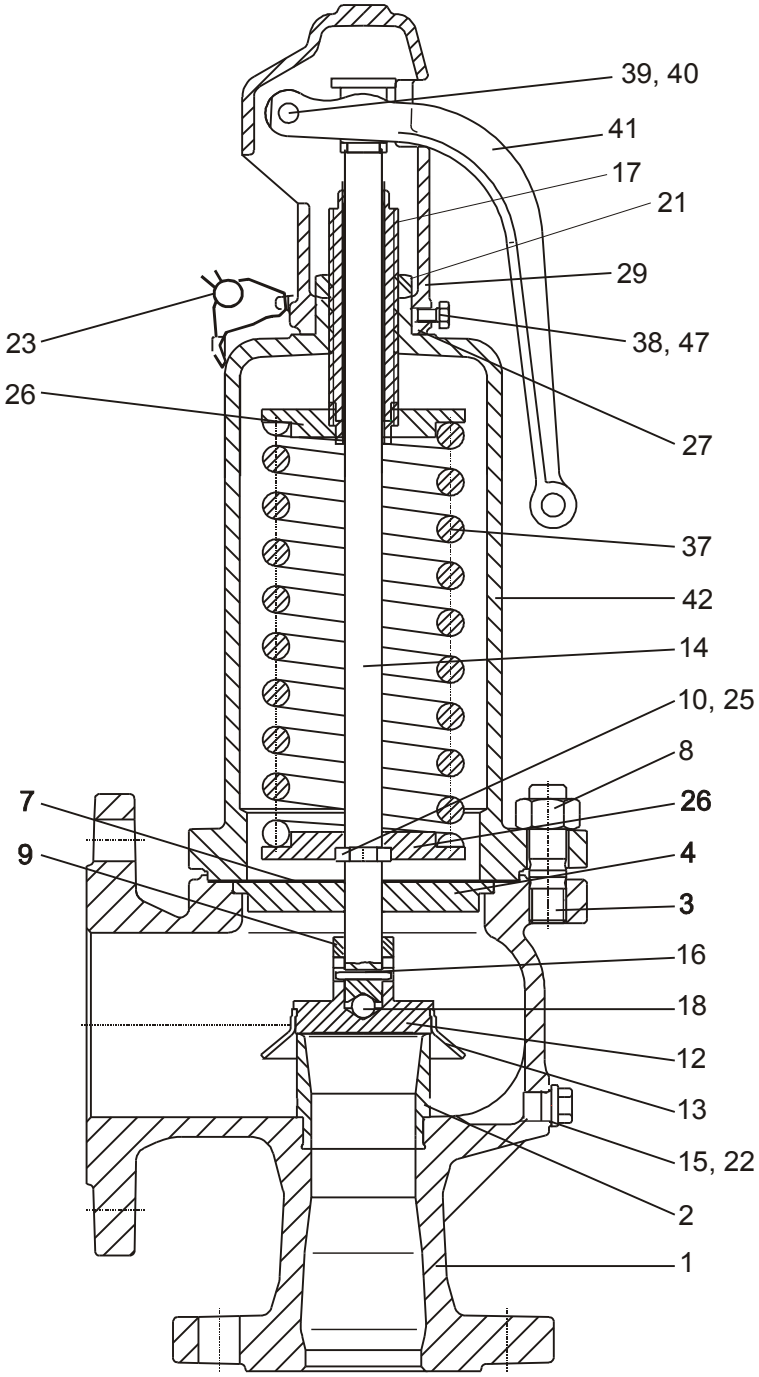


Figure 2 **om6040_01_safe_0x0056600en.wmf**

Temporary locking of a safety valve

1 General

During commissioning work or later tests of the opening pressure for the safety valves, only one safety valve should be checked at a time. This means that the other safety valve must be locked. The following instruction describes the temporary locking of a safety valve.

1.1 Procedure for locking of a safety valve

Step A: Remove the bolt (39) and split pin (40), see Figure 2.

Step B: Remove the lifting lever (41).

Step C: Unscrew the screw (38) and break the lead seal (23), if provided.

Step D: Unscrew the cap (29).

Step E: Place one or two bolts (48) on top of the spindle. The height of the bolts should be approximately 1-2 mm higher than the normal distance between the top of the spindle and the inside top of the cap (29).

Step F: Carefully screw on the cap until the spindle and bolts are locked. The safety valve will be completely locked when the bolts cannot be moved anymore.

Step G: The other safety valve can now be tested without any interference from the locked safety valve.

1.2 Procedure for unlocking of a safety valve

Warning: As soon as the test procedure for the safety valve has been carried out the locked safety valve must be unlocked.

Step A: Unscrew the cap (29) and remove the bolts (48).

Step B: Mount the cap (29) again and screw in the screw (38).

Step C: Mount the lifting lever (41), bolt (39), and split pin (40).

Step D: Provide the safety valve with a lead seal (23), if necessary. This depends on the local rules of the classification society.

Temporary locking of a safety valve

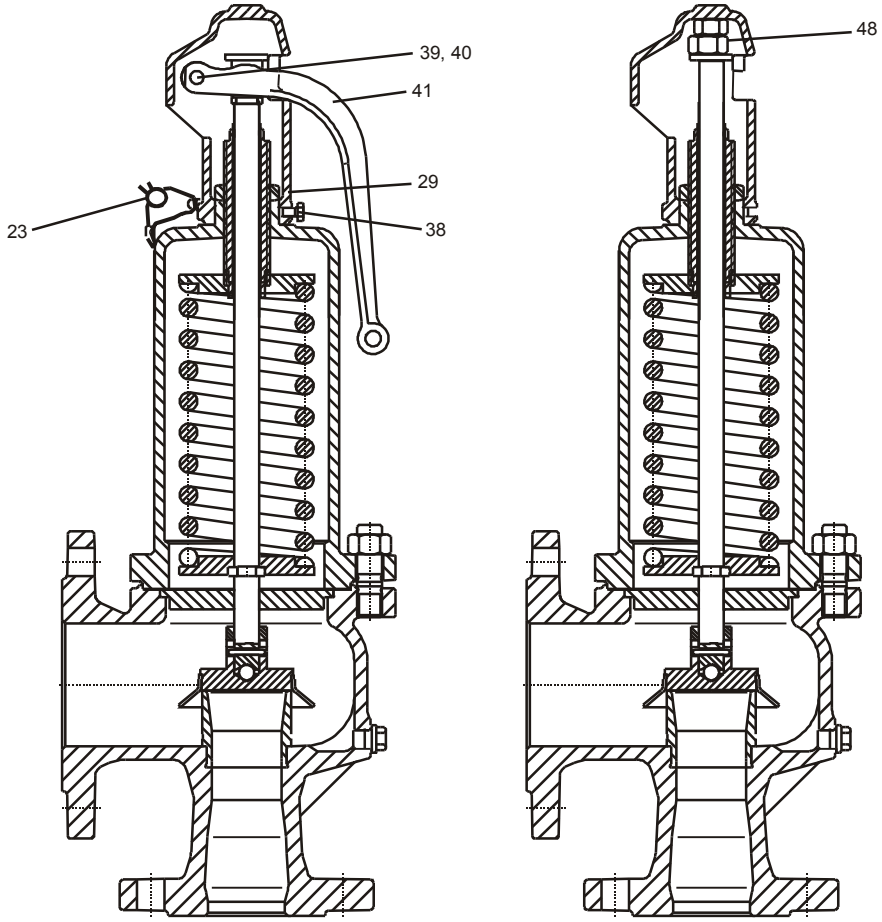


Figure 1 **om6040_02_safe_0x0056610en.wmf**

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Feed water system

SD9230_12	Water level control	8-2
OM8210_04	Safety device	8-3
OM8210_13	Water level control system	8-9

Water level control

1 Description

The water level control is a modulating system at this type of boiler. The system is illustrated in Figure 2. The system consists of one independent safety device electrode for too low water level shut down and burner stop. For measuring and control of the water level, one capacitance level electrode is provided, and it is used to give water level alarms/shut downs and control of the regulating feed water valve.

Water level control system

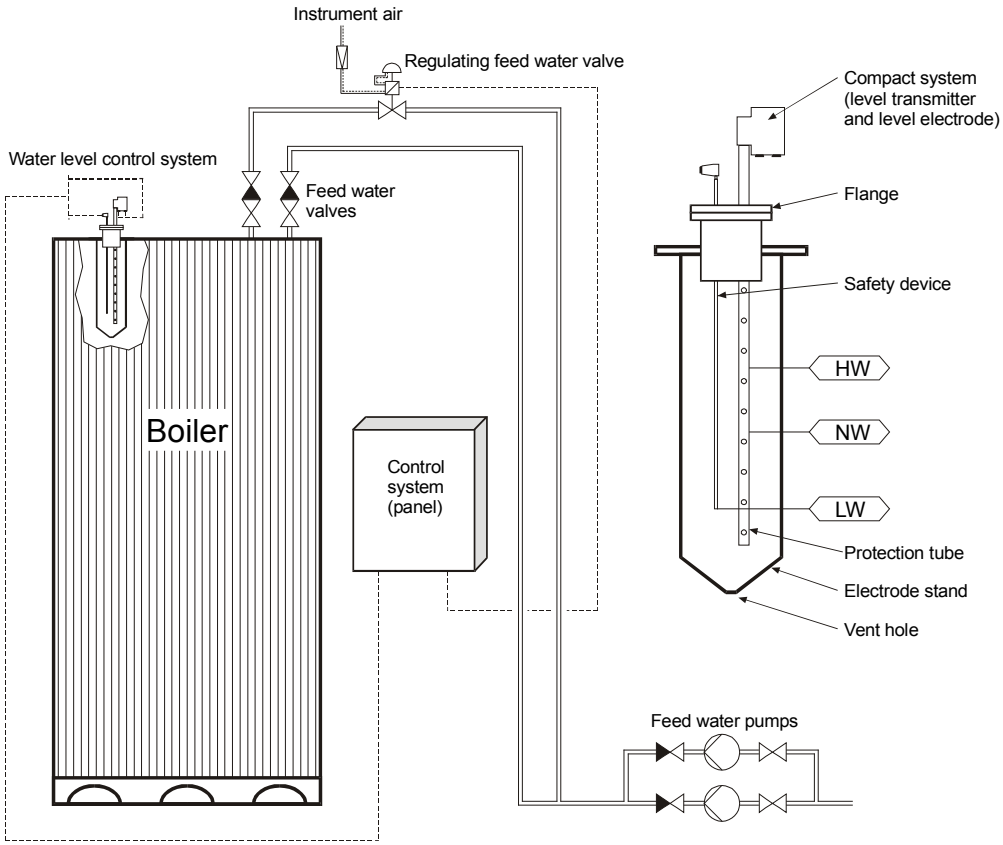


Figure 1 **sd9230_12_ges_1_x0063950en.wmf**

Safety device

1 General

The safety device consists of a level electrode and a level switch. The level electrode is mounted in an electrode stand on top of the boiler, and the level switch is placed inside the control system. Depending on the rules of the classification society, the boiler can be provided with one or two sets of safety devices. The function of the safety device is to continuously supervise the water level in the boiler and subsequently give a shut down and cut out of the burner if the water level is too low.

The combination of a level electrode NRG 16-11 and a level switch NRS 1-7b provides a fail-safe protection against a first fault, i.e. the system will still continue to provide the safety function even after a first fault.

The self-monitoring design ensures an interruption of the burner circuit in case of a failure of the electrode, supply cables, level switch, or in the power supply.

The safety device has a built-in response delay, which is indicated on the name plate. This eliminates unintentional cut-out of the burner circuit caused by interference from splash, level fluctuations, etc.

2 Level electrode

2.1 Operation

The too low level electrode operates on the conductive measuring principle using the electrical conductivity of the boiler water for level signalling. An illustration of the level electrode type NRG 16-11 is shown in Figure 1. The length of the electrode is adjusted to the correct length before mounting in the electrode stand.

In normal operation the electrode tip is submerged in the water, and the imbalance of the bridge circuit is positive. If the water level is below the electrode tip or in case of a fault, the electrode produces a negative imbalance of the bridge circuit provided in the level switch (NRS 1-7b). This produces the too low level shut down signal and consequent cut-out of the burner circuit.

The level electrode consists of two single electrodes (measuring electrode and compensating electrode), which are concentrically arranged and insulated from each other by special insulating seals. The electric connection of the two electrodes is effected coaxially with a tube, contact ring, and stud. A system of compression springs in the

electrode body ensures sufficient sealing forces at the insulating seals, even if the temperatures vary. The stud is insulated by a Teflon foil. PTFE insulated wires connect the contact ring and body to the terminal block.

If the insulating seals placed between the electrodes and body are no longer tight due to deterioration caused by mechanical or chemical breakdown, liquid will penetrate into the cavities between the body, tube, and stud. This produces a strong negative imbalance of the bridge circuit, which causes a too low level shut down signal. But in this case the signal is due to a malfunction. This means that the water level in the boiler must be checked in the water level gauges if the level switch signals an shut down.

Level electrode type NRG 16-11

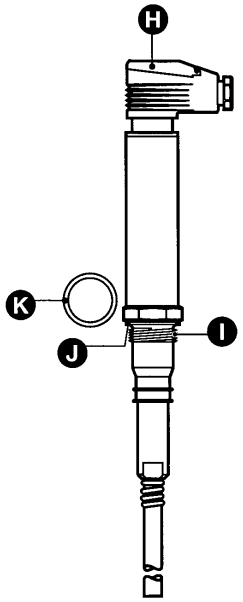


Figure 1 **om8210_04_nrg16-x0058280en.wmf**

2.2 Cleaning/exchanging the electrode

The following work procedures must be carried out if the level electrode is cleaned or replaced:

Dismantling:

Step A: Stop the boiler plant according to the separate instructions for start/stop of the boiler.

Warning: When the level electrode is loosen, steam or hot water might escape. This presents the danger of severe injury. It is therefore essential not to dismantle the level electrode unless the boiler pressure is zero.

Step B: Disconnect the wires for the compact system and safety device.

Step C: Unscrew the bolts on the flange for the compact system and safety device.

Step D: Pull out the flange including the compact system and safety device from the electrode stand.

Step E: Unscrew the locking screw, which locks the level electrode to the flange.

Step F: Unscrew the level electrode from the flange by means of a 36 mm ring spanner.

Step G: Pull out the level electrode from the flange and electrode holders.

Cleaning:

Note: The interval for cleaning of the electrode rod depends on the present boiler water conditions. Therefore an exact time interval cannot be given.

Step A: Clean the rod of the level electrode with a wet cloth.

Replacing the level electrode:

Step A: Exchange the defect level electrode.

Replacing the electrode tip:

Step A: Screw the electrode tip "D" into the measuring electrode "A", see Figure 2.

Step B: Carefully determine the required measuring length and mark the length of the electrode tip "D".

Step C: Unscrew the electrode tip "D" from the measuring electrode "A" and cut the tip. If provided with a PTFE insulation this must be cut min. 150 mm above the electrode tip and fixed with a starlock washer.

Step D: Screw the electrode tip "D" into the measuring electrode "A" and tighten. Slide the spring "C" along the electrode tip "D" so that its bend end completely enters into the small bore "B".

Assembling:

Step A: Check the seating surfaces of the level electrode thread and flange, see Figure 1.

Step B: Place the joint ring "K" onto the seating surface "J" of the level electrode. Use only a joint ring (stainless steel) D 27 x 32.

Step C: Apply a light smear of silicone grease (e.g., DOW Corning 111 compound) to the level electrode thread "I".

Attention: Do not insulate the electrode thread with hemp or PTFE tape.

Step D: Screw the level electrode into the flange and electrode holders. The torque required is 160 Nm (when cold).

Step E: Screw the locking screw into the level electrode.

Step F: Check the seating surfaces of the electrode stand flange and level electrode flange. Place a flat gasket on the electrode stand flange.

Step G: Place the flange including the compact system and safety device onto the electrode stand flange. Fix the flanges with bolts and tighten the bolts in diagonally opposite pairs.

Step H: Connect the wires for the compact system and safety device.

Assembling of the NRG 16-11 level electrode

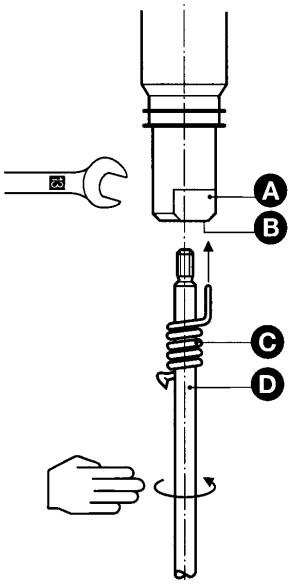


Figure 2 **om8210_04_nrg16-x0058290en.wmf**

3 Level switch

3.1 Operation

The level switch is a two-channel unit provided with an automatically self-checking circuitry. The level switch of type NRS 1-7b is illustrated in Figure 3, and the wiring diagram can be seen in Figure 4.

The green LED indicates mains on. Two red LEDs indicate the shut down states too low level or malfunction of the system. A single red LED signals the failure of one channel (loss of redundancy).

The self-checking circuitry is effected periodically. The test includes the checking of the cable between the level electrode and level switch and also of the self-checking circuitry (redundancy). The output relays are not influenced by the internal tests.

As the circuit of the relay contacts is normally closed, a shut down will also be signalled in the event of a mains failure. The level switch can signal the following three operating conditions:

- Normal operation: correct level
- Shut down: too low level
- Shut down: defect in the level switch or electrode

Level switch type NRS 1-7b

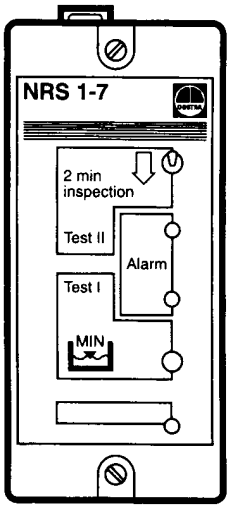


Figure 3 **om8210_04_nrs1-7x0058300en.wmf**

3.2 Performance tests

Live test:

Step A: Decrease the water level in the boiler by means of the blow-down valves until the water level has fallen below the too low level mark.

Step B: After the response delay indicated on the name plate, the two red LEDs on the level switch must light up. If the burner is running, it will immediately be stopped or if it is stopped, it will be blocked from operation.

Note: Should the too low level point be reached during a self-checking cycle, this cycle must first be completed. Only then the alarm system will enter its own delay period. Thus the total maximum delay of twice the nominal delay period may occur.

Test 1:

A too low level shut down can be simulated by pushing the button "TEST 1" whilst the electrode tip is submerged in water. This test should be carried out with frequent intervals.

Step A: Push the button "TEST 1" until the response delay has expired. Both red LEDs must light up.

Test 2/inspection:

The checking circuitry of the level switch can also be checked. This test must, as a minimum be carried out at least once every year.

Step A: Operate the switch "TEST 2/INSPECTION" in the direction of the arrow with the electrode tip submerged in water (above the too low level mark).

Step B: After maximum two minutes the two red LEDs must signal too low level shut down.

Note: The button "TEST 1" must not be operated during this test nor must the water level fall below the too low level mark.

Step C: Return the switch into its original position after the test. After the response delay the two red LEDs must extinguish.

3.3 Fault finding

Fault finding scheme	
Fault	**Remedy**
The level switch signals too low level shut down before the water level in the boiler has fallen below the too low level mark.	Measure the conductivity of the boiler water. Check the wiring of the level switch and electrode. Check the length of the electrode tip.
After raising the water level above the too low level mark, the two red LEDs on the level switch are not extinguished or only after a considerable period.	Check whether a vent hole has been provided in the electrode stand.
One or both red LEDs on the level switch light up without the water level has fallen below the too low level mark.	This means that an electronic failure within the level switch has occurred, i.e. failure of one or two of the channels. In this case replace the level switch.
The test with the switch "TEST 2/ INSPECTION" was not successful, i.e. only one red LED or none of the two red LEDs lighted up two minutes after the start of the test.	Replace the level switch.

Table 1

Wiring diagram

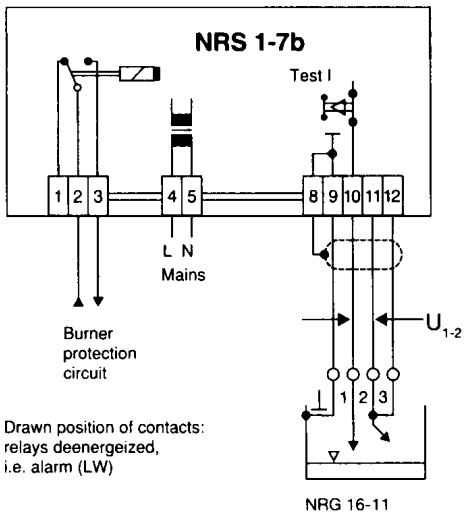


Figure 4 **om8210_04_nrs1-7x0058310en.wmf**

Water level control system

1 General

The compact system of type NRGT 26-1 consists of a level electrode, protection tube, and level transmitter. Via a flange the level electrode is inserted in an electrode stand mounted on top of the boiler. Inside the electrode stand the protection tube is connected to the flange and surrounds the level electrode. The integrated level transmitter is placed on top of the level electrode. Figure 1 illustrates the compact system of type NRGT 26-1. In the first illustration the compact system is shown without the protection tube and flange. The flange shown in the second illustration can be of a different type.

The compact system works according to the capacitance measurement principle and is used for signalling different water levels in the boiler. The electrode rod and protection tube form a capacitor. If the level of the dielectric (boiler water) located between the two capacitor plates changes, the current which flows through the plates changes proportionally to the level. The level transmitter produces a standard analogue output of 4-20 mA, which is sent to the control system. Figure 2 illustrates the level transmitter.

Compact system type NRGT 26-1

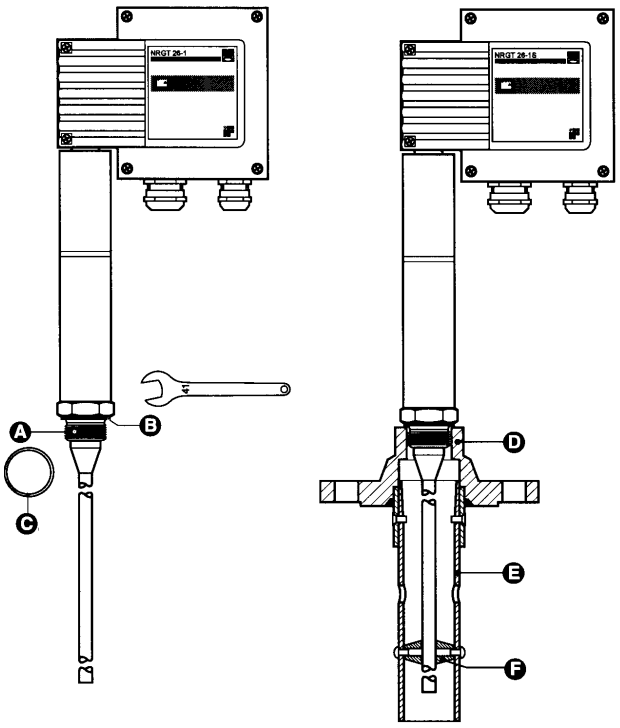


Figure 1 **om8210_13_nrgt26x0058440en.wmf**

Compact system type NRGT 26-1 (level transmitter)

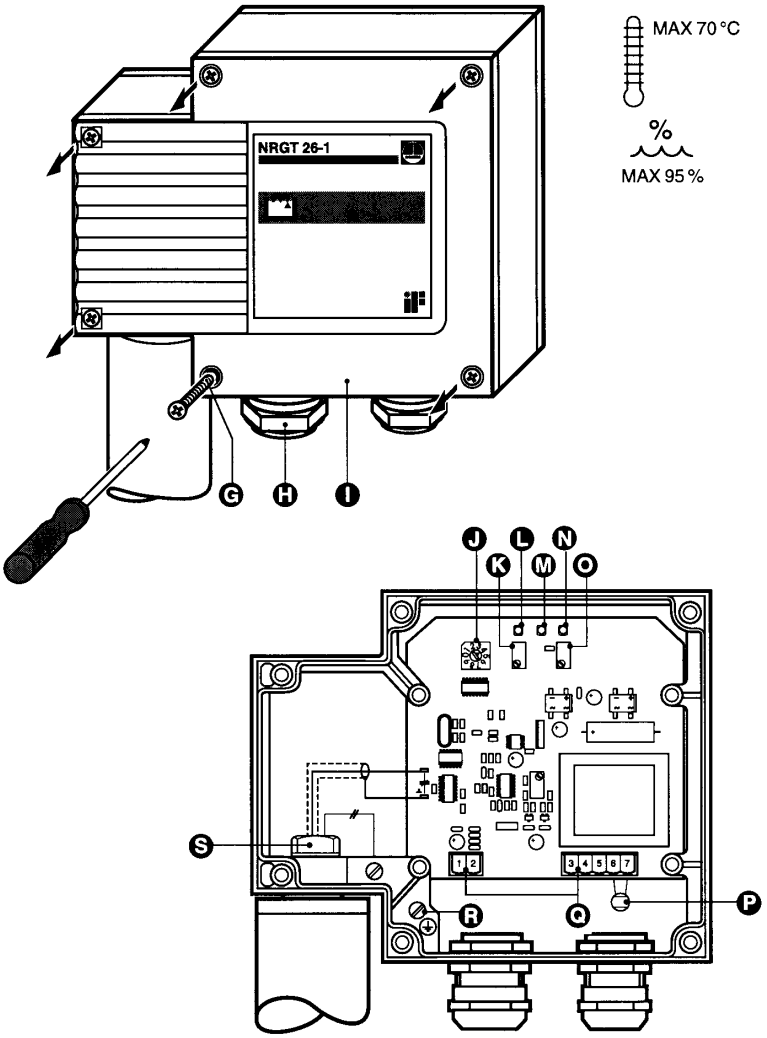


Figure 2 **om8210_13_nrgt26x0058430en.wmf**

Table for position numbers illustrated in Figure 1 and Figure 2			
A	Electrode thread 3/4" BSP, DIN 228	J	Measuring range switch
B	Sealing surface	K	Potentiometer for lower measuring point
C	Joint ring (of stainless steel) D 27 x 32 to DIN 7603	L	Red LED "level 0%"
		M	Green LED "level > 0%, < 100%"
D	Flange (different ones are used)	N	Red LED "level 100%"
E	Protection tube	O	Potentiometer for upper measuring point
F	Spacer disc	P	Thermal fuse Tmax 102°C
G	Housing screw M 4	Q	Terminal strip
H	Cable entry PG 9 / PG 16	R	PE connection
I	Housing cover	S	Screw

Table 1

2 Cleaning/exchanging the electrode

The following work procedures must be carried out if the level electrode is cleaned or replaced:

Dismantling:

Step A: Stop the boiler plant according to the separate instructions for start/stop of the boiler.

Warning: When the level electrode is loosen, steam or hot water might escape. This presents the danger of severe injury. It is therefore essential not to dismantle the level electrode unless the boiler pressure is zero.

Step B: Disconnect the wires for the compact system and safety device.

Warning: The terminal strip and the electronic components of the NRGT 26-1 are live during operation. This presents the danger of electric shock. Cut off the power supply before fixing or removing the housing cover. During commissioning use only completely insulated spanner for adjusting the measuring points.

Step C: Unscrew the bolts on the flange for the compact system and safety device.

Step D: Pull out the flange including the compact system and safety device from the electrode stand.

Step E: Unscrew the locking screw, which locks the level electrode to the flange.

Step F: Unscrew the level electrode from the flange by means of a 41 mm open-end spanner.

Step G: Pull out the level electrode from the flange and protection tube.

Cleaning:

Note: The interval for cleaning of the electrode rod depends on the present boiler water conditions. Therefore an exact time interval cannot be given.

Step A: Clean the rod of the level electrode with a wet cloth.

Replacing:

Step A: Exchange the defect level electrode including the level transmitter.

Assembling:

Step A: Check the seating surfaces of the level electrode thread and flange.

Step B: Place the joint ring "C" onto the seating surface "B" of the level electrode (see Figure 1). Use only a joint ring (stainless steel) D 27 x 32.

Step C: Apply a light smear of silicone grease (e.g., DOW Corning 111 compound) to the level electrode thread "A".

Attention: Do not insulate the electrode thread with hemp or PTFE tape.

Step D: Screw the level electrode into the flange and protection tube. The torque required is 160 Nm (when cold).

Step E: Screw the locking screw into the level electrode.

Step F: Check the seating surfaces of the electrode stand flange and level electrode flange. Place a flat gasket on the electrode stand flange.

Step G: Place the flange including the compact system and safety device onto the electrode stand flange.

Step H: Fix the flanges with bolts and tighten the bolts in diagonally opposite pairs.

Step I: Connect the wires for the compact system and safety device. A wiring diagram for the compact system can be seen in Figure 3.

Wiring diagram

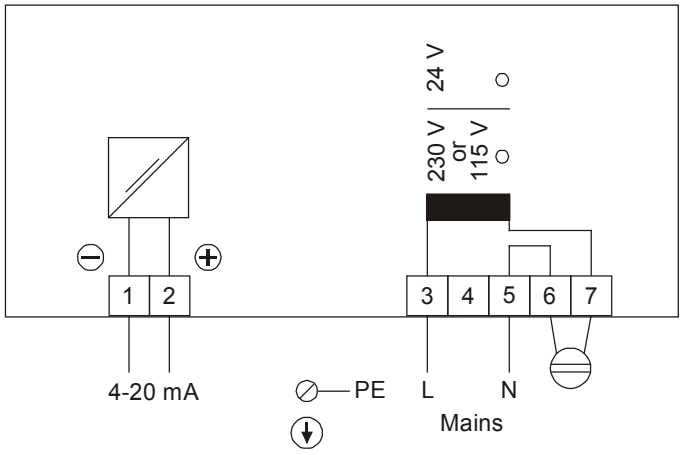


Figure 3 **om8210_13_nrgt26x0058420en.wmf**

3 Standard setting

The purpose of the switch "J" is to set the optimal frequency band for the internal measurement inside the compact system. To obtain the best measuring conditions, the switch "J" is set to a position determined by the active measuring length of the level electrode. The compact system is delivered with the following factory settings:

- Measuring range 275 mm: switch "J" position 3, water ≥ 20 µS/cm
- Measuring range 375 mm to 675 mm: switch "J" position 4, water ≥ 20 µS/cm
- Measuring range 775 mm to 1375 mm: switch "J" position 5, water ≥ 20 µS/cm
- Measuring range 1475 mm to 1975 mm: switch "J" position 6, water ≥ 20 µS/cm

4 Commissioning

Wiring check:

Step A: Check that the system has been wired according to the wiring diagram (see Figure 3 and the electrical drawings).

Step B: Check that the mains supply corresponds to the value shown on the label of the equipment.

Application of mains voltage:

Step A: Unscrew the screws "G" and remove the housing cover "I".

Step B: Apply mains voltage. The LED "L" will light up (see the position in Figure 2).

Adjustment of the lower measuring point:

Step A: Fill the boiler with water until the lower measuring point is reached.

Step B: Start the boiler according to the separate instructions for start/stop of the boiler.

Step C: Raise the boiler pressure till normal working pressure.

Step D: Turn the potentiometer "K" to the left. The red LED "L" lights up.

Step E: Turn the potentiometer "K" to the right until only the green LED "M" lights up.The lower measuring point is now adjusted.

Adjustment of the upper measuring point:

Step A: Fill the boiler with water until the upper measuring point is reached.

Step B: Operate the burner until the boiler pressure has reached normal working pressure.

Step C: Turn the potentiometer "O" to the right until only the red LED "N" lights up.

Step D: Turn the potentiometer "O" to the left until the green LED "M" lights up.

Step E: Turn the potentiometer "O" to the right until the green LED "M" extinguishes.

Step F: Mount the housing cover "I" and screw in the screws "G".The upper measuring point is now adjusted.

Note: When adjusting the measuring points of the electrode in a cold boiler, the measuring points will shift with rising temperature as a result of the longitudinal expansion of the electrode rod. The adjustment must be corrected proportionally.

---

5 Fault finding

Fault finding chart	
Fault	**Remedy**
The equipment does not work	
Mains voltage has not been applied.	Apply mains voltage. Wire the equipment according to the wiring diagram.
The thermal fuse has failed.	In the case of a defective thermal fuse, the mains voltage has not been connected to terminal "Q". Replace the defective thermal fuse. The ambient temperature must not exceed 70°C.
The electrode housing does not have earth connection to the boiler.	Clean the seating surfaces and insert the metal joint ring (of stainless steel) 27 x 32 to DIN 7605. Do not insulate the compact system with hemp or PTFE tape.
The electronic board is defective.	Replace the board.
The equipment does not work accurately	
The electrode has been installed without the protection tube. The protection tube serves as reference electrode.	Install the protection tube.
The vent hole in the protection tube does not exist, is obstructed, or flooded.	Check the protection tube and, if necessary, provide a vent hole.
The desired zero point does not lie within the measuring range of the electrode. The electrode is too short.	Replace the compact system. Choose an adequate electrode length.
The adjustment of the measuring range is wrong.	Adjust switch "J" correctly (see the instructions).
Dirt deposits have been accumulated on the electrode rod.	Remove the compact system and clean the electrode rod with a wet cloth.
The gasket of the electrode rod is damaged. Measure the current at terminal 1 and 2 (≥20 mA).	Replace the compact system.

Table 2

Table of contents

Regulating feed water valve

OM6010_02	Control valves, type 470/471	9-2
OM5520_01	Pneumatic actuator, type dp	9-7
OM5510_05	Positioner, SIPART PS2 6DR5000	9-14

Control valves, type 470/471

1 General

This type of control valve is suited to regulate fluids, gases and steams. The valve plug is normally a parabolic plug, but can also be supplied in a perforated design. Both types of plugs can have either linear or equal percentage flow characteristic.

The flow direction for parabolic plugs is always against the closing direction. However, with perforated plugs for steam and gases, it is in the closing direction. If a valve with a perforated plug is operated by means of a pneumatic actuator with the flow in the closing direction, the pneumatic actuator should have a stronger thrust force. This is necessary to prevent thumping near to the closing position.

All control valves can be fitted alternately with manual-, pneumatic-, electric- or hydraulic operation devices.

Illustration of control valves type 470 and 471

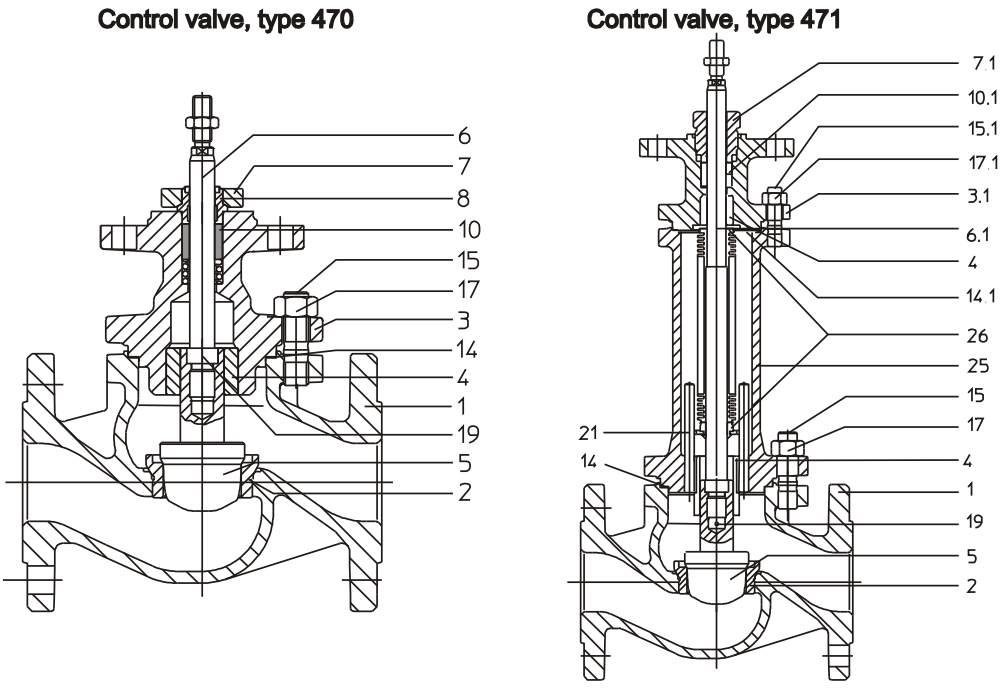


Figure 1 **om6010_02_val47xx0056570en..wmf**

Table of position numbers in Figure 2					
Part	**Designation**	**Part**	**Designation**	**Part**	**Designation**
1	Body	7	Gland flange	15.1	Studs
2	Seat ring	7.1	Screw joint	17	Hexagon nuts
3	Mounting bonnet	8	Spindle guiding	17.1	Hexagon nuts
3.1	Mounting bonnet	10	Stuffing box	19	Spring-type straight pin
4	Guiding bush	10.1	Stuffing-box packing	21	Set-pin
5	Plug	14	Gasket	25	Bellow housing
6	Spindle	14.1	Gasket	26	Bellow unit
6.1	Spindle	15	Studs		

Table 1

2 Operation

2.1 Fitting instructions

The valve should be inserted so that the spindle has a vertical position together with the actuator. The valve can also be tilted to a maximum horizontal position if the installation point does not allow any better condition.

To guarantee a disturbance free function of the control valve, the inlet and outlet stretches of the piping should be of straight piping length (min. two times the pipe diameter by inlet and six times by outlet). The piping should be rinsed to clear out any pollution, welding beads, rust, etc. before inserting the control valves. A strainer should be fitted in front of the control valve to catch the remaining particles. Bolts should be tightened after taking into operation.

The flow direction is signalled by an arrow on the valve body. The valves should be insulated against high temperatures to guard the actuator.

2.2 Actuator assembly

The control valves are normally delivered with actuators already fitted. For alternations or maintenance of actuator, the assembly should occur in accordance with the operation instructions for the actuator.

2.3 Setting into operation

When the piping system is filled, the spindle sealing should be checked for leakage and, if necessary, tightened. A PTFE-V-ring unit does not require any tightening as the spring tension maintains the necessary force.

The bolts must be tightened gradually in steps, diametrically in pairs, but not tighter than it is necessary for the sealing. Flange connection bolts should never be loosened or tightened when the valve is under temperature or pressure even if a leakage may arise.

For actuators please see to the appropriate actuator operation instructions.

3 Maintenance

Before any maintenance of the control valve is carried out, the piping system must be shut off and pressure free.

3.1 Exchange of the stuffing-box packing

A leak stuffing-box packing should initially be carefully tightened to stop the leakage. If this does not help, a new layer should be inserted, or the complete packing should be replaced.

3.1.1 Additional packing layer

Step A: Open the valve fully and unscrew the hexagon nuts (17).

Step B: Lift the gland flange (7) and the spindle guiding (8) upwards.

Step C: Insert adequate quantity of packing rings (split ring-displacement, splitting at 180° to avoid overlapping).

Step D: Fix the hexagon nuts (17) properly.

3.1.2 Exchange

Step A: Drive the actuator into middle position and dismantle the actuator.

Step B: Unscrew the hexagon nuts (17) from the studs (15).

Step C: Remove the gland flange (7), the spindle guiding (8) and the old stuffing box (10) and clean the packing compartment.

Step D: Clean the valve spindle and check for damage and if necessary replace. If the damaged spindle is not replaced, the new packing will leak after a short period.

Step E: Insert the new packing rings (split ring-displacement, splitting at 180° to avoid overlapping).

Step F: Fix the hexagon nuts (17) properly.

Note: Strenuous tightening will prevent leakage, but will also have a brake effect on the spindle which aggravates the movement of the spindle.

3.2 Exchange of a PTFE-V-ring sealing unit

A PTFE-V-ring unit is spring loaded and has enough set pressure to ensure a good seal even by low operation pressures. It is replaced as mentioned above.

The PTFE-V-ring sealing unit should be lubricated before it is inserted. The sealing lips must face against the pressure direction.

Note: Special care should be given to the spindle surface. Rough surfaces wear the sealing lips enormously and can be due to failure of the packing unit.

3.3 Exchange of the bellow unit

Step A: Drive the actuator into middle position and dismantle the actuator.

Step B: Unscrew the screw joint (7.1).

Step C: Unscrew the hexagon nuts (17) and remove the bellow housing (25). Dismantle the plug as described in the next section.

Step D: Unscrew the hexagon nuts (17.1) and dismantle the mounting bonnet (3.1).

Step E: The bellow unit (26) is removed from the bellow housing (25).

Step F: Replace the two gaskets (14.1) and the gasket (14).

Step G: When the bellow unit (26) is replaced, the proper position of the anti-twisting device must be observed.

Step H: The set pins (21) have to drive within the slots of the anti-twisting device. Check for friction-free movement.

Step I: Replace mounting bonnet (3.1) and screw down the hexagon nuts (17.1) crosswise.

3.4 Exchange of the plug-spindle unit

Step A: Drive the actuator into middle position and dismantle the actuator.

Step B: Unscrew the gland flange (7).

3.4.1 Control valve type 470

Step A: Unscrew the hexagon nuts (17) and dismantle the mounting bonnet (3).

Step B: Pull out the plug with the spindle and exchange this unit.

Step C: Remove the spring-type straight pin (19) and unscrew the spindle (6).

Step D: Replace the old parts and assemble it.

Step E: Drill a hole through the plug shaft and insert a new pin.

Step F: Replace the gasket (14) and assemble the mounting bonnet (3).

Step G: Tighten the nuts (17) evenly, crosswise.

3.4.2 Control valve type 471

Step A: Unscrew the hexagon nuts (17) and dismantle the bellow housing (25) with plug (5).

Step B: Drive the spindle in the bottom position and remove the spring-type straight pin (19).

Step C: Unscrew the plug.

Step D: Screw a new plug at the spindle and drill through the shaft. Drive the spring-type straight pin (19) into the hole.

Step E: Replace the gasket (14).

Step F: Assemble the bellow housing (25) with plug (5) together with the body (1) and fix it by screwing the hexagon nuts (17) crosswise.The spindle can only be completely replaced together with the bellow.

3.5 Changing the seat ring

The seat ring is screwed into the valve body. The seat ring can be obtained after removing the bonnet and can then be refinished or replaced as required.

Step A: Clean and lubricate the thread and conical sealing surface before insertion.

Pneumatic actuator, type dp

1 General

The pneumatic linear actuator is designed to be mounted directly on a control valve. The pneumatic actuator converts positioning command signals into stem thrust forces. The required back setting force is produced by the spring arrangement inside the actuator. The rolling-diaphragm produces linear spindle movements over the complete stroke.

The preferred mounting position is with the actuator and valve spindle in vertical position.

The mode of operation for the actuator depends on how the springs are inserted when the actuator is assembled. Even when the actuator is fitted in a piping system, the mode of operation can be changed.

The pneumatic actuator can be operated as:

- Spring opens valve/air closes valve operation mode
- Air opens valve/spring closes valve operation mode

Illustration of a pneumatic actuator

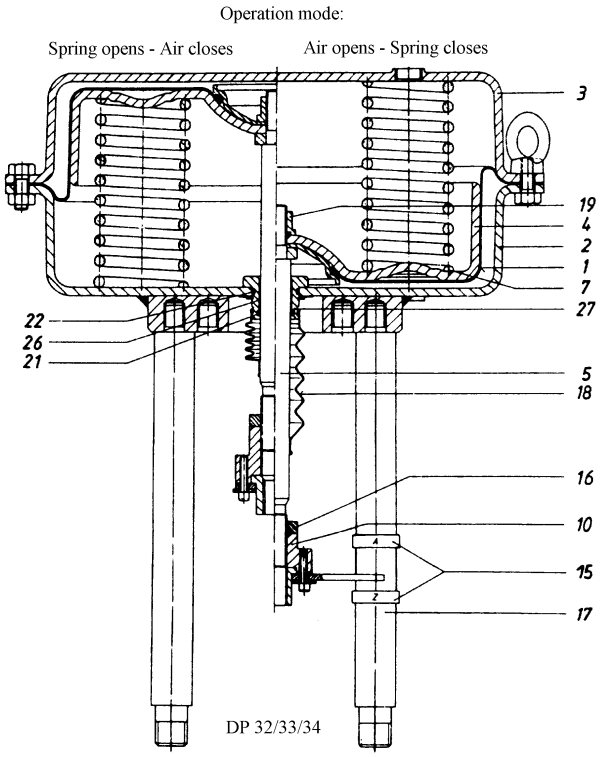


Figure 1 **om5520_01_dpactux0053610en.wmf**

Table 2 below shows a list of the position numbers in Figure 3 and Figure 3.

Table of position numbers in Figure 3			
Part	**Denomination**	**Part**	**Denomination**
1	Rolling diaphragm	15	Stroke indicator
2	Diaphragm housing	16	Hexagon nut
3	Diaphragm lid	17	Mounting rod
4	Diaphragm plate	18	Bellow
5	Spindle	19	Collar nut
7	Spring	21	O-ring (spindle)
10	Coupling flange	22	O-ring (bushing)
11	Guide flange	26	Slotted guide bearing
12	Rotation guard	27	Spindle guide
13	Socket screw	30	Hexagon nut
14	Threaded bushing	31	Hexagon nut

Table 1

1.1 Pneumatic connection

The air supply should be dry and at a low service temperature. A heat-guard should be installed to prevent high service temperature.

The pneumatic supply tube must be connected to the diaphragm housing (2) by operation mode “spring closes" and to the diaphragm lid (3) by operation mode “spring opens”.

By air failure the stem automatically returns into the original position caused by the inserted springs.

Warning: The actuator diaphragm may only be pressure loaded on the side opposite of the springs. The vent hole in the other connection must remain open.

1.2 Assembly of the actuator on the valve

The assembling of the actuator on the valve is shown in Figure 3. For both “spring closes” and “spring opens” operation modes the following assembling procedure should be followed:

Step A: If the actuator and the valve are separated, press the plug and spindle unit (5) into the closed position for operation mode “spring closes” or into the open position for operation mode “spring opens”.

Warning: Make sure that the plug does not turn while pressing on the seat during assembly.

Step B: Loosen the socket screws (13), remove the rotation guard (12) and the guide flange (11). The threaded bushing (14) is now free.

Step C: Turn the locking hexagon nut (30) onto the valve spindle. Place the rotation guard (12) and the guide flange (11) over the valve spindle and then turn the threaded bushing (14) onto the valve spindle.

Step D: Check the actuator for proper operation mode and connect the pneumatic supply to the connection piece in the diaphragm housing (2) for operation mode “spring closes” or in the diaphragm lid (3) for operation mode “spring opens”.

Step E: Drive the actuator into approximately mid-stroke position over the air supply and mount it onto the valve (read the value from the pressure gauge - middle of the spring range).

Step F: Tighten the hexagon nuts (31).

Assembly of the actuator on the valve

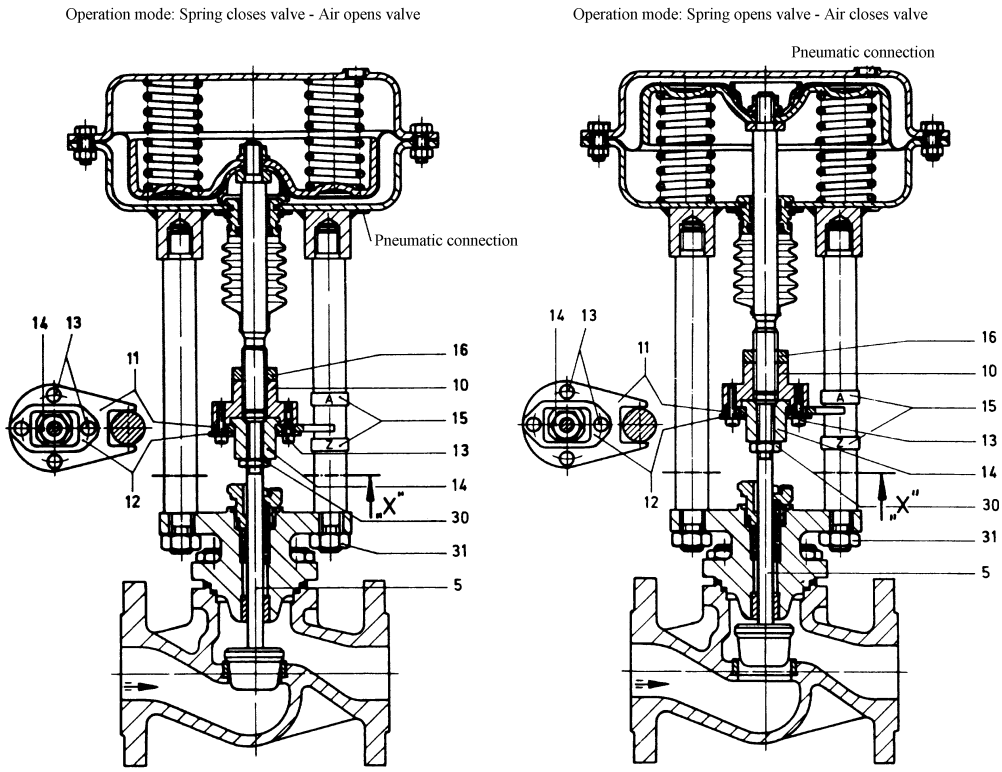


Figure 2 **om5520_01_dpactsx0053600en.wmf**

1.3 Adjustment of the starting pressure signal

Step A: Drive the actuator to the required spring-starting point over the air supply.

Step B: Turn the threaded bushing (14) up against the coupling flange (l0) so that the collar enters into the flange and presses against it. Make sure that the plug is lying on the valve seat.

Attention: Note that sufficient thread of the valve spindle is inside the threaded bushing (14). If not, turn the coupling flange (10) downwards from the actuator spindle and pull the threaded bushing (14) against it.

Step C: For operation mode: “spring closes”:
- Attach the guide flange (11) and the rotation guard (12) with the socket screws (13) to the coupling flange (10).
- Check that the plug lifts off the seat at the required spring starting point.

Step D: For operation mode: “spring opens”:
- Check that the plug leaves the end position at the required spring starting point, and finishes the valve stroke at the spring-range end value.
- The plug must then also press on the valve seat.

Step E: After the test operation set the stroke indicators (15) into the end positions.

Step F: Lock the hexagon nuts (16 + 30) at the valve mid-stroke.

Step G: Do not turn the plug on the seat when it is under force.

2 Reversal of the actuator action

The actuator action can be reversed even when the valve is installed in a piping system. The position numbers mentioned in this section refer to Figure 3 and Figure 3.

Step A: Drive the actuator into approximately mid-stroke position with the air supply.

Step B: Loosen and remove the socket screws (13) from the coupling flange (10) and drop the rotation guard (12) over the valve spindle.

Step C: Remove the hexagon nuts (31) from the actuator and lift off the valve.

Step D: Reduce the air supply until the chamber is pressure free.

Step E: Loosen and remove the diaphragm lid screws.

Step F: Remove the diaphragm lid (3).

Warning: The actuators DP 32 and DP 33 have two longer screws when fitted with stronger spring ranges. The actuator DP 34 has four. These screws should be the last screws to be loosened, and must be loosened evenly to reduce the high spring tension.

Step G: For reversal from “spring closes” into “spring opens”:

- Remove the springs (7) and the diaphragm plate (4) with the diaphragm (1) and the spindle (5).
- Loosen and remove the seal lock nut (19) and remove the spindle (5). Turn over the diaphragm plate (4) with the diaphragm (1) and the diaphragm clamping flange, and place it over the spindle (5).
- Tighten with the seal lock nut (19). Make sure that the spindle surface is not damaged.
- Grease the spindle surface and the 0-ring.
- Place the diaphragm plate (4) with the diaphragm (1) into the diaphragm lid (3).
- Arrange the springs (7) onto the moulds pressed into the diaphragm plate (4).
- Place the diaphragm housing with the spindle sealing unit over the spindle, and screw it together. Make sure that the springs stay properly arranged.
- Turn the hexagon nut (16) and the coupling flange (10) onto the spindle (5).
- Mount the actuator as described previously, and connect the air supply tube to the diaphragm lid (3).

Step H: For reversal from “spring opens” into “spring closes”:

- Remove the diaphragm (1) and the diaphragm plate (4) with the spindle (5) and the springs (7).
- Loosen and remove the seal lock nut (19) from the spindle (5). Turn over the diaphragm plate (4) with the diaphragm (1) and the diaphragm clamping flange, and place it on the spindle (5).
- Tighten with the seal lock nut (19). Make sure that the spindle surface is not damaged.
- Grease the spindle surface and the 0-ring.
- Stick the diaphragm plate (4) with the diaphragm (1) and the spindle (5) into the diaphragm housing (2).
- Arrange the springs (7) onto the moulds pressed into the diaphragm plate (4).Place the diaphragm lid (3) on the top, and screw it together. Make sure that the springs (7) stay properly arranged.
- Turn the hexagon nut (16) and the coupling flange (10) onto the spindle (5).
- Mount the actuator as described previously, and connect the air supply tube to the diaphragm housing (2).

3 Manual operation device

Some actuators are fitted with a manual operation device. The device is connected to the actuator by means of a new diaphragm lid, a spindle extension with a USIT-ring and a spindle sealing unit.

The manual operation device is equipped with stroke indicators. The stroke indicators of both the actuator and the manual operation device must be in the same end positions when the actuator is pressure free.

The manual operation device must be set into neutral position when the actuator is running automatically.

The locking device of the manual operation device must be unlocked before operating.

The locking device prevents an unwanted disarrangement of the setting during operation, e.g. due to vibration, etc.

4 Maintenance

The pneumatic actuator is maintenance free. To maintain a disturbance free operation, the air should be supplied by an air-supply station.

The diaphragm, spindle sealing unit and springs are wear parts and should be replaced when necessary.

4.1 Exchange of spindle sealing

When the spindle sealing is changed, the slotted PTFE-guide bearing and the 0-ring should be replaced. The spindle surface must be clean and undamaged. Before the actuator is assembled, the spindle unit and the spindle must be greased.

Positioner, SIPART PS2 6DR5000

1 General

The following instruction is a general description of SIPART positioners and covers the complete range in the PS2 6DR5000 series.

The electronic pneumatic positioner is used as the final control element of a pneumatic linear actuator or a part-turn actuator (rotary movements). The positioner converts a current output signal (4 to 20 mA) from a process controller or control system to a set point value and into a corresponding movement. The positioner changes the pressure in a pneumatic actuator chamber or cylinder until the position corresponds to the set point value.

The positioner can be set up either as a single-action positioner or a double-action positioner. The single-action positioner is mainly used together with a control valve. The opposite movement for the control valve is supplied by means of springs. The double-action positioner is mainly used to control an air damper via a pneumatic cylinder (actuator). All movements of the pneumatic cylinder are supplied by the positioner. An illustration of the function diagram for the positioner is shown in Figure 8. The function diagram is shown with option modules.

1.1 Mode of operation

Comparison of the set point and the actual value takes place electronically in a micro controller. If the micro controller detects a deviation, it uses a 5-way switch procedure to control the piezoelectric valves, which in turn regulate the flow of air into the actuating chambers. When connected in a two-wire system, the SIPART PS2 draws its power exclusively from the 4 to 20 mA set point signal.

The piezoelectric valve converts the command into a pneumatic positional increment. The positioner outputs a continuous signal in the area where there is a large control deviation (high-speed zone). In areas of moderate control deviation (slow-speed zone) it outputs a sequence of pulses. No positioning signals are output in the case of a small control deviation (adaptive or variable dead zone).

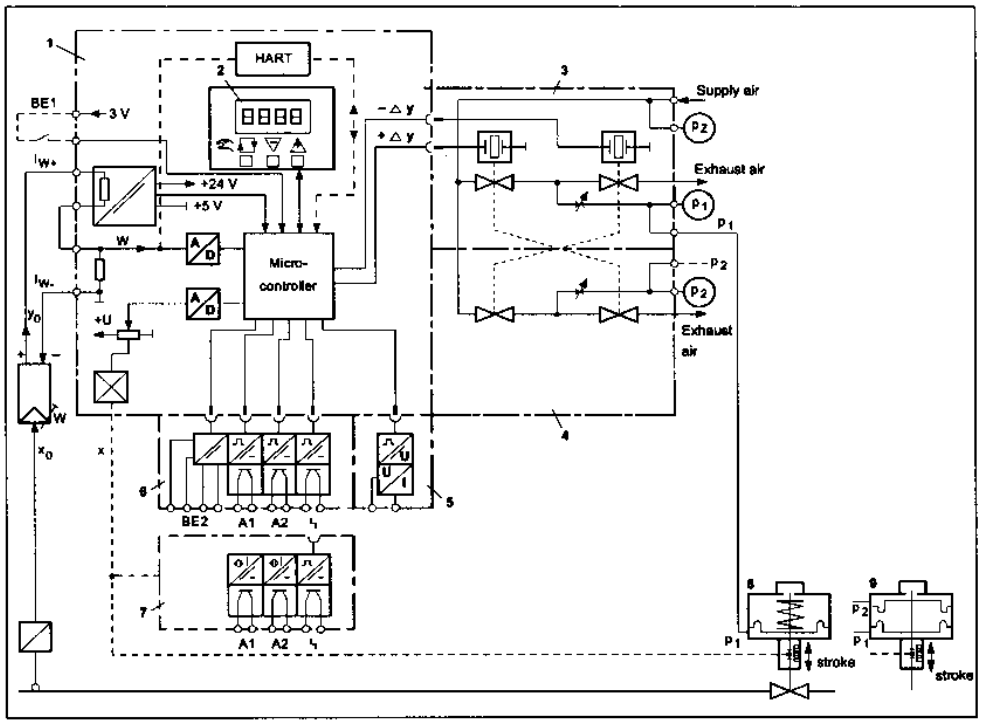
Commissioning (initialisation) is carried out automatically to a large extend. During initialisation, the micro controller automatically determines the zero, full-scale value, direction of action, and positioning speed of the actuator. It uses these to determine the minimum pulse time and dead zone, thus optimising the control.

The positioner can also be operated manually by the pushbuttons and the LCD of the SIPART PS2.

The installation of the positioner must be carried out in the following order:

- Mechanic connection
- Electric connection
- Pneumatic connection
- Commissioning

Illustration of a function diagram



1 Motherboard with microcontroller and input circuit
2 Control panel with LC-display and momentary action switch
3 Piezo-valve unit, always built-in
4 Valve unit with double action positioner always built-in
5 Iy-module for positioner SIPART PS2
6 Alarm module for three alarm outputs and one digital input
7 SIA-module (Slot Initiator-Alarm-module)
8 Spring-loaded pneumatic actuator (single action)
9 Spring-loaded pneumatic actuator (double action)

Figure 1 **om5510_05_sips2_x0053470en.wmf**

2 Mechanic connection of the positioner

Normally the positioner is pre-mounted on the actuator or cylinder. If not, follow the installation guide lines below.

2.1 Mechanic connection to an actuator

Figure 8 shows the mechanic connection of the positioner to an actuator for a control valve.

Step A: Mount clamping assembly (3) with hexagon socket cap screws (17) and lock washers (16) on the actuator spindle.

Step B: Insert the pick-up bracket (2) into the recesses of the clamping assembly. Set the necessary length and tighten the screws so that the pick-up bracket can still be shifted.

Step C: Push the roll (5), spring (13), and guide washer (22) onto the pin (4).

Step D: Insert the pin in the lever (6) and assemble with nut (18), spring washer (14), and U-washer (12).

Step E: The value of the stroke range specified on the actuator should be set or if this does not exist as a scaling value, the next greatest scaling value should be set. The centre of the pin must be in line with the scaling value. The same value can be set later under parameter "3.YWAY" in commissioning to display the way in [mm] after initialisation.

Step F: Assemble the hexagon socket cap screw (17), spring washer (16), washer (12), and square nut (19) on the lever.

Step G: Push the pre-mounted lever onto the positioner axis up to the stop and fix with the hexagon socket cap screw (17).

Step H: Fit the mounting bracket (1) with two hexagon head screws (9), lock washer (10), and flat washer (11) on the rear of the positioner.

Step I: Selection of the row of holes depends on the width of the actuator yoke. The roll (5) should engage in the pick-up bracket (2) as close as possible to the spindle but may not touch the clamping assembly.

Step J: Hold the positioner with the mounting bracket on the actuator so that the pin (4) is guided within the pick-up bracket (2).

Step K: Tighten the pick-up bracket.

Step L: Position the mounting parts according to the type of actuator.
- Actuator with ledge: hexagon head screw (8), flat washer (11), and lock washer (10).
- Actuator with plane surface: four hexagon head screws (8), flat washer (11), and lock washer (10).
- Actuator with columns: two U-bolts (7), four hexagon nuts (21) with flat washer (11), and lock washer (10).

Step M: Secure the positioner onto the yoke using the previously positioned mounting parts.

Note: Set the height of the positioner so that the horizontal lever position is reached as close to the stroke centre as possible. The lever scale can be used as orientation. It must be guaranteed that the horizontal lever position is passed through within the stroke range.

Mechanic connection of the positioner (linear actuator)

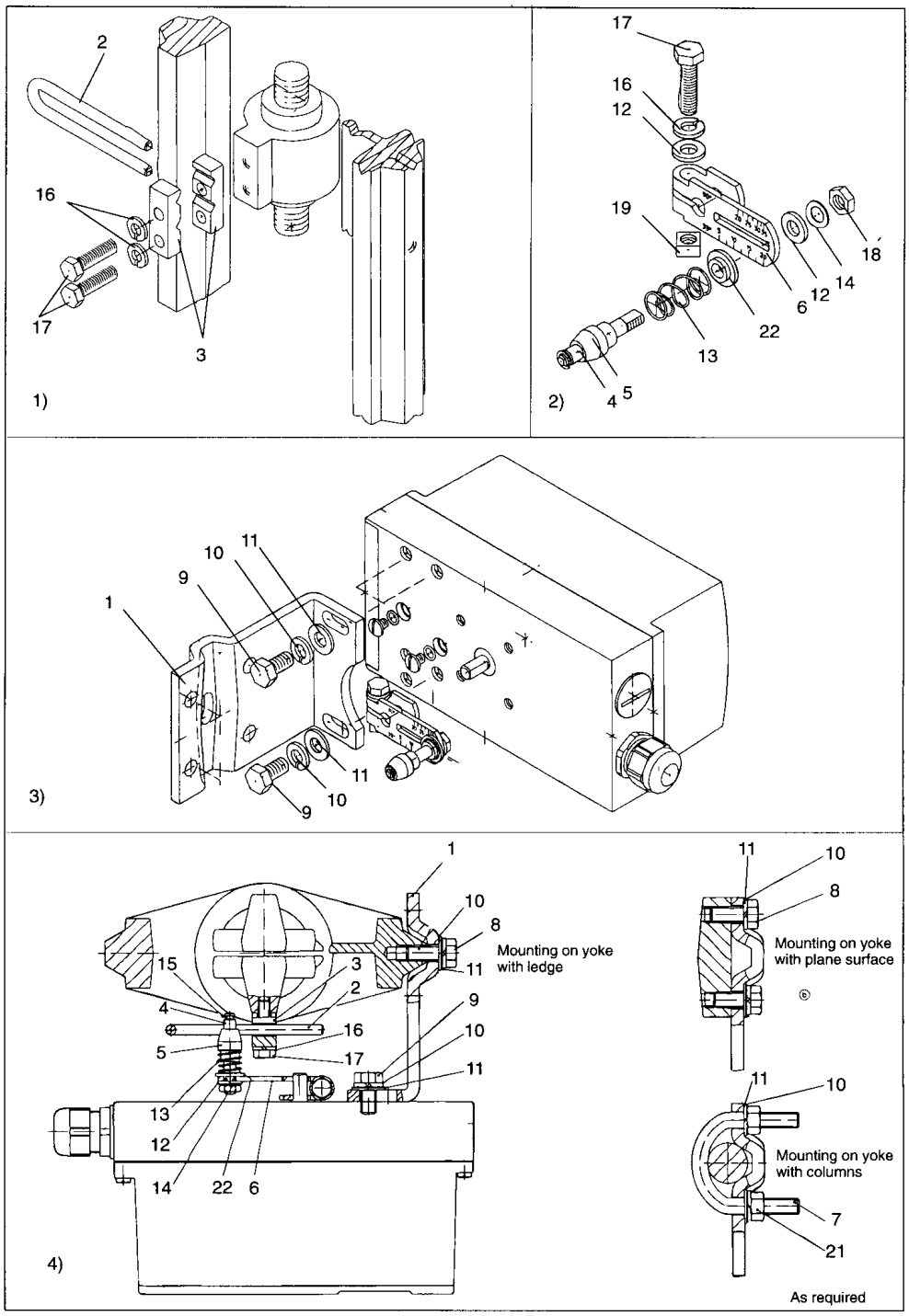


Figure 2 **om5510_05_sips2_x0053480en.wmf**

2.2 Mechanic connection to a pneumatic cylinder

The positioner is connected to a pneumatic cylinder by means of fixing bracket, lever arm with Allen screw, extension arm, and roller.

The pneumatic piston is connected to a guide rail with an oblique angle via a linkage. The guide rail moves together with the piston, and the roller/lever connection senses the position of the piston. By operating both sides of the pneumatic cylinder, the set point is reached. A spring inserted between the fixing bracket and the lever arm secures that the roller is pressed down against the guide rail.

2.3 Mechanic connection to a rotary actuator

Figure 8 shows the mechanic connection of the positioner to a rotary actuator.

Step A: Attach the mounting console (9, actuator specific) onto the rear of the positioner and secure using the hexagon head screws (14) and lock washers (15).

Step B: Adhere pointer (4.2) onto the mounting console in the centre of the centring hole.

Step C: Push coupling wheel (2) onto the positioner axis, pull back by about 1 mm and tighten the hexagon socket head screw (18) with the Allen key provided.

Step D: Place the carrier (3) onto the end of the actuator and secure using Fillister head screw (16) and washer (17).

Step E: Carefully place the positioner with mounting console onto the actuator such that the pin of the coupling wheel engages in the driver.

Step F: Align the positioner/mounting console assembly in the centre of the actuator and screw tight (screws are not included in the delivery, they are part of the actuator mounting console).

Step G: Follow the start-up sequence as described later. Drive the actuator to the end position and adhere the scale (4.1) onto the coupling wheel (2) according to the direction of rotation and rotaryactuator. The scale is self-adhesive.

Mechanic connection of the positioner (rotary actuator)

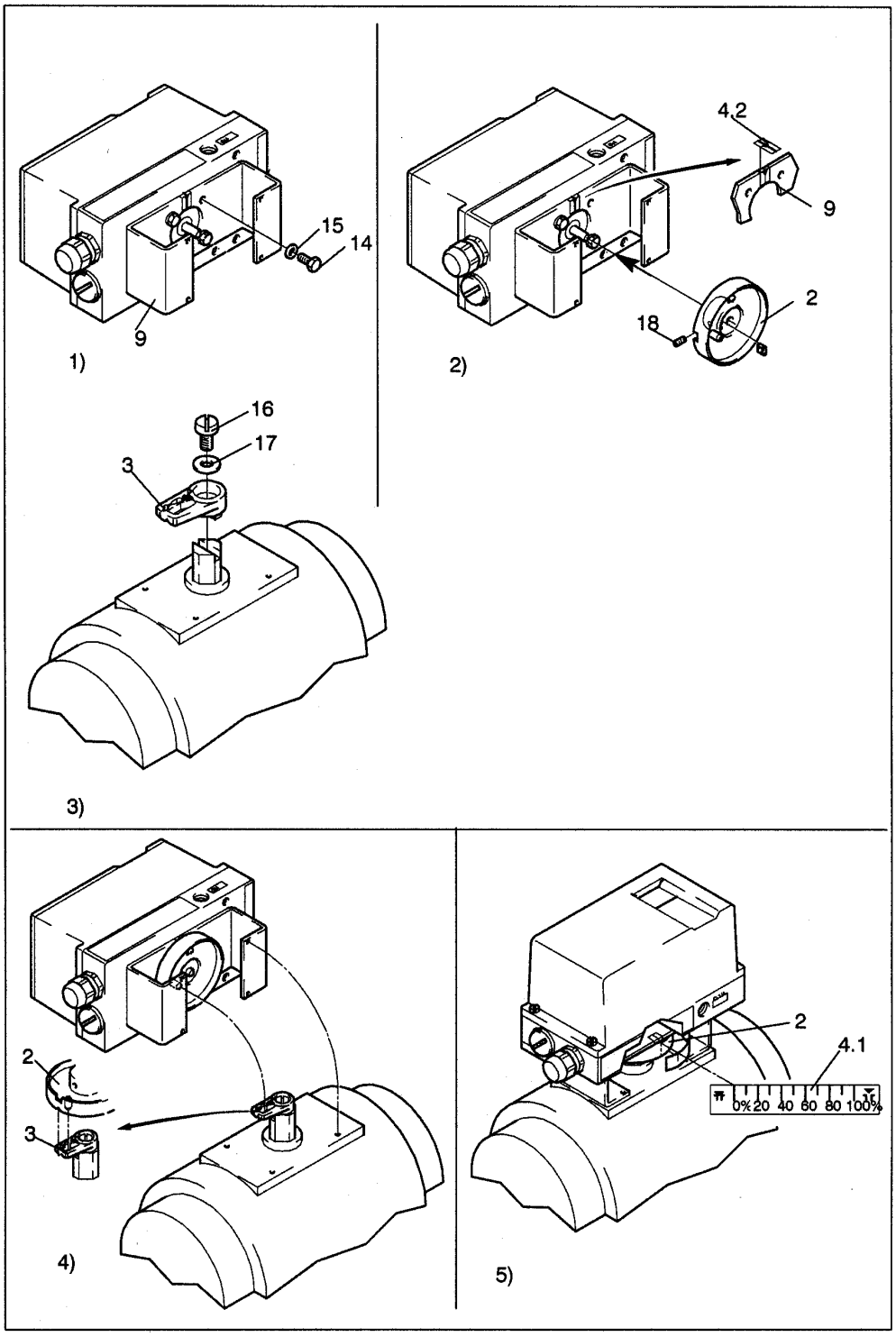
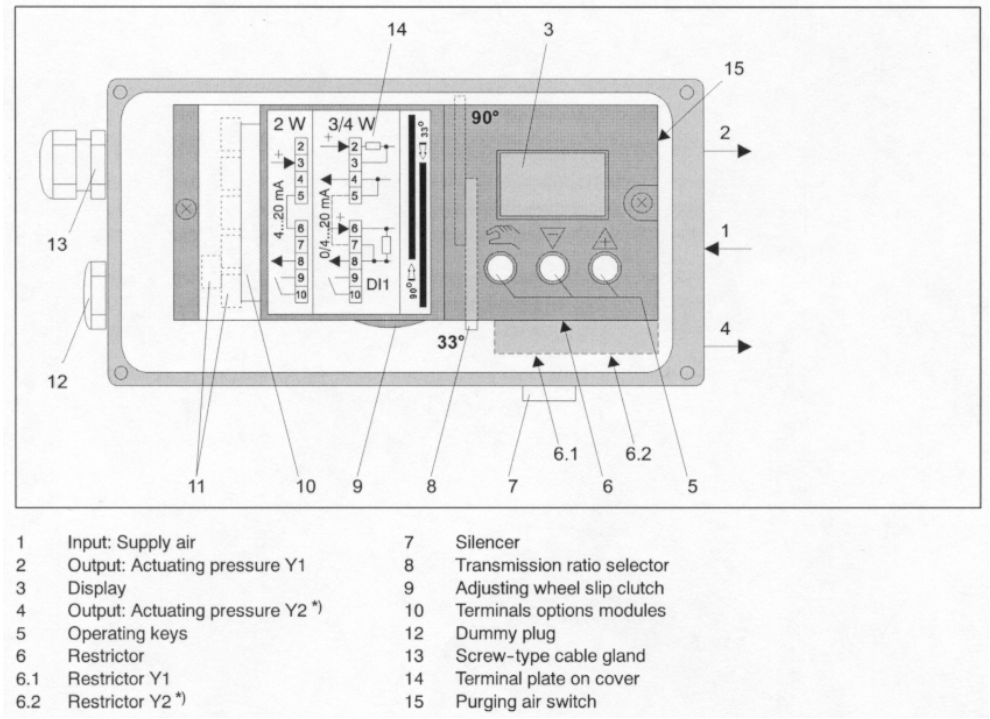


Figure 3 **om5510_05_sips2_x0053490en.wmf**

3 Electric connection of the positioner

When the positioner is connected in a two-wire system, the positioner draws its power exclusively from the 4 to 20 mA set point signal. Figure 8 indicates the input circuits for the positioner.

View of the controls and connections



1	Input: Supply air	7	Silencer
2	Output: Actuating pressure Y1	8	Transmission ratio selector
3	Display	9	Adjusting wheel slip clutch
4	Output: Actuating pressure Y2 *)	10	Terminals options modules
5	Operating keys	12	Dummy plug
6	Restrictor	13	Screw-type cable gland
6.1	Restrictor Y1	14	Terminal plate on cover
6.2	Restrictor Y2 *)	15	Purging air switch

Figure 4 **om5510_05_sips2_x0053500en.wmf**

4 Pneumatic connection

Ensure that the air quality is suitable. Grease-free instrumental air with a solid content <30 µm and a pressure dew point 20 K below the lowest ambient temperature must be supplied.

Warning: For reasons of safety, pneumatic power may only be supplied after assembly when the positioner is switched to operating level "P manual" operation with electrical signal applied.

4.1 Selection of P manual mode

4.1.1 Selection of P manual mode

Before pneumatic power is connected, the positioner must be in P manual mode. The display must show “NOINIT” in the bottom line.

4.1.2 Pneumatic connections

Figure 8 shows a view of the positioner controls and connections.

Step A: If required, connect a manometer block for supply air and actuating pressure.
Step B: The silencer in the exhaust output can be removed if necessary.
Step C: Connect actuating pressure Y1 and/or Y2 (Y2*) is only used with double-acting actuators) according to the desired safety position.
Step D: Connect the supply air (1). The pressure should be between 1.4 to 7 bar.

Note: In order for spring-loaded pneumatic actuators to be able to reliably exploit the maximum possible actuating path, the supply pressure must be sufficiently greater than the maximum required final pressure of the actuator.

4.1.3 Safety positionwhen the electric power supply fails

For a single-action actuator is Y1 deaerated. For a double-action actuator is Y1 equal to the supply air pressure and Y2 is deaerated.

4.1.4 Restrictors

To increase the positioning times for fast actuators when necessary, the air flow can be reduced with the restrictors Y1 and Y2 (only for double-action valves). Turning the restrictors in the clockwise direction reduces the air flow until it is shut off. To set the restrictors it is recommended to first close them and then open them again slowly (see initialisation process RUN 3).

4.1.5 Purging air switchover

The purging air changeover switch located above the pneumatic terminal block on the valve manifold can be accessed when the housing is open. When the switch is in position “IN” the interior of the housing is purged with very small quantities of clean and dry instrument air. In position “OUT” the purging air is led directly out of the instrument.

5 Commissioning

Commissioning (initialisation) is carried out automatically to a large extend. During initialisation, the micro controller automatically determines the zero value, full-scale value, direction of action and positioning speed of the actuator. It uses these to determine the minimum pulse time and dead zone, hereby optimising the control.

The positioner can also be operated manually by the pushbuttons and the LCD of the SIPART PS2.

The commissioning of the positioner can be divided into the following steps:

- Preparation for initialisation
- Start the automatic initialisation procedure
- Set additional parameters if required
- Select automatic mode

Figure 8 shows the possible operation modes for the positioner and gives an overview of how to change between them. The levels are P-manual mode, configuration and initialisation, manual mode, automatic mode, and diagnostic display. From these modes it is possible to select operation mode, set operation parameters, restore to factory setting, run an automatic initialisation, etc.

Operation levels

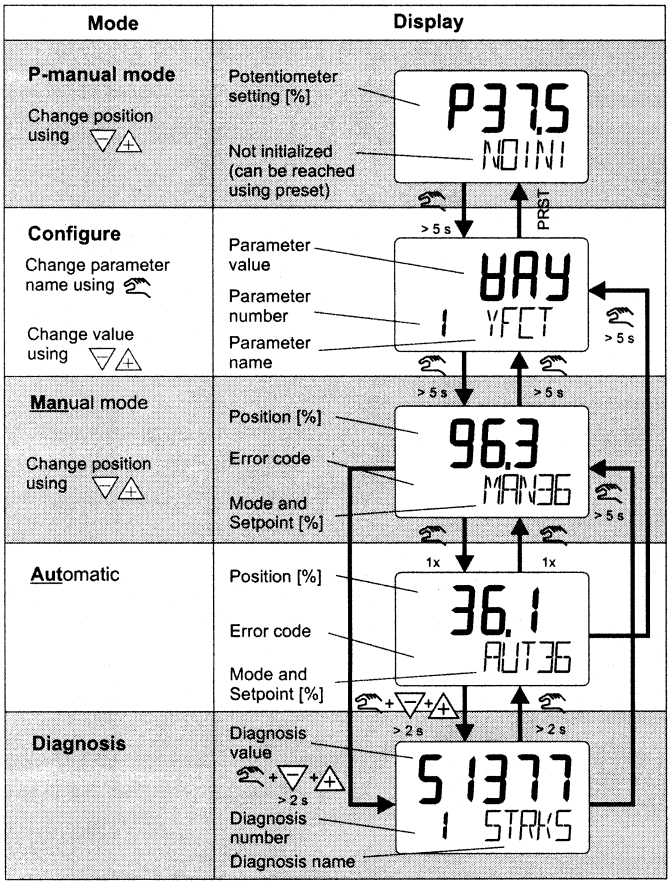


Figure 5 **om5510_05_sips2_x0053510en.wmf**

5.1 Preparation for initialisation

Step A: Check and set the gear transmission switch to the correct position. Figure 8(position 8) indicates the location of the switch. For linear actuators the gear transmission switch is set according to the stroke range as described in Table 4 for the parameter "3.YWAY". For part-turn actuators 90° must be selected.

Step B: Check that the pneumatic supply power (inlet air) is present. The operating pressure should be at least one bar greater than is necessary for closing/ opening the valve during initialisation.

Step C: Without initialisation the positioner is in "P manual mode" and "NOINIT" flashes in the display. This level can also be reached by using "55.PRST"function (see Table 4).

Step D: Check the free running of the mechanics in the whole actuating range by moving the actuator with the keys "↑" and "↓" and driving to the respective end position.

Step E: With linear actuators drive the actuator to horizontal lever position. The display must indicate 48% to 52%. If necessary, correct the value by adjusting the sliding clutch. After the check is completed, the actuator must be approximately half way along its stroke. This is due to establishment of the action direction during automatic initialisation.

5.2 Automatic initialisation

Figure 8 shows the configuration modeincluding the operation in this mode and Table 4 shows the parameter/configuration list. Figure 8 shows the initialisation process of the positioner. The initialisation process is stored in the microprocessor. This means that an additional initialisation only is necessary if any parts of the unit have been changed.

Note: The numerical values used in Figure 8, Figure 8, and Figure 8 are examples.

Step A: Call the configuration mode by pressing the hand symbol key for longer than 5 seconds.

Step B: Set the actuator type, linear or part-turn, in the menuitem line "1.YFCT".

Step C: Switch to the second parameter by pressing the hand symbol key briefly.

Step D: Set the rated angle of rotation for feedback in the menu item line "2.YAGL". It is vital that this value corresponds to the setting of the gear transmission ratio selector (Figure 8, position 8), 33° or 90°.

Step E: Switch to the next parameter by pressing the hand symbol key briefly.

Step F: This parameter ("3.YWAY") is only set for linear actuators and if the total stroke in mm should be displayed at the end of the initialisation phase. To do this, select the same value in the display to which the carrier pin to the scale on the lever is set to.

Step G: Switch to the following parameter by pressing the hand symbol key briefly.

Step H: Start the initialisation ("4.INITA") by pressing the "↑" key for longer than 5 seconds.

Step I: During the initialisation phase "RUN1" to "RUN5" appear one after another in the bottom of the display. Please note that the initialisation process may last up to 15 minutes depending on the actuator.

Note: The ongoing initialisation can be aborted at any time by pressing the hand symbol key. The previous settings are retained. All the parameters are reset to the factory setting only after performing a preset "55.PRST".

Step J: If problems occur, carry out the measures as described in the table "Possible messages" shown in Figure 8.

Step K: The initialisation is completed when "FINSH" appears in the bottom of the display.

Step L: When pressing the hand symbol key briefly the menu item line "4.INITA" is displayed.

Step M: To exit the configuration operating mode, press the hand symbol key for longer than 5 seconds. The software version is displayed after about 5 seconds. The instrument is in manual operationafter releasing the key.

Step N: The positioner can be changed to automatic mode by pressing the "↓"key once as indicated in Figure 8.

Step O: The automatic mode is the normal mode. In this mode the positioner compares the set point current with the current position and moves the actuator until the control deviation reaches the dead zone.

Operation in the configuration mode

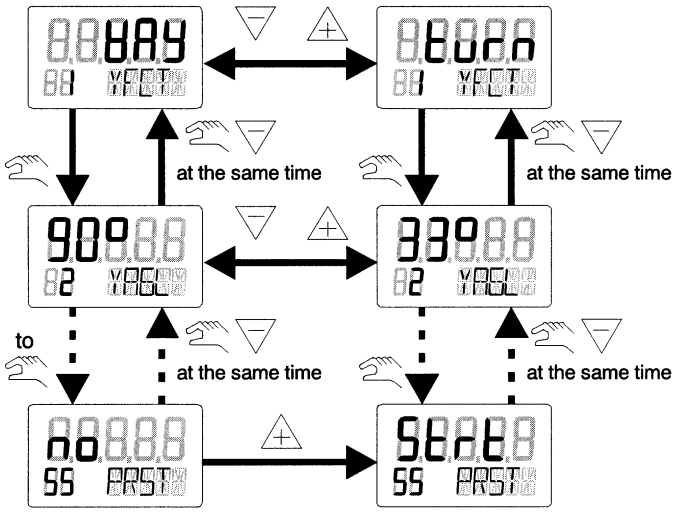


Figure 6 **om5510_05_sips2_x0053520en.wmf**

Initialisation process

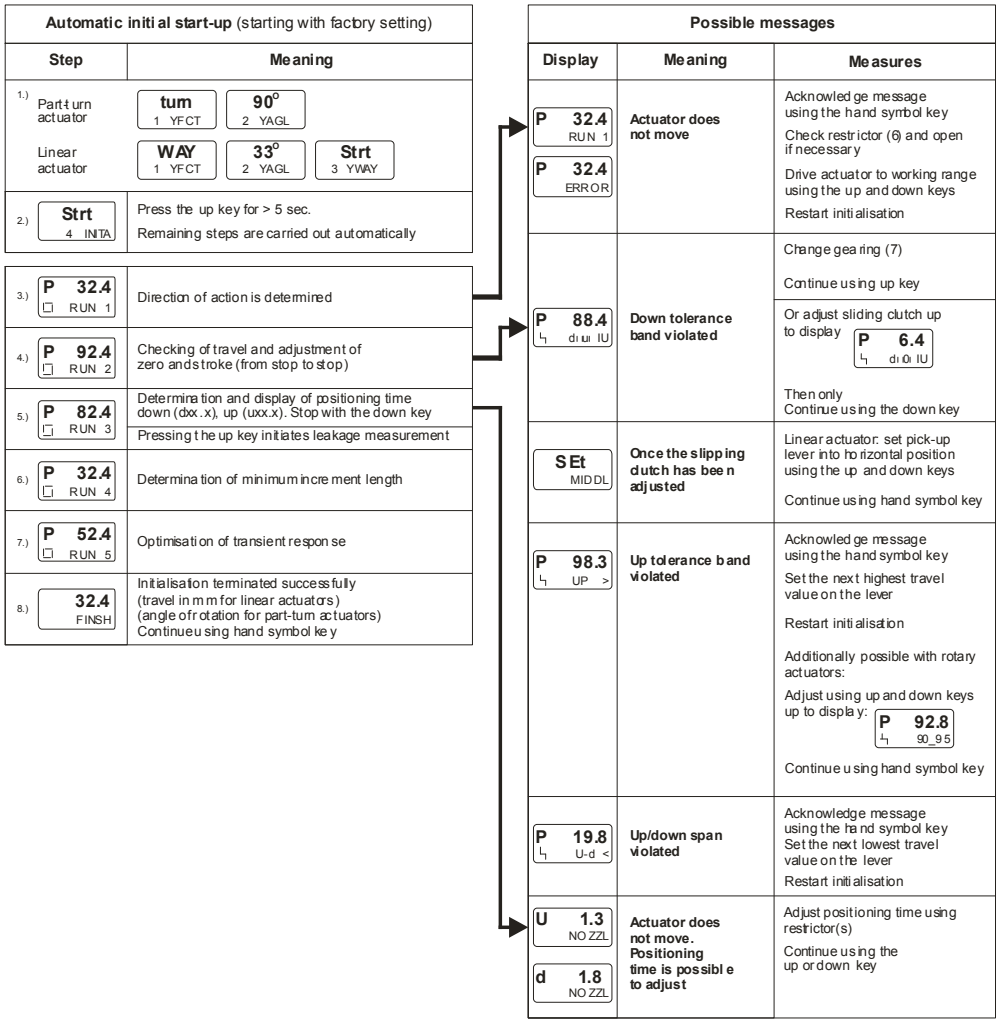


Figure 7 **om5510_05_sips2_x0053530en.wmf**

5.3 Parameters

Table 4 shows the parameter list for the positioner. The parameter name is written in plain text in the “menu line” column. The function of the parameter is described briefly in the “Function column”. In addition, the possible parameter values, the physical unit and the factory setting of the parameters are shown.

After the initialisation process, the positioner can be configured to meet the requirements of a specified task. The factory settings correspond to the requirements for a typical application. This means that normally only a few parameters will need to be changed.

The positioner can be installed and configured to fit linear and part-turn actuators with reverse action. E.g. linear actuators with the set point in the falling direction or part-

turn actuators for counter clockwise operation direction. In this case the parameters "7.SDIR" and 38."YDIR" should be set to "FALL".

Parameter list

Menu line	Function	Parameter values	Unit	Factory setting	Customer setting
1.YFCT	Type of actuator	turn (part-turn actuator) WAY (linear actuator) LWAY (linear actuator without sine correction) ncSt (part-turn actuator with NCS) -ncSt (part-turn actuator with NCS, inverted)		WAY	
2.YAGL[1)]	Rated angle of rotation for feedback (must correspond to gear ratio)	90° 33°	Degrees	33°	
3.YWAY[2)]	Stroke range (optional setting) When used, the value must correspond with the set of the leverage ratio on the actuator Driver pin must be set to the value of the actuator travel or, if this value is not scaled, to the next lager scale value	OFF 5 , 10 , 15 , 20 (short lever 33°) 25 , 30 , 35 (short lever 90°) 40 , 50 , 60 , 70 , 90 , 110 , 130 (long lever 90°)	mm	OFF	
4.INITA	Initialisation (automatically)	noini / no / ###.# / Strt		no	
5.INITM	Initialisation (manually)	noini / ###.# / Strt		no	
6.SCUR	Current range of set point 0 to 20 mA 4 to 20 mA	0 MA 4 MA		4 MA	
7.SDIR	Set point direction rising falling	riSE FALL		riSE	
8.SPRA	Set point for start of split range	0.0 to 100.0	%	0.0	
9.SPRE	Set point for end of split range	0.0 to 100.0	%	0.0	
10.TSUP	Set point ramp up	Auto 0 to 400	s	0	
11.TSDO	Set point ramp down	0 to 400	s	0	
12.SFCT	Set point function Linear Equal-percentage 1:25, 1:33, 1:50 Inverse equal-percentage 1:25, 1:33, 1:50 Freely adjustable	Lin 1–25 , 1–33 , 1–50 n1–25 , n1–33 , n1–50 FrEE		Lin	
13.SL0[3)] 14.SL1 to 32.SL19 33.SL20	Set point turning point at 0% 5% to 95% 100%	0.0 to 100.0	%	0.0 5.0 to 95.0 100.0	
34.DEBA	Dead zone of controller	Auto 0.1 to 10.0	%	Auto	
35.YA	Start of manipulated variable limiting	0.0 to 100.0	%	0.0	

Parameter list						
36.YE	End of manipulated variable limiting		0.0 to 100.0	%	100.0	
37.YNRM	Standardisation of manipulated variable	To mech. travel To flow	MPOS FLOW		MPOS	
38.YDIR	Direction of manipulated variable for display	Rising Falling	riSE FALL		riSE	
39.YCLS	Tight closing with manipulated variable	Without Top only Bottom only Top and bottom	no uP do uPdo		no	

Table 1

Parameter list continued						
Menu line	**Function**		**Parameter values**	**Unit**	**Factory setting**	**Customer setting**
40.YCDO	Value for tight closing, bottom		0.0 to 100.0	%	0.5	
41.YCUP	Value for tight closing, top		0.0 to 100.0	%	99.5	
42.BIN1[4)]	Function of BI 1: None Only message (NO/NC contact) Block configuring (NO contact) Block configuring and manual (NO contact) Drive valve to pos. up (NO/NC contact) Drive valve to pos. down (NO/NC contact) Block movement (NO/NC contact)		OFF on / -on bLoc1 bLoc2 uP / -uP doWn / -doWn StoP / - StoP		OFF	
43.BIN2[4)]	Function of BI 2: None Only message (NO/NC contact) Drive valve to pos. up (NO/NC contact) Drive valve to pos. down (NO/NC contact) Block movement (NO/NC contact)		OFF on / -on uP / -uP doWn / -doWn StoP / -StoP		OFF	
44.AFCT[5)]	Alarm function	Without A1=min. A2=max. A1=min. A2=min. A1=max. A2=max.	oFF N , NA N , N NA , NA		OFF	
45.A1	Response threshold of alarm 1		0.0 to 100.0	%	10.0	
46.A2	Response threshold of alarm 2		0.0 to 100.0	%	90.0	
47. ⌙ FCT [6)]	Function of alarm output On fault Fault + not automatic Fault + not automatic + BI (“+” means logical OR operation)		⌙ ⌙ nA ⌙ nAb		⌙	
48. ⌙ TIM	Monitoring time for fault message “control deviation”		Auto 0 to 100	s	Auto	
49. ⌙ LIM	Response threshold for fault message “control deviation”		Auto 0.0 to 100.0	%	Auto	
50. ⌙ STRK	Limit for stroke integral		OFF 1 to 1.00E9		OFF	
51. ⌙ DCHG	Limit for direction change		OFF 1 to 1.00E9		OFF	
52. ⌙ ZERO	Limit for end stop monitoring, bottom		OFF 0.0 to 100.0	%	OFF	
53. ⌙ OPEN	Limit for end stop monitoring, top		OFF 0.0 to 100.0	%	OFF	
54. ⌙ DE-BA	Limit for dead zone monitoring		OFF 0.0 to 100.0	%	OFF	

Parameter list continued					
55.PRST	Preset (factory setting) “no” nothing activated “Strt” start of factory setting after pressing key for 5 sec. “oCAY” display following successful factory setting CAUTION: preset results in “NO INIT”	no Strt oCAY			

[1] If turn is selected it is not possible to set 33°.
[2] Parameter does not appear if 1.YFCT = turn has been selected.
[3] Turning points only appear with selection 12.SFCT = FrEE.
[4] Alternatively “no” if initialisation has not yet been carried out.
[5] NC contact means; action with opened switch or low level. NO contact means; action with closed switch or high level.
[6] Normal means: high level without fault. Inverted means: low level without fault.

Table 2

6 Diagnosis

In the diagnostic mode the current operating data (such as number of strokes, number of changes in direction, number of fault messages, etc.) can be displayed.From the automatic or manual modes the diagnostic mode can be reached by simultaneously pressing all three keys for at least 2 seconds.

Table 4 shows an overview of the displayable values. The diagnostic display has a similar structure as the parameter menu displays. The respective next diagnostic value can be selected with the hand symbol key. Certain values can be set to zero by pressing the “↑” key for at least 5 seconds. These are menu item line “1, 2, 3, and 4”. Some diagnostic values may be greater than 99999. In this case the display switches to exponential display.

Diagnostic list				
No.:	**Abbreviation**	**Meaning**	**Displayable value**	**Unit**
1	STRKS	Number of strokes	0 to 4.29E9	-
2	CHDIR	Changes of direction	0 to 4.29E9	-
3	↳CNT	Fault counter	0 to 4.29E9	-
4	A1CNT	Alarm counter 1	0 to 4.29E9	-
5	A2CNT	Alarm counter 2	0 to 4.29E9	
6	HOURS	Operating hours	0 to 4.29E9	Hours
7	WAY	Determined actuating path	0 to 130	mm or °
8	TUP	Travel time up	0 to 1000	s
9	TDOWN	Travel time down	0 to 1000	s
10	LEAK	Leakage	0.0 to 100.0	%
11	P0	Potentiometer value below stop (0%)	0.0 to 100.0	%
12	P100	Potentiometer value bottom stop (100%)	0.0 to 100.0	%

Diagnostic list				
13	IMPUP	Impulse length up	2 to 100	ms
14	IMPDN	Impulse length down	2 to 100	ms
15	DBOP	Dead zone up	0.1 to 100.0	%
16	DBDN	Dead zone down	0.1 to 100.0	%
17	SSUP	Short step zone up	0.1 to 100.0	%
18	SSDN	Short step zone down	0.1 to 100.0	%
19	TEMP	Current temperature	-45 to 85	°C
20	TMIN	Minimum temperature	-45 to 85	°C
21	TMAX	Maximum temperature	-45 to 85	°C
22	T1	Number of operating hours in Temperature range 1	0 to 4.29E9	Hours
23	T2	Number of operating hours in Temperature range 2	0 to 4.29E9	Hours
24	T3	Number of operating hours in Temperature range 3	0 to 4.29E9	Hours
25	T4	Number of operating hours in Temperature range 4	0 to 4.29E9	Hours
26	T5	Number of operating hours in Temperature range 5	0 to 4.29E9	Hours
27	T6	Number of operating hours in Temperature range 6	0 to 4.29E9	Hours
28	T7	Number of operating hours in Temperature range 7	0 to 4.29E9	Hours
29	T8	Number of operating hours in Temperature range 8	0 to 4.29E9	Hours
30	T9	Number of operating hours in Temperature range 9	0 to 4.29E9	Hours
31	VENT1	Number of cycles pre-control valve 1	0 to 4.29E9	-
32	VENT2	Number of cycles pre-control valve 2	0 to 4.29E9	-
33	STORE	Store current values as “last maintenance” Press the up key for at least 5 seconds (store)	-	-

Table 3

7 Service and maintenance

The positioner is largely maintenance-free. The positioner is fitted with filters in the pneumatic connection as protection against coarse particles of dirt. If the pneumatic energy supply contains particles of dirt, the filters may be clog and impair the function of the positioner. In this case the filters can be cleaned as follows:

Step A: Switch off the pneumatic power supply and remove the pipes.

Step B: Unscrew the cover.

Step C: Remove the three screws from the pneumatic connector strip.

Step D: Remove the filters and O-rings behind the connector strip.

Step E: Clean the filters (e.g. with compressed air).

Step F: After cleaning first insert the filters in the recesses in the housing and then place the O-rings on the filters.

Step G: Align the pneumatic connector strip on the two lugs and screw tight with the three self-tapping screws.

Note: Make sure that the same thread is used. To do this, turn the screws anti-clockwise until they snap into the thread audibly. Only then should the screws be tightened.

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Feed water pump unit (MISSION OS)

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Technical data for feed water pumps

1 General data

- Project No.:.....051868-01
- Project name:.....051868-01-1/-02-1/-03-1/-04-1/-05-1/-06-1/-07-1/-08-1
- Classification society/local authority:.....H2390/91/92/93, H2403/04/05/06
- Thermometer calibration:.....°C
- Language for signs:.....UK

2 Data for feed water pumps

- Pump:.....Modulating
- Pump type:.....CR 10-10
- Delivery head:.....140 m
- Pump capacity:.....9,4 m³/h
- NPSH:.....2,2 m
- Max. media temperature:.....120°C
- Weight of unit:.....92 kg
- Colour of unit:.....Makers standard

3 Data for pump motor

- Motor make:.....Grundfos
- Power supply:.....3 x 440 V, 60 Hz
- Rated output for motor:.....7,5kW
- Rated current:.....13,5 A
- Starting method:.....Direct
- Starting current:.....135 A
- Revolutions:.....3525 r.p.m.
- Ambient air temperature:.....40°C
- Insulation class:.....F
- Degree of protection:.....IP55

Pumps, type CR, CRN

1 General

The multistage in-line centrifugal pumps are used as condensate, make-up, and feed water pumps in boiler plants. To have a proper functioning of the centrifugal pumps it is essential that the pumped liquid does not contain any steam, air, solid particles or fibres. Furthermore the liquid must not attack the pump material chemically.

1.1 Technical data

- Electrical data: see motor nameplate.
- Ambient temperature: Max. 40°C.
- Minimum inlet pressure: see section 2.
- Maximum inlet pressure: see Table 1. However, the actual inlet pressure + pressure when the pump is running against a closed valve must always be lower than the “maximum permissible operating pressure".

Maximum inlet pressure			
50 Hz		**60 Hz**	
CR, CRN 1			
CR, CRN 1s-2 → CR, CRN 1s-36 CR, CRN 1-2 → CR, CRN 1-36	10 bar 10 bar	CR, CRN 1s-2 → CR, CRN 1s-27 CR, CRN 1-2 → CR, CRN 1-25 CR, CRN 1-27	10 bar 10 bar 15 bar
CR, CRN 3			
CR, CRN 3-2 → CR, CRN 3-29 CR, CRN 3-31 → CR, CRN 3-36	10 bar 15 bar	CR, CRN 3-2 → CR, CRN 3-15 CR, CRN 3-17 → CR, CRN 3-25	10 bar 15 bar
CR, CRN 5			
CR, CRN 5-2 → CR, CRN 5-16 CR, CRN 5-18 → CR, CRN 5-36	10 bar 15 bar	CR, CRN 5-2 → CR, CRN 5-9 CR, CRN 5-10 → CR, CRN 5-24	10 bar 15 bar
CR, CRN 10			
CR, CRN 10-1 → CR, CRN 10-6 CR, CRN 10-7 → CR, CRN 10-22	8 bar 10 bar	CR, CRN 10-1 → CR, CRN 10-5 CR, CRN 10-6 → CR, CRN 10-17	8 bar 10 bar
CR, CRN 15			
CR, CRN 15-1 → CR, CRN 15-3 CR, CRN 15-4 → CR, CRN 15-17	8 bar 10 bar	CR, CRN 15-1 → CR, CRN 15-2 CR, CRN 15-3 → CR, CRN 15-12	8 bar 10 bar
CR, CRN 20			
CR, CRN 20-1 → CR, CRN 20-3 CR, CRN 20-4 → CR, CRN 20-17	8 bar 10 bar	CR, CRN 20-1 CR, CRN 20-2 → CR, CRN 20-10	8 bar 10 bar
CR, CRN 32			
CR, CRN 32-1-1 → CR, CRN 32-4 CR, CRN 32-5-2 → CR, CRN 32-10 CR, CRN 32-11-2 → CR, CRN 32-14	4 bar 10 bar 15 bar	CR, CRN 32-1-1 → CR, CRN 32-2 CR, CRN 32-3-2 → CR, CRN 32-6 CR,CRN 32-7-2 → CR,CRN 32-10-2	4 bar 10 bar 15 bar
CR, CRN 45			
CR, CRN 45-1-1 → CR, CRN 45-2 CR, CRN 45-3-2 → CR, CRN 45-5 CR,CRN 45-6-2 → CR,CRN 45-13-2	4 bar 10 bar 15 bar	CR, CRN 45-1-1 → CR, CRN 45-1 CR, CRN 45-2-2 → CR, CRN 45-3 CR, CRN 45-4-2 → CR, CRN 45-7	4 bar 10 bar 15 bar
CR, CRN 64			
CR, CRN 64-1-1 → CR, CRN 64-2-2 CR, CRN 64-2-1 → CR, CRN 64-4-2 CR, CRN 64-4-1 → CR, CRN 64-8-1	4 bar 10 bar 15 bar	CR, CRN 64-1-1 CR, CRN 64-1 → CR, CRN 64-2-1 CR, CRN 64-2 → CR, CRN 64-5-2	4 bar 10 bar 15 bar
CR, CRN 90			
CR, CRN 90-1-1 → CR, CRN 90-1 CR, CRN 90-2-2 → CR, CRN 90-3-2 CR, CRN 90-3 → CR, CRN 90-6	4 bar 10 bar 15 bar	CR, CRN 90-1-1 → CR, CRN 90-2-1 CR, CRN 90-2-2 → CR, CRN 90-4-2	10 bar 15 bar

Table 1

- Maximum permissible operating pressure: see Table 2.

Maximum permissible operating pressure			
Frequency	**Pump type**	**Temperature range**	**Operating pressure**
50 Hz	CR, CRN 1s, 1	-20°C to +120°C	25 bar
	CR, CRN 3		25 bar
	CR, CRN 5		25 bar
	CR, CRN 10-1 → CR, CRN 10-22		25 bar
	CR, CRN 15-1 → CR, CRN 15-17		25 bar
	CR, CRN 20-1 → CR, CRN 20-17		25 bar
	CR, CRN 32-1-1 → CR, CRN 32-7		16 bar
	CR, CRN 32-8-2 → CR, CRN 32-12		25 bar
	CR, CRN 32-13-2 → CR, CRN 32-14		30 bar
	CR, CRN 45-1-1 → CR, CRN 45-5		16 bar
	CR, CRN 45-6-2 → CR, CRN 45-9		25 bar
	CR, CRN 45-10-2 → CR, CRN 45-10		33 bar
	CR, CRN 64-1-1 → CR, CRN 64-5		16 bar
	CR, CRN 64-6-2 → CR, CRN 64-7-1		25 bar
	CR, CRN 90-1-1 → CR, CRN 90-4		16 bar
	CR, CRN 90-5-2 → CR, CRN 90-6		25 bar
60 Hz	CR, CRN 1s, 1	-20°C to +120°C	25 bar
	CR, CRN 3		25 bar
	CR, CRN 5		25 bar
	CR, CRN 10-1 → CR, CRN 10-17		25 bar
	CR, CRN 15-1 → CR, CRN 15-12		25 bar
	CR, CRN 20-8 → CR, CRN 20-10		25 bar
	CR, CRN 32-1-1 → CR, CRN 32-5		16 bar
	CR, CRN 32-6-2 → CR, CRN 32-8		25 bar
	CR, CRN 32-9-2 → CR, CRN 32-10-2		40 bar
	CR, CRN 45-1-1 → CR, CRN 45-4		16 bar
	CR, CRN 45-5-2 → CR, CRN 45-6		25 bar
	CR, CRN 64-1-1 → CR, CRN 64-3		16 bar
	CR, CRN 64-4-2 → CR, CRN 64-4-1		25 bar
	CR, CRN 90-1-1 → CR, CRN 90-3		16 bar
	CR, CRN 90-4-2		25 bar

Table 2

- Minimum flow rates: See Table 3.

Minimum flow rates		
Pump type	**Liquid temperature**	
	Up to + 80ºC	**+ 80ºC to + 120ºC**
CR, CRN 1s	0.1 m^3/h	0.2 m^3/h
CR, CRN 1	0.1 m^3/h	0.3 m^3/h
CR, CRN 3	0.4 m^3/h	0.8 m^3/h
CR, CRN 5	0.6 m^3/h	1.3 m^3/h
CR, CRN 10	1.2 m^3/h	2.6 m^3/h
CR, CRN 15	1.8 m^3/h	3.8 m^3/h
CR, CRN 20	2.4 m^3/h	5.0 m^3/h
CR, CRN 32	3.8 m^3/h	7.6 m^3/h
CR, CRN 45	5.4 m^3/h	11.0 m^3/h
CR, CRN 64	7.7 m^3/h	16.0 m^3/h
CR, CRN 90	11.0 m^3/h	24.0 m^3/h

Table 3

- Liquid temperature: -20°C to 120°C. See also Table 2 which indicates the relationship between liquid temperature and maximum permissible operating pressure.

Note: In condensate and feed water systems where an open hot-well is used it is recommended to keep a temperature in the hot-well of 85-95ºC.

- Further technical data can be found on the data sheet related to the pumps.

2 Calculation of minimum inlet pressure

The minimum inlet pressure "H" in metres head required to avoid cavitation in the pump is calculated as follows:

$H = p_b \times 10.2 - NPSH - H_f - H_v - H_s$

- p_b = barometric pressure in bar (barometric pressure can be set to 1.0 bar). In closed systems p_b indicates the system pressure in bar.
- NPSH = net positive suction head in metres head (to be read from the NPSH curves in Figure 2and Figure 3at the highest flow the pump will be delivering).
- H_f = friction loss in suction pipe in metres head at the highest flow.
- H_v = vapour pressure in metres head, see Figure 1. Tm = liquid temperature
- H_s = safety margin = 0.5 metres head.

If the calculated “H” is positive, the pump can operate at a suction lift of maximum “H” metres head. If the calculated “H” is negative, an inlet pressure of minimum “H” metres head is required. There must be a pressure equal to the calculated “H” during operation.

Example:

Pump type = CR 20 - 60 Hz, flow rate = 24 m^3/h, p_b = 1.0 bar.

H_f = 3.0 metres head, liquid temperature = + 90ºC.

H_v (from Figure 1) = 7.5 metres head.

NPSH (from Figure 2) = 2.5 metres head.

$H = p_b \times 10.2 - NPSH - H_f - H_v - H_s$

$H = 1 \times 10.2 - 2.5 - 3.0 - 7.5 - 0.5 = -3.3$ metres head.

This means that an inlet pressure of minimum 3.3 metres head is required.

Relationship between H_v and Tm

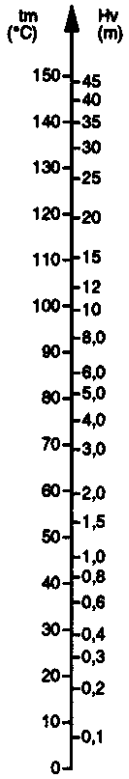


Figure 1 **om5540_20_cr02ax0054100en.wmf**

NPSH curves

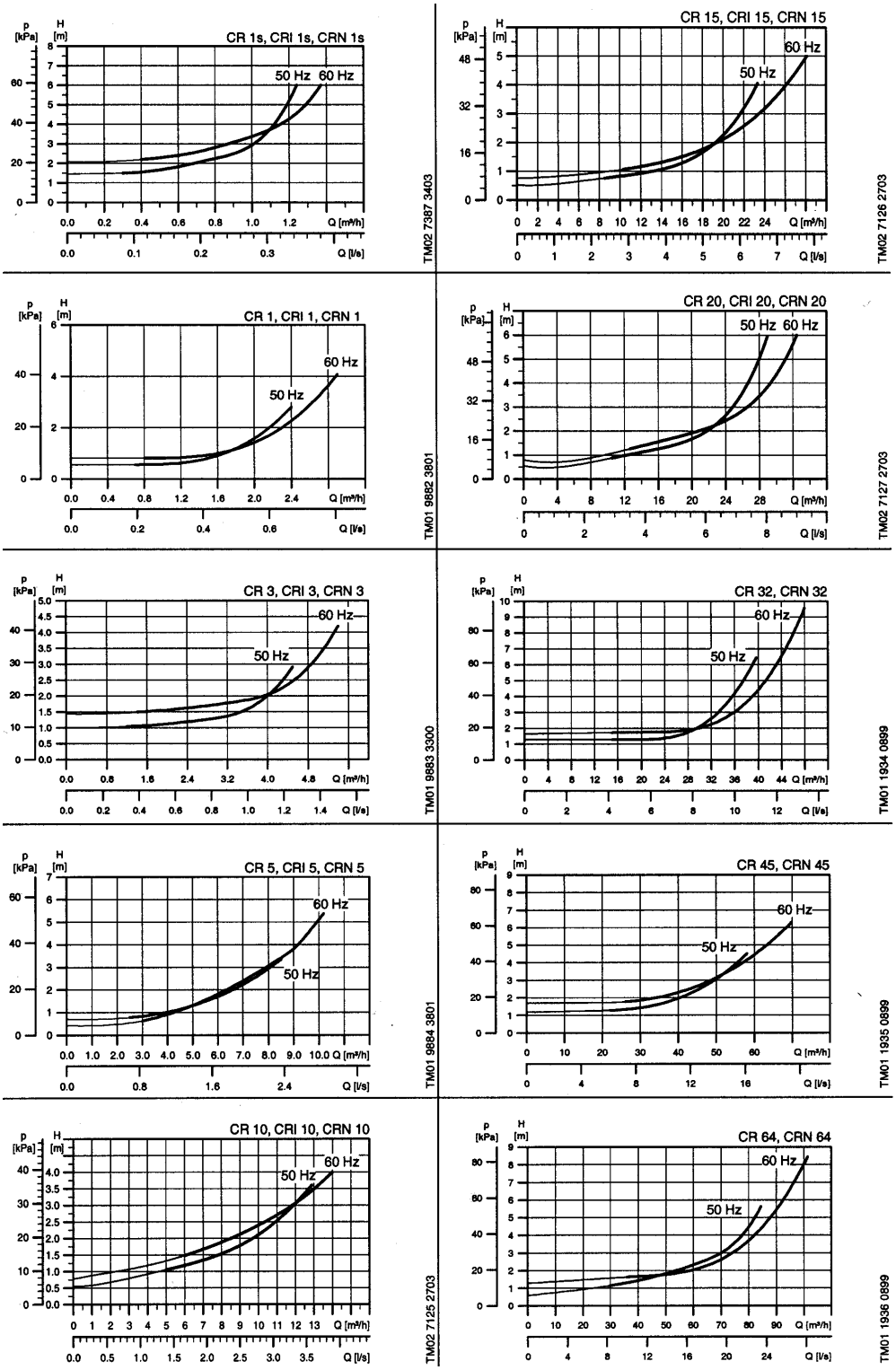


Figure 2 **om5540_20_cr03bx0054110en.wmf**

NPSH curves, continued

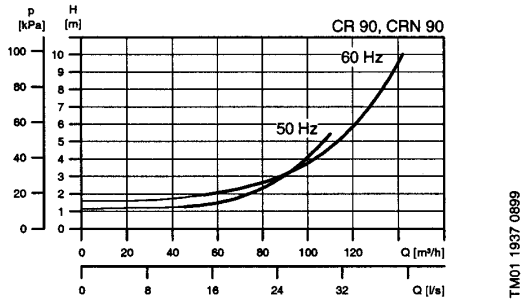


Figure 3 **om5540_20_cr07ax0054130en.wmf**

3 Start-up

Note: The pump is not allowed to run against a closed discharge valve as this will cause an increase in temperature/formation of steam in the pump which may cause damage to the pump.

If there is any danger of the pump running against a closed discharge valve, a minimum liquid flow through the pump should be ensured by connecting a by-pass / drain to the discharge pipe. The drain can for instance be connected to a hot-well / tank.

Warning: Do not start the pump until it is filled with liquid and has been primed and vented.

3.1 Priming

Note: The following does only apply to systems where the liquid level is above the pump inlet

Step A: Close the discharge isolating valve and loosen the vent screw in the pump head, see Figure 4.

Note: Pay attention to the direction of the vent hole and take care to ensure that the escaping water does not cause injury to persons or damage to the motor or other components. In hot water installations, special attention should be paid to the risk of injury caused by scalding hot water.

Step B: Slowly open the isolating valve in the suction pipe until a steady stream of liquid runs out the vent hole.

Step C: Tighten the vent screw and completely open the isolating valve(s).

Illustration of the centrifugal pumps

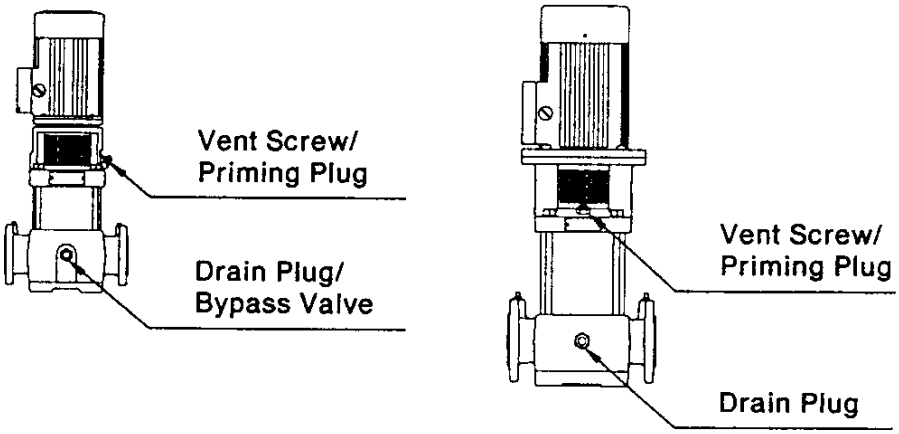


Figure 4 **om5540_20_cr06x0054120en.wmf**

3.2 Checking direction of rotation

Do not start the pump to check direction of rotation until it has been filled with liquid.

Note: The direction of rotation should not be checked with the motor alone, as an adjustment of the shaft position is required when the coupling has been removed.

The correct direction of rotation is shown by arrows on the pump head and/or on the motor fan cover. When seen from the fan, the pump should rotate counter-clockwise.

3.3 Starting

Before starting the pump:

Step A: Open the isolating valve completely on the suction side of the pump and leave the discharge isolating valve almost closed.

Step B: Start the pump.

Step C: Vent the pump during starting by loosening the vent screw in the pump head until a steady stream of liquid runs out the vent hole, see Figure 4.

Warning: Pay attention to the direction of the vent hole and take care to ensure that the escaping water does not cause injury to persons or damage to the motor or other components. In hot water installations, special attention should be paid to the risk of injury caused by scalding hot water.

When the piping system has been filled with liquid:

Step D: Slowly open the discharge isolating valve until it is completely open.When pumping liquids containing air, it is advisable to vent the pump regularly. To vent the pump:

Step E: Loosen the vent screw in the pump head during operation.

3.4 Frequency of starts and stops

Motors smaller than 4 kW should not start more than 100 times per hour.

Other motors should not start more than 20 times per hour.

4 Maintenance

Caution: Before starting work on the pump, make sure that no power is supplied to the pump and that it cannot be accidentally switched on. Before removing the cover of the electrical terminal box and before any removal/ dismantling of the pump, make sure that the electricity supply has been switched off.

Pump bearings and shaft seal are maintenance-free.

If the pump is to be drained for a long period of inactivity then:

Step A: Remove one of the coupling guards to inject a few drops of silicone oil on the shaft between the pump head and the coupling.

This will prevent the shaft seal faces from sticking. When fitting the coupling guards, make sure that they are centred vertically in the recesses in the pump head.

4.1 Motor bearings

Motors which are not fitted with grease nipples are maintenance-free.

Motors fitted with grease nipples should be lubricated with a high-temperature lithium-based grease.

In the case of seasonal operation (motor is idle for more than 6 months of the year), it is recommended to grease the motor when the pump is taken out of operation.

5 Frost protection

Pumps which are not used during periods of frost should be drained to avoid damage.

Step A: Drain the pump by loosening the vent screw in the pump head and by removing the drain plug from the base.

Warning: Care must be taken to ensure that the escaping water does not cause injury to persons or damage to the motor or other components. In hot water installations, special attention should be paid to the risk of injury caused by scalding hot water.

Do not tighten the vent screw and replace the drain plug until the pump is to be used again.

Step B: Before replacing the drain plug in the base, screw the by-pass valve out against the stop, see Figure 4.

Step C: Fit the drain plug by tightening the large union nut followed by the bypass valve.

6 Fault finding chart

Before removing the terminal box cover and before any removal/dismantling of the pump, make sure that the electricity supply has been switched off.

Fault finding chart		
Fault	**Cause**	**Remedy**
1. Motor does not run when started.	a) Supply failure. b) Fuses blown. c) Motor starter overload has tripped out. d) Main contacts in motor starter are not making contact or the coil is faulty. e) Control circuit fuses are defective. f) Motor is defective.	Connect the electrical supply. Replace fuse. Reactivate the motor protection. Replace contacts or magnetic coil. Repair the control circuit. Replace the motor.
2. Motor starter overload trips out immediately when supply is switched on.	a) One fuse is blown/automatic circuit breaker is blown. b) Contacts in motor starter overload are faulty. c) Cable connection is loose or faulty. d) Motor winding is defective. e) Pump mechanically blocked. f) Overload setting too low.	Cut the fuse. Replace motor starter contacts. Fasten/replace the cable connection. Replace the motor. Remove blocking of the pump. Set the motor starter correctly.
3. Motor starter overload trips out occasionally.	a) Overload setting too low. b) Low voltage at peak times.	Set the motor starter correctly. Check the electrical supply.
4. Motor starter has not tripped out but the pump does not run.	a) Check 1 a), b), d) and e).	-
5. Pump capacity not constant.	a) Pump inlet pressure is too low (cavitation). b) Suction pipe/pump partly blocked by impurities. c) Pump draws in air.	Check the suction conditions. Clean the pump or suction side. Check the suction conditions.
6. Pump runs but gives no water.	a) Suction pipe/pump blocked by impurities. b) Foot or non-return valve blocked in closed position. c) Leakage in suction pipe. d) Air in suction pipe or pump. e) Motor rotates in the wrong direction.	Clean the pump or suction side. Repair the foot or non-return valve. Repair the suction pipe. Check the suction conditions. Change the direction of rotation of the motor.
7. Pump runs backwards when switched off.	a) Leakage in suction pipe. b) Foot or non-return valve defective.	Repair the suction pipe. Repair the foot or non-return valve.
8. Leakage in shaft seal.	a) Shaft seal is defective.	Replace the shaft seal.
9. Noise.	a) Cavitation occurs in the pump. b) Pump does not rotate freely (frictional resistance) because of incorrect pump shaft position.	Check the suction conditions. Adjust the pump shaft.

Table 4

CR/CRI/CRN 10

50/60 Hz

SHAFT SEAL KIT

Pos.	Description	HUBE	HUBV	HUBK	HUBF	HUUE	HUUV	HUUK
	Kit no.	**96511836**	**96511837**	**96511838**	**96511839**	**96511840**	**96511841**	**96511842**
105	Shaft seal	1	1	1	1	1	1	1
	Adjusting fork	1	1	1	1	1	1	1

Pos.	Description	HUUF	HQQE	HQQV	HQQK	HQQF	HQBE	HQBV
	Kit no.	**96511843**	**96511844**	**96511845**	**96511846**	**96511847**	**96511848**	**96511849**
105	Shaft seal	1	1	1	1	1	1	1
	Adjusting fork	1	1	1	1	1	1	1

COUPLING GUARD KIT

Pos.	Description	MG 71 - 80	MG 90 - 100 56C	MG 132 182TC - 215TC	MG 160 254TC - 284TSC
	Kit no.	**96509611**	**96509612**	**96509613**	**96509614**
7	Coupling guard	2	2	2	2
7a	Screw	4	4	4	4

WEAR PARTS KIT

Pos.	Bearings	Kit no.		
	Silicon carbide	**96511889**	**96511922**	**96511925**
	Bronze	**96511920**	**96511923**	**96511926**
	Carbon graphite	**96511921**	**96511924**	**96511927**
Pos.	**Description/stages**	–8	–14	–22
4a	Chamber with bearing	1	2	3
26b	Screw M8x25	2	2	2
26c	Washer	2	2	2
45	Neck ring	7	12	19
47a	Bearing ring rotating	1	2	3
61	Seal driver	1	1	1
62	Stop ring	1	1	1
64a	Spacing pipe 9.0 mm	1	2	3
64c	Spacer lower	1	1	1
64d	Spacing pipe 6.0 mm	1	2	3
65	Neck ring retainer	7	12	19
66	Lock washer set	1	1	1
67	Lock nut	1	1	1

PLUG KIT

Pos.	Description	CR	CRI, CRN	CR NEMA	CRI, CRN NEMA
	Kit no.	**96511311**	**96511312**	**96511313**	**96511314**
18	Air vent screw	1	1	1	1
23	Pipe plug	1	1	1	1
23a	Pipe plug 1/4"			1	1
25	Drain plug	1	1	1	1
38	O-ring ø16.3 x 2.4 EPDM + FKM	1 + 1	1 + 1	1 + 1	1 + 1
38a	O-ring ø5.3 x 2.4 EPDM + FKM	1 + 1	1 + 1	1 + 1	1 + 1
100	O-ring ø16.3 x 2.4 EPDM + FKM	2 + 2	2 + 2	2 + 2	2 + 2

COUPLING COMPLETE

Pos.		D ia. shaft motor/pump	D14/D16	D19/D16	D24/D16	D28/D16	D38/D16	D15.9/D16	D28.6/D16	D34.9/D16	D41.3/D16
		Kit no.	**96511315**	**96511317**	**96511319**	**96511350**	**96511351**	**96511353**	**96511354**	**96511355**	**96511356**
Pos.		**Description**						NEMA	NEMA	NEMA	NEMA
8	**9**	Screw	4	4	4	4	4	4	4	4	4
	10	Pin	1	1	1	1	1	1	1	1	1
	10a	Coupling half	2	2	2	2	2	2	2	2	2

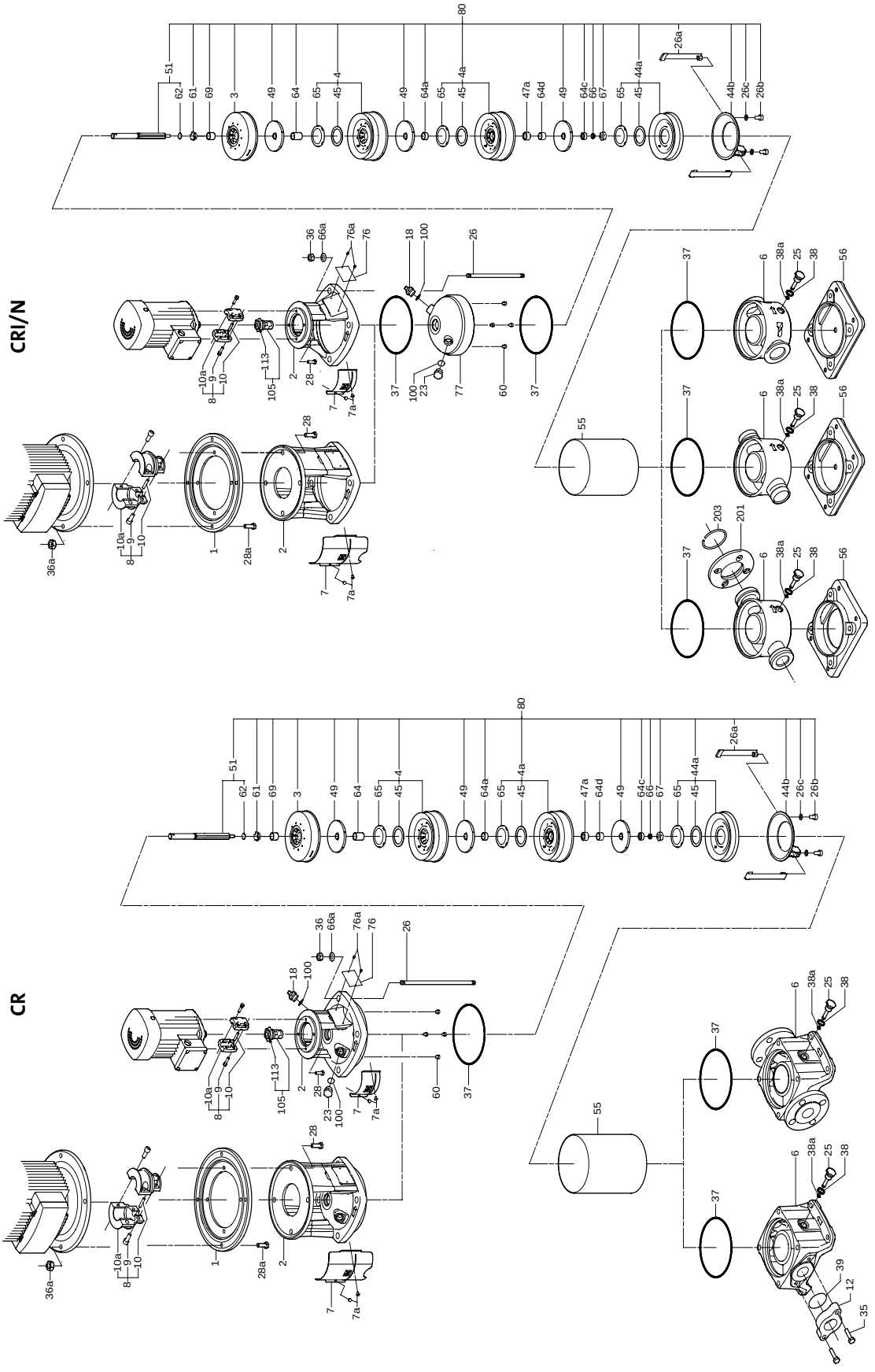
CHAMBER STACK COMPLETE (SILICON CARBIDE BEARING)

Pos.	Pump type	CR	CRI	CRN
	Number of stages	**Kit no.**	**Kit no.**	**Kit no.**
80	1	**96508403**	**96491694**	**96491720**
	2	**96508404**	**96491695**	**96491721**
	3	**96508405**	**96491696**	**96491722**
	4	**96508406**	**96491697**	**96491723**
	5	**96508407**	**96491698**	**96491724**
	6	**96508408**	**96491699**	**96491725**
	7	**96508409**	**96491700**	**96491726**
	8	**96508410**	**96491701**	**96491727**
	9	**96508411**	**96491702**	**96491728**
	10	**96508412**	**96491703**	**96491729**
	12	**96508413**	**96491704**	**96491730**
	14	**96508414**	**96491705**	**96491731**
	16	**96508415**	**96491706**	**96491732**
	17	**96529403**	**96529404**	**96529404**
	18	**96508416**	**96491707**	**96491733**
	20	**96508417**	**96491708**	**96491734**
	22	**96508418**	**96491709**	**96491735**

GASKET KIT

Pos.	Description	EPDM	FKM
	Kit no.	**96509609**	**96509610**
37	O-ring ø170.7 x 3.3	2	
38	O-ring ø16.3 x 2.4	1	
38a	O-ring ø5.3 x 2.4	1	
39	Gasket for oval flange CR 10	2	
	O-ring ø90 x 3.0 for oval flange CR 15/20	2	
	Gasket for FGJ flange CR 10	2	
	Gasket for FGJ flange CR 15/20	2	
60	Rubber spring	4	
100	O-ring ø16.3 x 2.4	2	

CR/CRI/CRN 10



TM02 6496 1003 TM02 6495 1003

CR/CRI/CRN 10

50/60 Hz

SHAFT SEAL KIT

Pos.	Description	HUBE	HUBV	HUBK	HUBF	HUUE	HUUV	HUUK
	Kit no.	**96511836**	**96511837**	**96511838**	**96511839**	**96511840**	**96511841**	**96511842**
105	Shaft seal	1	1	1	1	1	1	1
	Adjusting fork	1	1	1	1	1	1	1

Pos.	Description	HUUF	HQQE	HQQV	HQQK	HQQF	HQBE	HQBV
	Kit no.	**96511843**	**96511844**	**96511845**	**96511846**	**96511847**	**96511848**	**96511849**
105	Shaft seal	1	1	1	1	1	1	1
	Adjusting fork	1	1	1	1	1	1	1

COUPLING GUARD KIT

Pos.	Description	MG 71 - 80	MG 90 - 100 56C	MG 132 182TC - 215TC	MG 160 254TC - 284TSC
	Kit no.	**96509611**	**96509612**	**96509613**	**96509614**
7	Coupling guard	2	2	2	2
7a	Screw	4	4	4	4

WEAR PARTS KIT

Pos.	Bearings	Kit no.		
	Silicon carbide	**96511889**	**96511922**	**96511925**
	Bronze	**96511920**	**96511923**	**96511926**
	Carbon graphite	**96511921**	**96511924**	**96511927**
Pos.	**Description/stages**	**–8**	**–14**	**–22**
4a	Chamber with bearing	1	2	3
26b	Screw M8x25	2	2	2
26c	Washer	2	2	2
45	Neck ring	7	12	19
47a	Bearing ring rotating	1	2	3
61	Seal driver	1	1	1
62	Stop ring	1	1	1
64a	Spacing pipe 9.0 mm	1	2	3
64c	Spacer lower	1	1	1
64d	Spacing pipe 6.0 mm	1	2	3
65	Neck ring retainer	7	12	19
66	Lock washer set	1	1	1
67	Lock nut	1	1	1

PLUG KIT

Pos.	Description	CR	CRI, CRN	CR NEMA	CRI, CRN NEMA
	Kit no.	**96511311**	**96511312**	**96511313**	**96511314**
18	Air vent screw	1	1	1	1
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23a	Pipe plug 1/4"			1	1
25	Drain plug	1	1	1	1
38	O-ring ø16.3 x 2.4 EPDM + FKM	1 + 1	1 + 1	1 + 1	1 + 1
38a	O-ring ø5.3 x 2.4 EPDM + FKM	1 + 1	1 + 1	1 + 1	1 + 1
100	O-ring ø16.3 x 2.4 EPDM + FKM	2 + 2	2 + 2	2 + 2	2 + 2

COUPLING COMPLETE

Pos.		D ia. shaft motor/pump	D14/D16	D19/D16	D24/D16	D28/D16	D38/D16	D15.9/D16	D28.6/D16	D34.9/D16	D41.3/D16
		Kit no.	**96511315**	**96511317**	**96511319**	**96511350**	**96511351**	**96511353**	**96511354**	**96511355**	**96511356**
		Description						NEMA	NEMA	NEMA	NEMA
8	9	Screw	4	4	4	4	4	4	4	4	4
	10	Pin	1	1	1	1	1	1	1	1	1
	10a	Coupling half	2	2	2	2	2	2	2	2	2

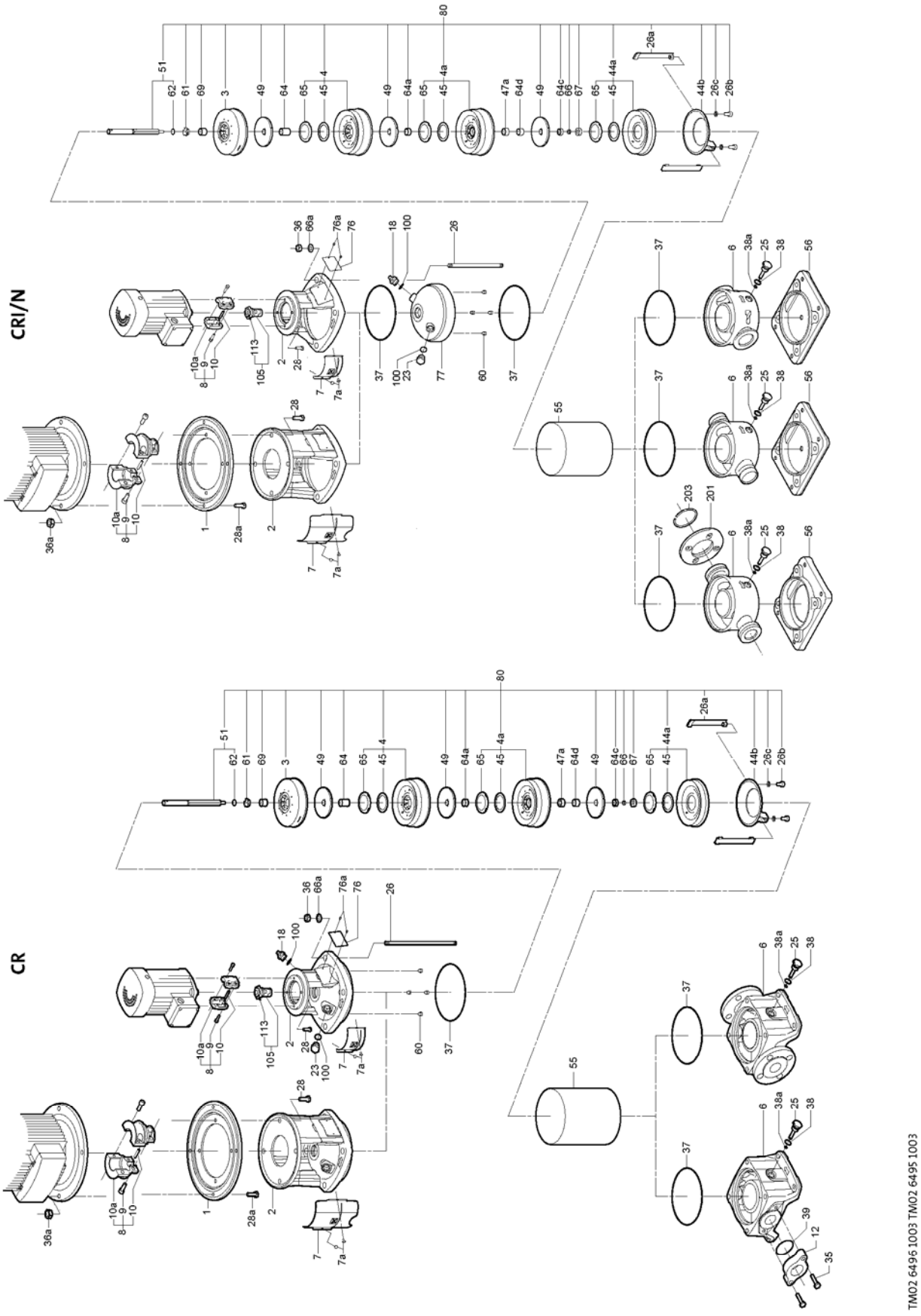
CHAMBER STACK COMPLETE (SILICON CARBIDE BEARING)

Pos.	Pump type	CR	CRI	CRN
	Number of stages	**Kit no.**	**Kit no.**	**Kit no.**
80	1	96508403	96491694	96491720
	2	96508404	96491695	96491721
	3	96508405	96491696	96491722
	4	96508406	96491697	96491723
	5	96508407	96491698	96491724
	6	96508408	96491699	96491725
	7	96508409	96491700	96491726
	8	96508410	96491701	96491727
	9	96508411	96491702	96491728
	10	96508412	96491703	96491729
	12	96508413	96491704	96491730
	14	96508414	96491705	96491731
	16	96508415	96491706	96491732
	17	96529403	96529404	96529404
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	O-ring ø90 x 3.0 for oval flange CR 15/20	2	
	Gasket for FGJ flange CR 10	2	
	Gasket for FGJ flange CR 15/20	2	
60	Rubber spring	4	
100	O-ring ø16.3 x 2.4	2	

CR/CRI/CRN 10



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Chemical dosing pump

1 General

The chemical dosing pump is a microprocessor controlled solenoid metering pump. The pump offers highly accurate reproducible metering in the dosing of liquid chemicals in pressurised pipe systems, and into open and closed containers. The main components of the chemical dosing pump are the operating panel, power end, and liquid end Figure 1 illustrates the chemical dosing pump.

The working principle of the pump is that chemical feed occurs as a result of pulsed deflections of the dosing diaphragm within the liquid end, which causes pressure differentiation between the suction side, liquid end cavity, and discharge side. The pressure differentiation causes the suction and discharge self-acting valves to open and close, resulting in chemical feed. The dosing diaphragm is driven by an electromagnet, which is stimulated and controlled by a microprocessor.

Regulation of the required doseis variable via thestroke length in the range of10-100 % in steps of 10% or can be set at 1 ofthe 4 settings via the strokefrequency. This gives anadjustment ratio of 1:40. Optimum dosing reproducibility is achieved by setting the stroke length between 30% and 100%. For external actuation a retrofit kit is needed in addition.

Illustration of the chemical dosing pump

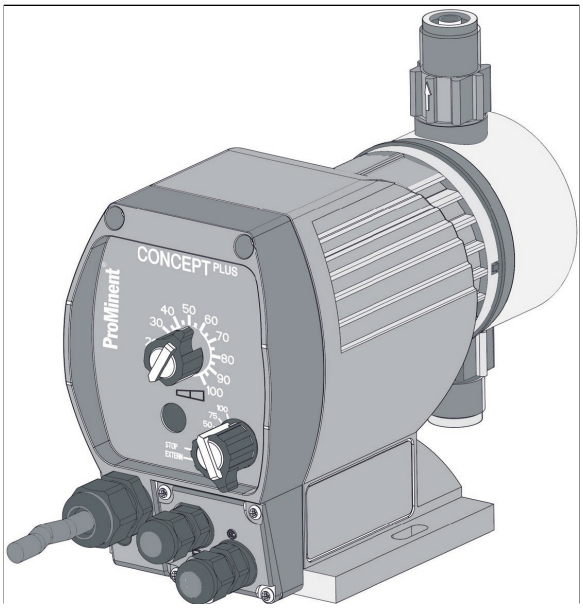


Figure 1 **om5540_07_chem_0x0200520en.wmf**

2 Safety

The following guidelines describe correct use of the equipment and how to avoid potentially dangerous situations and must always be observed during installation, commissioning, operation, maintenance, and repair.

- The pump may be used only for metering liquid media!
- All other uses or modifications are prohibited!
- The pump is not suitable for metering gaseous media or solids!
- The pump must be operated by appropriately trained and authorisedpersonnel!The personnel must be familiar with metering pumps and their operation!
- The pump may start to operate as soon as it connected to the mainspower supply! Ensure that no hazardous metering chemical can leak out!If you have not done so, set the multifunction switch to STOP ordisconnect the pump from the mains immediately.
- The pump cannot be switched off! In the case of an electrical failure,disconnect the mains cable from the power supply.
- Disconnect the power cable from the mains before working onthe pump.
- Risk of electric shock - This pump is supplied with a groundingconductor and grounding-type attachment plug. To reduce the risk ofelectric shock, be certain that it is connected only to a properlygrounding-type receptacle.
- Always depressurise liquid end before working on the pump.
- Always empty and rinse the liquid end before working on the pumpif used with hazardous or unknown feed chemicals.
- Wear safety equipment appropriate to the metering chemical whenworking on the liquid end.
- Never let the pump work against a significantly increased operating pressure or a closed stop tap on the discharge-side. This cancause lines to burst.
- Avoid overfeed due to positive pressure difference between intakeand discharge sides. E.g. use a ball check valve with at least 1.5bar opening pressure with an atmospheric pressure outlet.
- Assembly and installation of this metering pump with nonoriginalparts, which have not been checked and recommended bysupplier is not allowed and can lead to harm to persons orproperty for which no liability can be accepted.
- Note all national directives which apply to the installation.

3 Installation

The chemical dosing pump is normally pre-mounted on a chemical tank. However, in case that the pump must be mounted elsewhere or replaced please observe the following general installation notes:

- The chemical dosing pump must be located in an environment with ambient temperature between -10°C to +45°C and a maximum permissible relative humidity of 92% non-condensing.
- The pump must be mounted with the pump foot resting on a firm horizontal base. Ensure that it is fastened into place firmly, and will not vibrate in operation.
- The maximum permissible priming and operating pressures must not be exceeded. For this type of pump the maximum priming lift is 2 mmWC and the maximum operating pressure is 16 barg. In case that the operating pressure is exceeded, e.g. due to the position of the chemical feed into the feed water system, the discharge side must be provided with a relief valve. The surplus chemicals should be led back to the chemical tank.
- Suction and discharge valves must be installed in a vertical position.
- The tubing should be attached in such a way that it allows lateral detachment of the pump and liquid end, if necessary. The tubing must be free from stress and bends when fitted. Only original hoses with the correct dimensions should be used.
- The suction tubing should be as short as possible and rising in order to prevent air bubbles forming.
- The foot valve should be installed so that it hangs just above the bottom of the chemical tank. For chemicals with impurities or sedimentation at the bottom, the foot valve should be positioned well above this layer.
- The check valve, which connects the discharge line to the feed water system, must be tightened properly.

3.1 Assembling of the tubing to plastic valves

3.1.1 Assembling of the tubing to plastic valves

When assembling the suction and discharge tubing to the plastic valves of the liquid end carry out the following work procedures (see figure 2).

Step A: Cut the hose ends straight across.

Step B: Push the union nut and clamping ring onto the hose.

Step C: Push the hose end over the grommet to the stop (widen if necessary).

Step D: Ensure that the O-ring is sitting correctly onto the intake connector.

Step E: Clamp the connector hose by tightening the union nut while pressing in the hose.

Step F: Retighten the hose connector by pulling the hose connected to the liquid end briefly and then retighten the union nut.

Assembling of the tubing to plastic valves

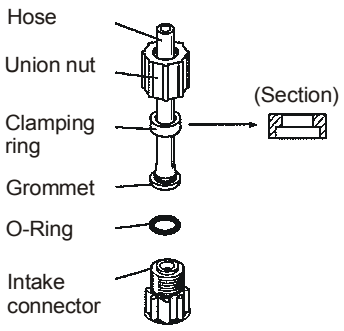


Figure 2 **om5540_07_chemicx0053980en.wmf**

3.2 Electrical installation

The pump is connected to the mains power supply by using the mains lead. If the pump is connected to the mains in parallel with inductive power consumers (e.g. solenoid valves, motors) it must be electrically isolated. This prevents damage caused by induction and voltage surges when switching off.

4 Commissioning

Step A: Check that the connections for the pump are completed properly.

Step B: Open the bleed valve by rotating the knob anticlockwise (see Figure 3)

Step C: Switch on the pump and allow it to run at maximum stroke length and rate until the liquid end is full and free from air bubbles (the feed chemical is visible at the bleed valve). The stroke length should only be set while the pump is running (see Figure 3).

Note: The pump should prime at 100% stroke length as the suction lift is dependent upon the lift volume when the liquid end is empty. If the pump is required to prime at less than 100% stroke length, and fails to do so, then select a correspondingly smaller suction lift.

Step D: Close the bleed valve (turn clockwise) (see Figure 4).

Step E: Switch off the pump.

Step F: The pump is ready to operate. Retighten screws in the liquid end after 24 hours operation time. Tightening torque for liquid end screws: 4.5 to 5 Nm.

Illustration of liquid end

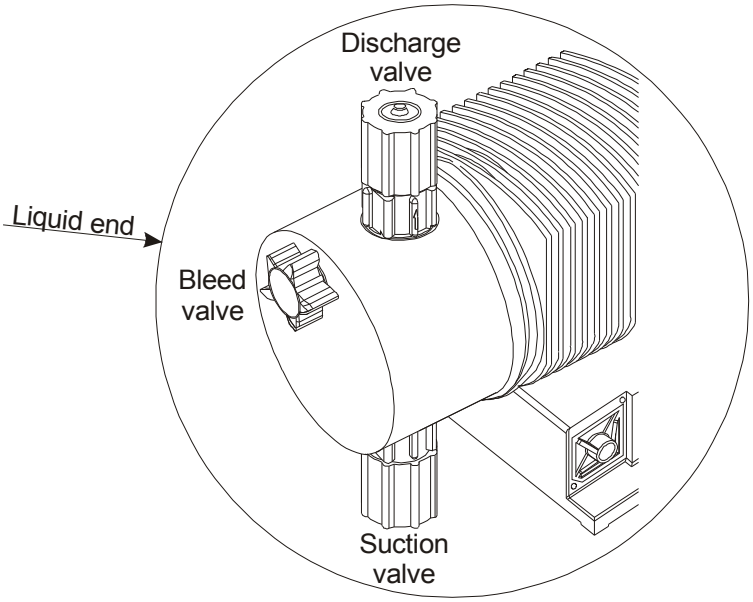


Figure 3 **om5540_07_chem_px0053970en.wmf**

4.1 Determining the feed capacity

When the necessary chemical dosing feed is known, e.g. by means of feed and boiler water analysis, the feed capacity of the pump can be set. Figure 4 shows the feed rate setting diagram for the pump. The measurements for determining the feed rate from the diagram were carried out using water as medium. In order to find the feed capacity the correction factor must be found and subsequently the stroke rate and stroke length should be set. For determination of the feed capacity carry out the following procedures:

Step A: Mark the operating pressure for the chemical dosing pump in the lower diagram. The operating pressure is equal to the pressure in the feed water system at the point of dosing.

Step B: Trace a line from this value vertically up to the curve and then horizontally left. Read off the correction factor.

Step C: Divide the required feed rate by the determined correction. Mark this value (l/h) on the "l/h" axis in the upper diagram.

Step D: Trace a horizontally line from this value to the left. Trace a line from the intersection with the straight line for the adjustable stroke frequencies vertically downwards the "stroke length" axis.

Step E: Set the pump to one of the stroke frequencies determined in this way, and the corresponding stroke length.

Feed rate setting diagram

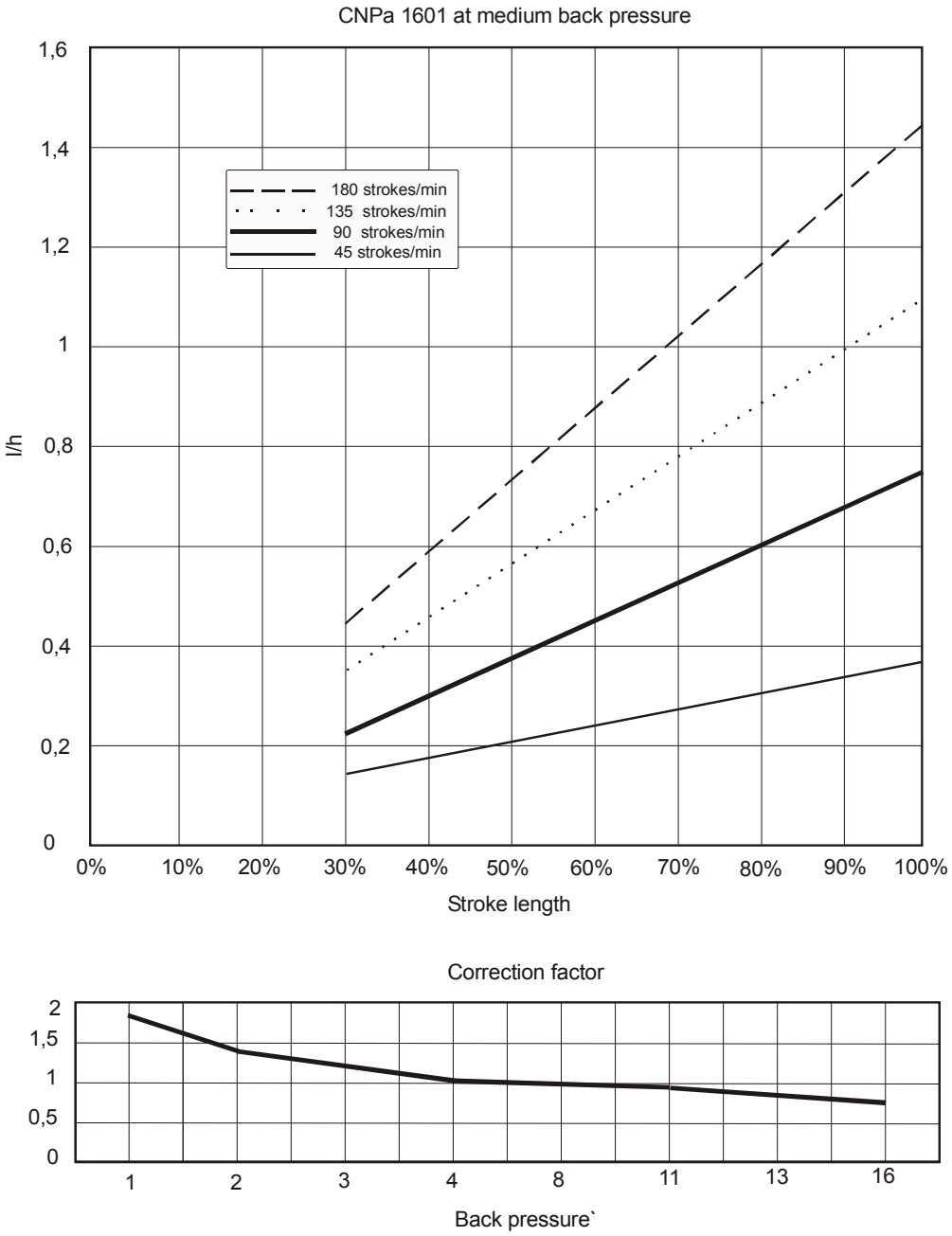


Figure 4 **om5540_07_chem_gx0053960en.wmf**

5 Operation

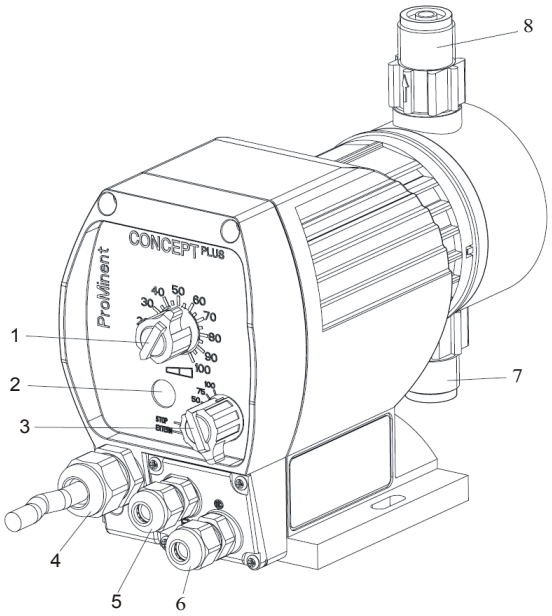
The operation panel of the chemical dosing pump is equipped with operation knobs/ switches, connection terminals, and indicators, which support the operation and setting of the pump. Figure 5illustrates the operation panel of the chemical dosing pump.

The pump can be operated through manual control or external control. If the pump is intended only to operate in manual mode it will not be provided with the optional socket connection for "external control". When the pump is intended to operate via "external control" and/or "float switch", a "external connection" retrofit kit and/or "float switch" retrofit kit must be provided.

The "Float switch" option provides information on the liquid level in the feed chemical tank, which is transmitted to the pump. This option requires the installation of a one-stage float switch and connection to the "float switch" socket.

The following instruction for pump operation is described as a complete instruction. If the chemical dosing pump includes parts or features, which are not provided for the actual dosing unit, the specified instructions should be disregarded.

Illustration of the operating panel for the chemical dosing pump



1. Stroke lenght adjustment knob
2. Error / operating indicator (error - red / operation - green)
3. Multifunction switch (stroke rates (in % of 180 strokes / min), stop operating mode "external" (Retrofit kit))
4. Power cable
5. "External actuation" socket (actuation via contact signal in "external" operating mode; Retrofit kit)
7. Suction valve
8. Disharge valve

The leakage bore is between the suction valve and the drive housing.

Figure 5 **om5540_07_chemx0053950en.wmf**

5.1 Basic information for the pump

5.1.1 Stroke length adjustment knob

The stroke length is continuously adjustable between 0% and 100% via the stroke length adjustment knob. Reproducibility is only technically practicable in the adjustment range 30% to 100%.

5.1.2 Multifunction switch

The multifunction switch is used to select the operating mode and to set the stroking rate. The following operating modes are selected using the multifunction switch:

- Stop.
- External.
- Manual (to set stroking rate in 10% steps).

Stop

- The "Stop" function allows the pump to be deactivated without disconnecting from the power supply.

External

- The "External" operating mode allows adjustment of individual strokes via the external operating mode terminal by means of contact or semi-conductor devices.
- The "Auxiliary frequency" operating mode enables activation of optionally selectable and programmable stroking rate, controlled via the external operating mode terminal. This stroking rate overrides "Manual" and "External" operating modes. In the standard version the "Auxiliary frequency" function is programmed to 100% stroking rate.
- The "Pause" function can be used to operate a remote pump stop function via the external operating terminal.

Manual

- In the "Manual" operating mode the stroking rate is manually adjustable in 10% steps via the multifunction switch.

5.1.3 Error/operating Indicator

The operating and error status are shown via the error/operating indicatoron the operating panel:

- Green indicator: During operation the indicator is green.
- Redindicator: If an error occurs the indicator is red.

6 Maintenance

To ensure a safe and reliable function of the chemical dosing pump maintenance work must be performed with regular intervals. The normal maintenance interval is three months. This is based on approximately 30% operation time. But in case of heavier use (e.g. continuous operation) the intervals should be shortened. Carry out the following maintenance work:

- Check for the correct feed rate by running the pump for a short period.
- Check that the discharge tubing is connected firmly the liquid end.
- Check that the discharge and suction valves are firmly fixed.
- Check that the liquid end is generally watertight, in particular leakage opening between suction value and drive housing.
- Check the diaphragm for damage.
- Check that the liquid end screws are fastened tightly. The screw fastening torque should be 4.5 to 5.0 Nm.
- Check that the bleed valve is firmly fixed in place (see Figure 6).
- Check that the bleed function is working correctly (see Figure6).
- Check the electrical connections for wear.

7 Repair

Repair work should only be carried out by qualified personnel. Suitable precautions must always be taken when using hazardous chemicals. Furthermore, is must be ensured that the pump and suction/discharge lines are de-pressurised. Figure 6 illustrates the discharge valve, suction valve, and exchanging of the diaphragm.

Illustration of discharge valve, suction valve, and exchanging of diaphragm

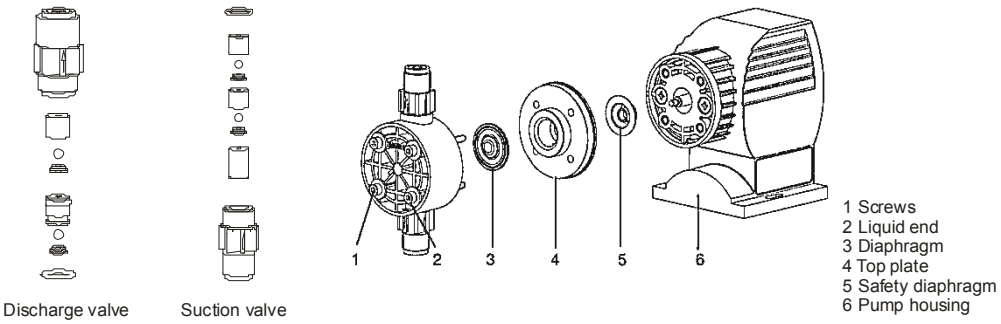


Figure 6 **om5540_07_chemicx0053990en.wmf**

7.1 Cleaning valves

7.1.1 Cleaning the discharge valve

Step A: Loosen the discharge line from the valve.

Step B: Unscrew the discharge valve from the liquid end and rinse thoroughly.

Step C: Remove the O-ring from the liquid end with a small screwdriver.

Step D: Insert an Allen key or similar into the smaller hole of the pressure connector and push out the valve inserts.

Step E: Remove the valve seats with a small screwdriver and allow the valve balls to drop out.

Step F: Clean all parts.

Step G: Drop the valve balls into the valve seats and push them on the valve inserts.

Step H: Press the valve seats into the pressure connector with their smaller hole in the direction of the flow (see the direction of the arrows on the fluting of the pressure connector).

Step I: Insert the O-ring into the liquid end.

Step J: Screw the valve in as far as it will go.

Step K: Secure the discharge line onto the valve.

Step L: Reset the pump after replacing a valve.

7.1.2 Cleaning the suction valve

Dismantling, cleaning, and reassembling of the suction valve is practically the same as for the discharge valve. Take care, however, that:

- Both valve inserts are actually identical.
- An additional spacer is found under the valve inserts.
- In the liquid end a shaped seal is used instead of an O-ring.
- The flow direction of the suction connection is reversed as for the pressure connector.

7.1.3 Change diaphragm

Step A: When the pump is running set the stroke length to 0% (the drive axis is then set). Switch off the pump.

Step B: Unscrew the connectors from the discharge and suction side.

Step C: Pull out the fine bleed (knob) and lift off the cover from the liquid end using a screwdriver.

Step D: Empty the liquid end (turn the unit upside down and let the feed chemical run out, rinse with a suitable material).

Step E: Remove the screws.

Step F: Loosen (only loosen) the liquid end and the top plate from the pump housing.

Step G: Hold the housing in one hand and with the other, clamp the diaphragm between the liquid end and the top plate. Release the diaphragm from the drive spindle with a light anticlockwise turn of the liquid end and top plate.

Step H: Unscrew the diaphragm completely from the drive spindle.

Step I: Remove the top plate from the housing. Please note the position.

Step J: Check the condition of the safety diaphragm and replace if necessary.

Step K: Push the safety diaphragm only as far onto the drive axis until it just lies flat on the pump housing.

Step L: Screw the new diaphragm carefully up to the stop on the drive axis - this must be exact to ensure correct metering.

Step M: Screw the diaphragm tight once more.

Step N: Position the top plate on the pump housing. The top plate must be positioned correctly. Do not distort the top plate on the pump housing, otherwise the safety diaphragm will not fit.

Step O: Lay the diaphragm onto the top plate.

Step P: Hold the top plate and screw the diaphragm in a clockwise direction until it is firmly in position (the resistance of the return spring can be felt). Do not over-tighten the diaphragm.

Note: The top plate must remain in position to prevent the safety diaphragm from distorting.

Step Q: Place the liquid end with the screws on the diaphragm and the top plate. The priming connector must point downwards once the pump is fully assembled.

Step R: Screw on the screws lightly and tighten. The torque should be 4.5 to 5.0 Nm.

Step S: Ensure that the liquid end cover engages in the liquid end and push the bleed vent (knob) into the liquid end.

Step T: Check the screw torque after 24 hours operation time.

8 Trouble shooting

The trouble shooting list is based on a proper set-up of the chemical dosing pump during commissioning and/or service. The list can be seen in Table 1.

Please note that the trouble shooting list is general for chemical dosing pumps and has not been made for any particular plant, but is based on several years of experience. Therefore, the cause of the specific problem may not be mentioned and vice versa. You are always welcome, however, to contact our service department for advice or service assistance.

Fault finding chart		
Fault	**Possible cause**	**Remedy**
Pump does not prime despite full stroke and venting.	Crystalline deposits on the ball seat because valves have dried out.	Remove suction sleeve from chemical supply and rinse out liquid end thoroughly. If still unsuccessful, dismantle valves and clean.
Fluid is leaking from the head washer.	The liquid end is leaking at the pump diaphragm.	Screw in the liquid end anti-clockwise (torque: 4.5 to 5.0Nm). If unsuccessful, replace the diaphragm.
Error/operating indicator not lit.	No or incorrect mains voltage. Fuse defective.	Use the recommended mains voltage as given in the voltage specification on the name plate. Contact Aalborg Industries.
Error/operating indicator lit red.	Liquid level in the supply tank has reached “low liquid level”. (if “float switch” retrofit kit provided). Electronic failure.	Fill the chemical storage tank. The pump needs repair. Contact Aalborg Industries.

Table 1

9 Decommissioning

When dismantling a pump, clean thoroughly, paying particular attention to the liquid end in order to remove all traces of chemicals and dirt. When disposing of a pump it must be broken down into separate material types. All parts must be sent for recycling or for correct disposal according to currently legal waste disposal requirements.

Relief valve

1 Description

The purpose of the relief valve is to protect the delivery line from impermissible overpressure caused by the chemical dosing pump. It features a pressure relief mechanism for both the pressure retaining function as well as for the pressure relief function. The valve functions are affected by means of a spring-loaded diaphragm. Figure 1 illustrates the multi-function relief valve. The relief valve has an overflow opening pressure of 16 bar. But depending on the pump type, the pressure may be up to 50% higher until the valve is completely opened.

Illustration of the relief valve

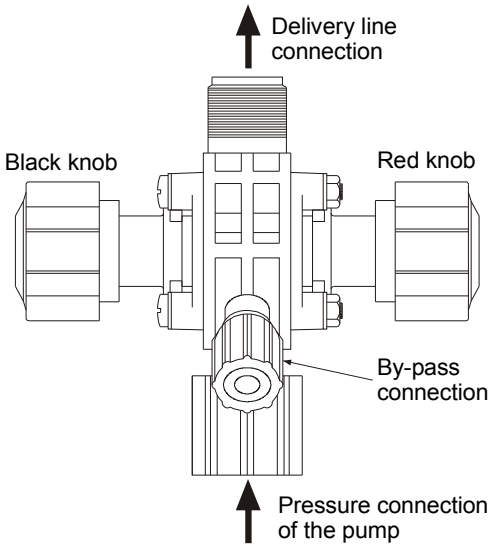


Figure 1 **om6000_01_reliefx0056540en.wmf**

1.1 Functional description

- Producing a defined back pressure for chemical dosing with respect to free outlet. The function can be cancelled by turning the black knob in clockwise direction.
- Prevents lift-through from the feed water system in case of vacuum at the dosing point. The function can be cancelled by turning the black knob in clockwise direction.
- Intake aid to prevent pressure when starting up the pump. It is not necessary to release the delivery line. The function can be achieved by turning the red knob.
- Depressurising the delivery line when the feed water system is at a standstill (e.g. repair). The function can be achieved by turning both the red knob and black knob.
- Overflow valve to protect the system from impermissible overpressure caused by the chemical dosing pump. The return flow is via a by-pass line. This function takes place automatically.

Note: The relief valve must not be used as a shut-off element and the by-pass line must always be connected.

1.2 Mounting and installation

The relief valve is screwed directly onto the pressure connection of the pump and can be turned or aligned through 360°. The delivery line or hose is secured on the valve outlet end by means of a connection set or GF screw fitting. An EPDM O-ring is fitted at the factory in the O-ring groove at the outlet. For applications in which EPDM is not suitable, it is advisable to fit a Viton B O-ring. This O-ring (brown) is supplied together with the valve.

The by-pass line is routed into the chemical tank and secured by means of a hose grommet and union nut. The by-pass line must always be connected since a minimum overflow into the by-pass line can occur during operation of the valve close to the pressure relief function.

Attention: A non-return valve must be installed at the dosing point since the entire contents of the system can flow back via the by-pass when the valve is operated.

1.3 Operation

Operation and setting the intake aid

The route to the by-pass line is cleared by means of the red knob by turning it in the direction indicated by the arrow (clockwise). The liquid flows back into the chemical tank. In this case, the delivery line is partly depressurised and the liquid can flow out of the by-pass. The chemical dosing pump must now be set to "intake" until the liquid can be seen in the by-pass line. The pump is now primed and can be placed into operation. After being released, the red rotary knob reverts of its own accord back to its initial position.

Depressurising the delivery line

The passage from the delivery line to the by-pass can be cleared by means of the red knob and the black knob by turning them in the direction indicated by the arrows (clockwise). The pressure drops in the line to approximately 1.5 bar if only the red knob is turned. Both knobs must remain unscrewed until no more liquid flows out of the by-pass line or no more liquid flows back into the chemical tank. The delivery line is now depressurised. Once released, both rotary knobs revert of their own accord back to their initial position.

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Salinity alarm equipment

OM8210_34 Salinometer, type SL 700.....12-2

Salinometer, type SL 700

1 Description

The salinometer is used in combination with a conductive electrode to measure and supervise the salinity of feed water. Figure 1 illustrates the control device and electrode.

The control device is provided with indication LED's for monitoring the salinity level and two LED's for alarm purpose. The measuring range as well as the adjustable alarm range is 0 – 20 ppm (sea salt). The alarm limit can be adjusted by means of the set screw located on the front panel. The alarm limit is indicated by a flashing LED in the indication LED row. If the salinity level exceeds the alarm limit the alarm LED's start flashing.

During commissioning it is not necessary to carry out any adjustments of the equipment except setting the alarm limit. When the power is turned on, the salinometer will perform a self test. This calibration will take approximately 5 sec.

Illustration of the control device

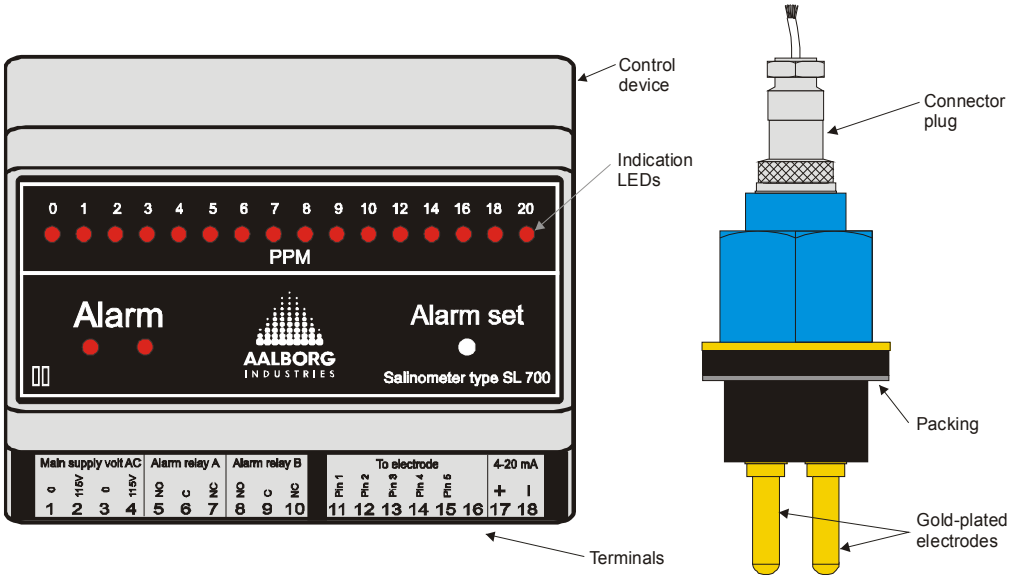


Figure 1 **om8210_34_sl700x0058911en.wmf**

2 Installation

The conductive electrode may be installed vertically, horizontally, or radial inclined. However, the electrode tips must be constantly submerged in feed water. Figure 2 illustrates the salinity system.

Illustration of the salinity system

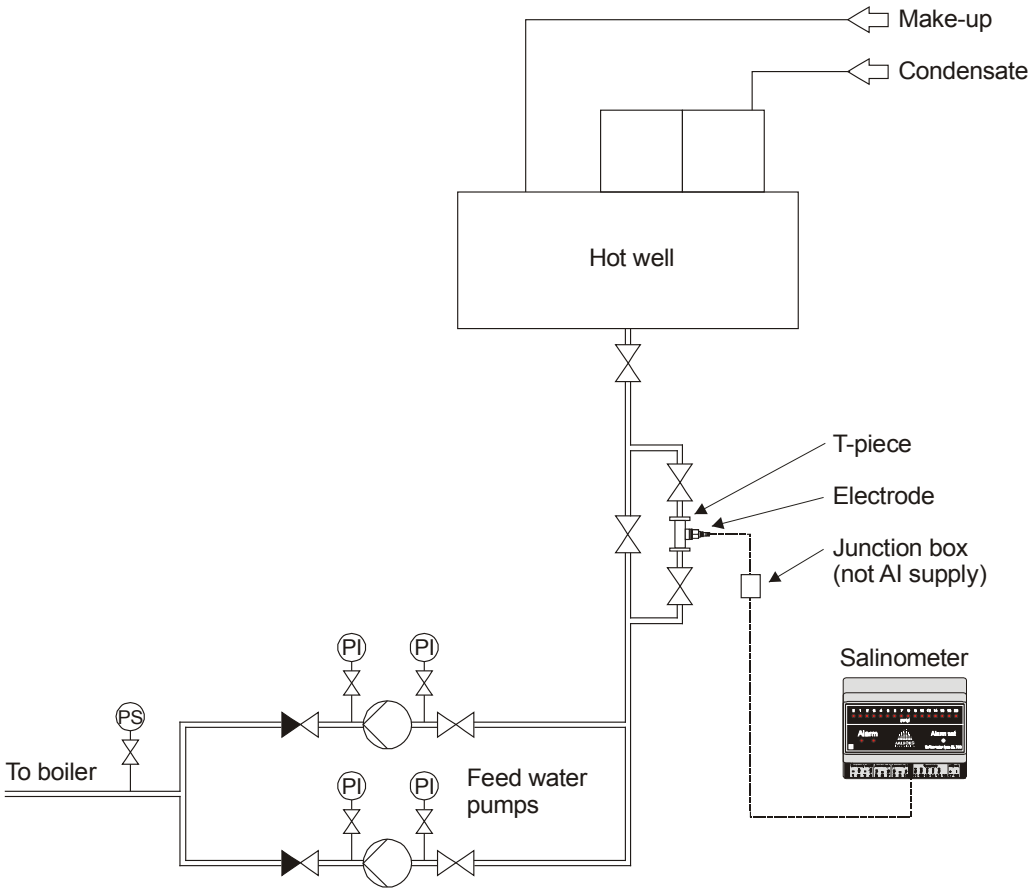


Figure 2 **om8210_34_sl700dx0058920en.wmf**

2.1 Wiring

The wiring should be carried out in accordance with the diagram shown in Figure 3.

Wiring diagram

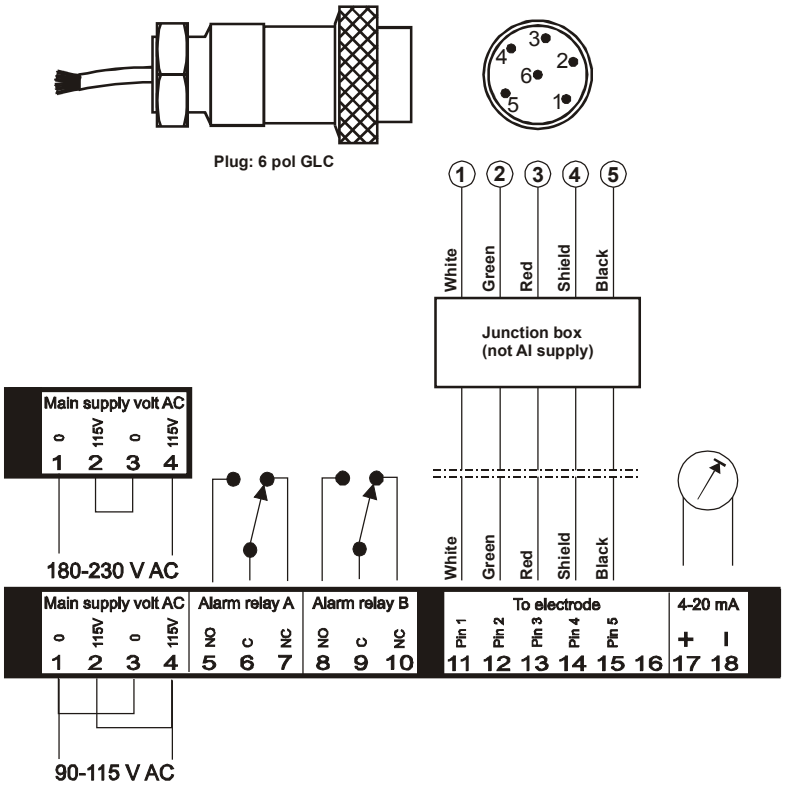


Figure 3 **821034wiringx0208340en.wmf**

The mains supply of the control device is 90-115 V_{AC} or 190-230 V_{AC}, 50-60 Hz.Ensure that the mains supply is secured against over current by a fuse (max.100mA).

The recommended cable for the conductive electrode is a multi-screened twin twisted pair like Farnell no. 385-4334, where the screen is connected to connector 14, one pair is used for connector 11+12, and the other pair is used for connector 13+15. The length of the cable must not exceed 200 m.

Important: The cable may not be placed together with power cables, as this will cause damage to the gold plating on the electrodes.

3 Maintenance

The accuracy of the salinometer equipment is very dependent on the electrodes are kept clean. The electrodes should be taken out and cleaned at least once a week. Use

only a clean and soft reg. When cleaning the electrodes it is important that oil or other chemicals do not pollute the electrodes. Any pollution will immediately result in an inaccurate measurement of the salinometer.

Note: Avoid damaging the gold plating.If the gold plating is damaged, the conductive electrode must be replaced.

The expected longevity of the conductive electrode is approximately 1.2 – 2.2 years.

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Oil detection equipment

OM9410_01 Oil detection equipment.....13-2

Oil detection equipment

1 General

This chapter contains installation, operation, and maintenance instructions for the ultrasonic interface detection system, Mobrey type 402 SD, using control unit type MCU200.

Each Mobrey ultrasonic control system requires a sensor to suit the specific application, plus a control unit. These instructions cover the control units in the MCU200 series.

2 Sensor installation

2.1 General description

The ultrasonic sensor contains two piezoelectric crystals. A high frequency signal (3.7 MHz) generated by the control unit is transmitted to one piezoelectric crystal by coaxial cable. This crystal converts the electrical signal into an ultrasonic oscillation.The sensor design allows the ultrasonic oscillation to pass from the transmitter crystal to the receiver piezoelectric crystal. The sensors of type 402 are “gap” type sensors, where the two piezoelectric crystals are separated by a gap. When the gap is in liquid the signal reaches the receiver, because of the low ultrasonic attenuation of the liquid. When the gap is filled with air, no ultrasonic signal can pass from transmitter to receiver. See Figure 1.

Working principle of the oil detection equipment

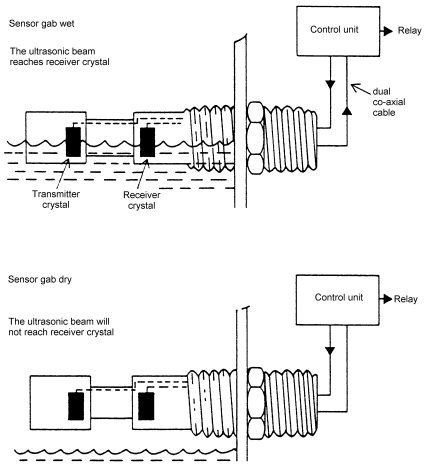


Figure 1 **om9410_01_mobreyx0063070en.wmf**

When the gap is filled with liquid, the piezoelectric receiver crystal converts the ultrasonic wave into an electrical signal, which is transmitted back to the control unit using a second coaxial cable. Usually the two coaxial cables to the sensor are in one overall sheath. The control unit circuitry is a feedback amplifier, which oscillates when the sensor is wet, and is quiescent for the sensor dry. The “oscillating” or “non-oscillating” sensor states dictate the output relay states of the MCU200.

For interface detection the sensor “oscillates” in a clear liquid, and is “non-oscillating” at the interface.

2.2 Switching levels and orientation

The gap sensors should normally be mounted with the gap vertical, to avoid build up of solids on the sensor faces on either side of the gap. In this condition the switching level will be half way up the face: if the sensor is mounted from the side of the tank this is normally on the centreline of the cylindrical body.

Occasionally such sensors are mounted with the sensor faces horizontal, either to avoid air bubbles passing through the gap or for convenience of installation. In this case the switching level will be at the sensor face at the top of the gap.

2.3 Installation of sensor

The sensor must be handled with care - it is a measuring instrument. Before installation, check that sensor, cable and control unit have not been damaged in transit. Drill and tap a hole with a suitable thread. It is advisable to use a boss or similar on thin walls. The sensor has a tapered thread. Use Ptfe tape or similar to seal the thread. Mark the sensor hexagon to identify the gap orientation of the sensor, if appropriate. Take care not to damage the sensor cable during tightening.

The cable should be laid on cable trays and separated from any high voltage or mains cables. The normal cable termination is a plastic gland (to fit the MCU200 control box drilled hole) and crimped terminal pins to suit the MCU200 terminals.

2.4 Extensions cables

Extension cables up to 50 metres long can be fitted to most Mobrey ultrasonic sensors in the factory to special order but a better site arrangement is to have a separate extension cable. Table 1 shows a list of suitable extension cables.

Suitable extension cables		
50 m	**50 - 100 m**	**Above 100 m**
RG174 RG178	URM76 RG58	Consult Aalborg Industries

Table 1

When double coaxial cable needs to be extended, two sets of coaxial plugs and sockets will be needed, one set for transmit and one receive. Care must be taken that the connectors are not connected to earth or shorted together in any way, to prevent cross-talk or pick-up. The coaxial connections must be made in a waterproof junction box. Terminal blocks should not be used.

The extension cable needs to be of 50 Ohm characteristic impedance. Suitable dual coaxial extension cables can be purchased from Aalborg Industries. For extensions over 50 metres it is recommended two runs of single coaxial low loss cable is used, with the transmit and return cable runs separated by 0.15 metres to minimise cross-talk.

If several sensor cables are being run together then all the transmit cables (those connected to E2) should be grouped together and all receive cables (those connected to 1E) grouped together maintaining the separation specified above.

Two cables are required per sensor. The RG178 should be used where the cable itself is subject to temperatures exceeding 74°C.

3 Control unit installation

3.1 Mechanical

The control unit is supplied with three holes drilled in the bottom (longer) side of the box. Two glands are supplied for the power input cable and relay output cable. The sensor is normally supplied fitted with a suitable gland on the cable. Two further holes can be drilled in the bottom side of the box should these be needed: it is recommended that the circuit board is removed whilst drilling extra gland holes.

Figure 2 shows the dimensions of the MCU200 housing box.

MCU200 Housing dimensions

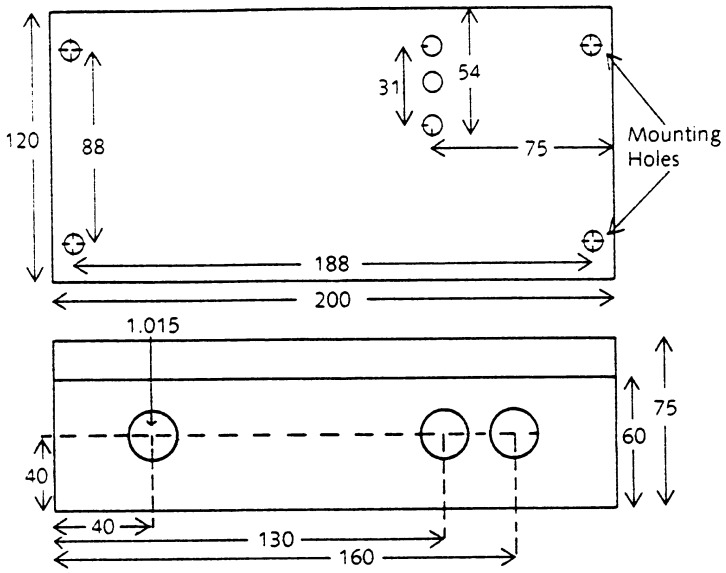


Figure 2 **om9410_01_mobreyx0063080en.wmf**

All cable connections are made to the terminal blocks along the bottom edge of the pcb, see Figure 3. Release the terminal screw before inserting the wire.

MCU201 PC board

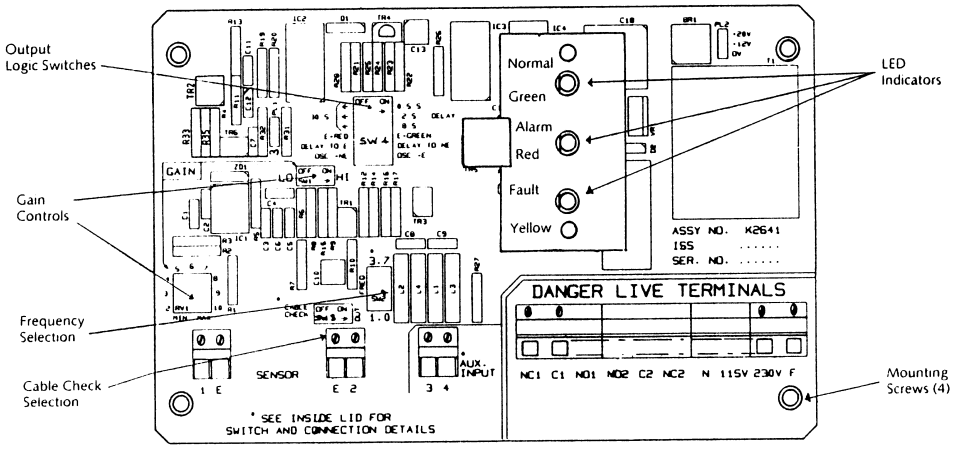


Figure 3 **om9410_01_mobreyx0063090en.wmf**

3.2 External connections

3.2.1 AC mains

AC mains is connected between the “N” terminal for neutral and one of the “115V” or “230V” terminals depending on the voltage supply available - BEWARE - the ter-

minal not connected externally will be “live” once the transformer is powered via the other terminals.

3.2.2 Mains earth

Mains earth should be connected to the terminal marked “E”. This provides an earth contact for the pcb mounting pints.

3.2.3 The relay

The relay output connections are labelled:

- NC - Normally closed (relay de-energised)
- C - Common
- NO - Normally open (relay de-energised)

There are also two sets of contacts for DPCO relay, labelled 1 & 2.

3.2.4 The sensor

The sensor connections are labelled "1", "E" for the receiver crystal and "2", "E" for the coax cable to the transmitter crystal. The screens of these coax cables are connected to the terminals marked "E".

3.2.5 The auxiliary input

The auxiliary input is a terminal which can be connected to a "push to reset" button to achieve a latching alarm, or to another Mobrey Control unit, to give a pump control from the MCU200 unit relay output. If a short circuit is connected between terminals 3 & 4, the MCU200 relay, once de-energised, is held de-energised. Even if the sensor attached to the MCU200 changes state, to that which should energise the output relay, this relay will not energise until the link between terminals 3 & 4 is broken in the circuit external to the MCU200.

3.3 Switch settings in MCU200 series

3.3.1 Gain switch and potentiometer

See section 4.

3.3.2 Frequency selection

This slide switch is labelled "FREQ" and is located between the sensor terminal block E2, and the Aux. input terminals. This selects the operating frequency of the MCU200 oscillator, which for the present installation must be set to 3.7 MHz (switch in the “up” position). The setting required is dictated by the sensor type connected to the control unit.

3.3.3 Cable check option selection

This slide switch is located directly above the sensor terminal block E2. It is labelled "Cable Check" and the ex factory setting is "OUT" with the slide switch to the right.

By sliding this switch to the left, the cable check circuitry is brought into action. This circuitry monitors the continuity of the screens of the two coaxial cables attached to

the sensors: normally these are linked at the sensor to the metal body of the fitting (or to each other in the case of non metallic sensors). If this continuity is broken, the "FAULT" LED" will illuminate giving an indication that the sensor cable is damaged, and the MCU200 will give the "ALARM" output relay state (see Figure 4).

3.3.4 Relay output and LED logic selection

The bank of six slide switches towards the top of the pcb sets the relay output state logic relative to the sensor state, associated time delays and the LEDs. These are slide switches, best adjusted with a pencil, and the ex factory wetting is with all switches to the right.

Each switch is colour coded as shown in Figure 4, and the PC board labels give brief function information.

Relay output and LED logic switch

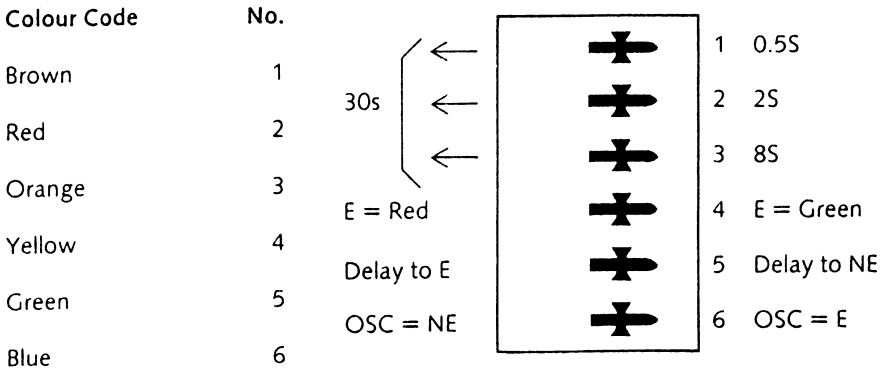


Figure 4 **om9410_01_mobreyx0063130en.wmf**

Note: At Figure 4 OSC means sensor oscillating. E means relay energised, NE means de-energised.

Set the switches in the following order, starting at the bottom and working upwards:

BLUE:

If the MCU200 relay is to be energised (E) when the sensor is oscillating (OSC) then set the No 6 blue switch to the right (OSC=E). This is the preferred setting, to give a de-energised relay in the ALARM state for a gap sensor as a low level alarm.

GREEN:

This selects the relay change which is subject to the time delay selected on the top switches. When the No.5 green switch is set to the right, the delay occurs between the sensor changing state and the relay de-energising or becoming “not energised” (NE). This time delay is a minimum of 0.l5 seconds, (achieved by switching the top BROWN

switch to the right) and is used to prevent relay chatter at the changeover point. Longer time delays are selected on the top three slide switches as shown in Figure 5.

The relay change in the opposite direction is immediate (within 50 milliseconds).

The top three slide switches

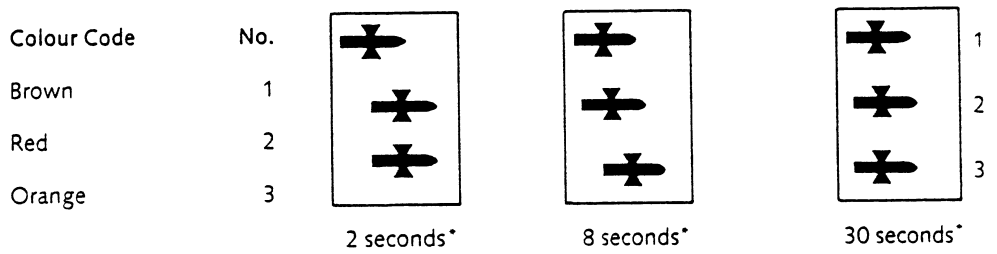


Figure 5 **om9410_01_mobreyx0063100en.wmf**

YELLOW:
Only one of the GREEN or RED LEDs will be illuminated at any one time. These LEDs show the state of the MCU200 output relay. The RED LED is labelled "ALARM" and the GREEN LED is labelled "NORMAL". The yellow slide switch (Number 4) determines which LED will be illuminated when the relay is energised (E). It is usual to have the GREEN/NORMAL condition occur with the relay energised, i.e. with switch Number 4 to the right (E=GREEN).

4 Applications

4.1 Gain adjustment

Correct adjustment of the gain (HI/LO switch and potentiometer) is essential for proper operation of any ultrasonic sensor system. This adjusts the gain of the feedback amplifier in the control unit, which produces oscillation of the sensor when the coupling between the ultrasonic crystals is sufficient. Therefore the higher the gain setting, the lower the coupling needed to produce an oscillating sensor.

The universal control unit of the MCU200 operates with many sensors, so the correct setting for the particular sensor and application should be found on site by experiment, if possible. This will take account of particular site conditions like RF coupling between extension cables, which can affect the maximum allowed gain. Other liquid characteristics, such as presence of suspended solids, or air bubbles, can mean that for reliable operation the MCU200 gain must be set as high as possible, to overcome future solids build up, but at least one potentiometer division below the maximum allowed level, to ensure temperature and component ageing stability.

The particular procedures outlined below for gain adjustments give the mid point gain settings, which may need to be adjusted to meet specific site/sensor future requirements as indicated above.

4.2 Interface detection

4.2.1 Interface detection between two dissimilar liquids

Viscous liquids, emulsions and liquids containing solid particles have a greater ultrasonic attenuation than clear liquids. This technique is used to detect which liquid is present at the sensor, for example for the separation of oil and water. For this duty Mobrey 402 sensors are used, operating at 3.7 MHz to produce the maximum ultrasonic difference between two liquids monitored.

The gain is adjusted so that the sensor oscillates only in the liquid with the lower ultrasonic attenuation: this is usually the clearer liquid (water in the example of Figure 6). Note that the signal when oil is present in the sensor gap will be the same as that for air in the gasp, and that emulsion layers give a very high attenuation.

Mobrey 402 Sensor as oil/water interface

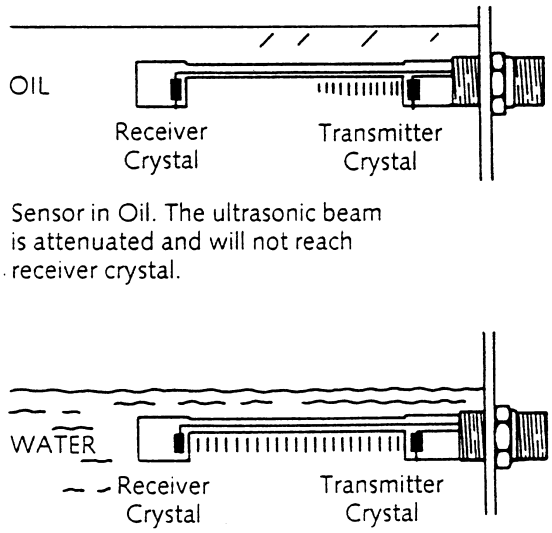


Figure 6 **om9410_01_mobreyx0063110en.wmf**

Step A: Reduce the gain potentiometer with the sensor immersed in one of the liquids until a "false dry" indication is obtained. Note the position of the pot.

Step B: Repeat for the sensor immersed in the other liquid.

Step C: Set the potentiometer half way between these two values. Correct performance requires a total difference between the two set points of at least 3 divisions.

Interface detection between two immiscible similar liquidsWhen liquids are ultrasonically very similar - as happens for example with paraffin or oil and water - the procedure in section 4.2.1. produces very little difference between the two "false dry" points. In this case the "reflection" method of interface detection is used. An illustration of this method is shown in Figure 7.

Note: The Mobrey 402 sensor in the hot well tank is installed as shown in Figure 7.

If an ultrasonic beam is transmitted from one liquid to another at a suitable angle (10%) it is split at the interface into a reflected and a refracted beam, so that it does not reach the receiver crystal. If there is no interference in the gap, but only one liquid, the beam is received and the sensor oscillates.

Interface detector by reflection method

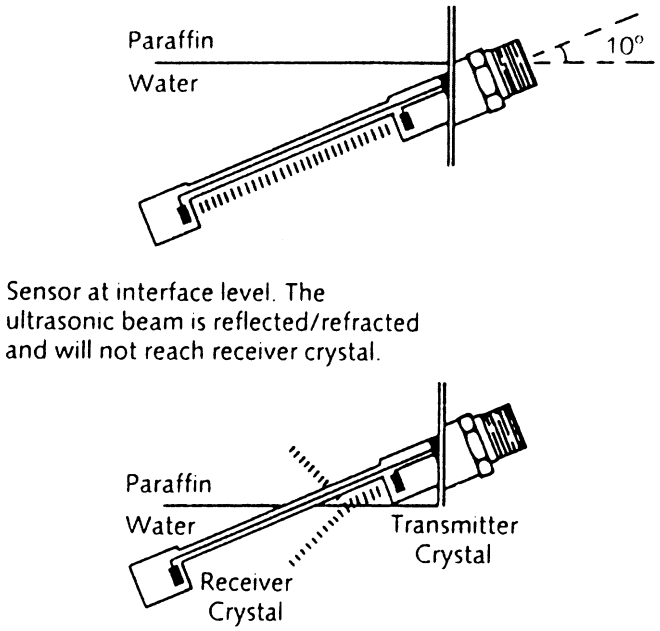


Figure 7 **om9410_01_mobreyx0063120en.wmf**

The gain adjustment is made so that the gain is 3 divisions higher than the highest false dry position obtained, as in section 4.2.1. Performance at the interface should then be checked.

Note: That the non oscillating state of the sensor, at the interface, also occurs throughout any emulsion layer at the interface, and also when the sensor is in air.

5 Spares and fault finding

5.1 Spares

The following parts are suitable for replacements on the MCU201:

- Main pcb complete: K2641
- LED indicator pcb: K2643
- LED pcb spacers: K2623
- LED pcb connector: K2624/50
- Box assembly: K2662
- Gland Assembly: K746/K747/K748

There are no consumable items such as fuses.

5.2 Fault finding

Step A: At least one LED should be illuminated. If not check the power supply to the unit.

Step B: If the "Fault" LED is on, check the coax cable to the sensor for incorrect wiring or damage. Particularly check continuity of extension cables, connection of crimped connectors on cable ends. The pcb board can be checked by linking the two terminals labelled E on the sensor terminals - this should cancel the fault indication LED.

Step C: If the sensor is giving incorrect indications check the gain adjustment (see section 4.0).

Check for correct sensor operation whenever the gain is adjusted away from the normal set point. Assume an overlap of 2 divisions between the "LO" and "HI" gain ranges.

Step D: Check that the incorrect operation has not been produced by incorrect setting of the frequency selection switch, or an external short circuit on the Auxiliary input terminals.

Step E: The circuit board can be checked by linking the sensor terminals 1 and 2 with a wire, to simulate an oscillating sensor.

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Steam dump equipment

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Steam dump equipment

1 General description

The steam dump equipment is designed for dumping excess steam generated by the boiler plant from the steam system to an atmospheric dump condenser.

This chapter contains some general instructions, which should be taken into consideration before installing and during operation of the steam dump equipment. More detailed instructions related to the components of the equipment can be found in other sections.

Note: It is essential that the condenser is dimensioned to be able to absorb the amount of steam generated in the exhaust gas boiler(s). Or if a composite boiler is installed the amount of steam generated by the exhaust gas part of the composite boiler(s).

Schematic illustration of the steam dump system

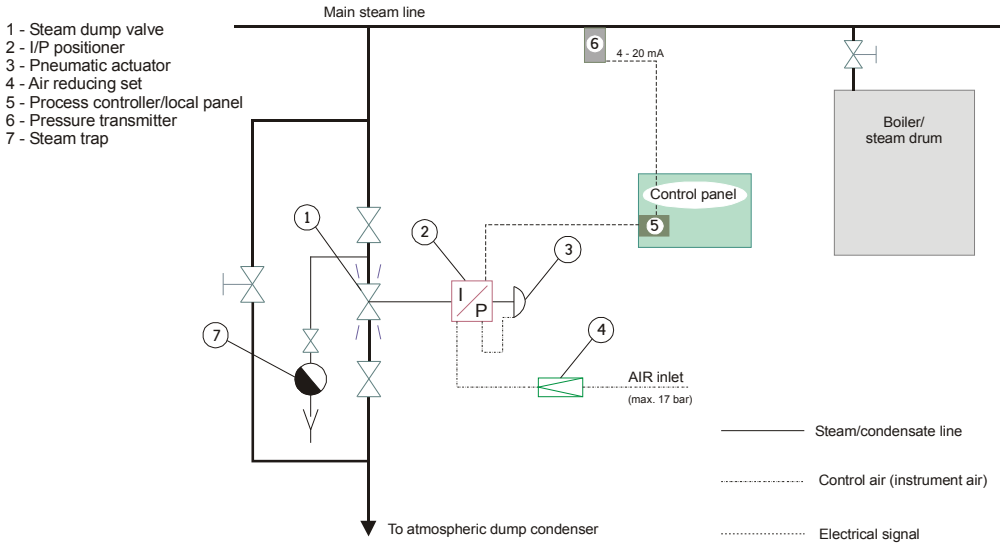


Figure 1 **om6050_03_steamdx0056780en.wmf**

Figure 1 shows a schematically illustration of the system, which consists of the following components:

- Control valve with pneumatic actuator.
- I/P positioner.
- Air reduction set.
- Process controller or local panel.
- Pressure transmitter.
- Steam trap.

The equipment is working by measuring the steam pressure (e.g. in the boiler, the steam drum or the main steam pipe) with a pressure transmitter (6). The transmitter sends an electrical signal (4-20 mA DC) to the process controller/local panel (5). In the control system the signal is compared with a pre-set adjustable value.

The steam pressure is then regulated when the control system sends an electrical signal to the I/P positioner (2). It converts the signal and via the pneumatic actuator (3) controls the position of the steam dump valve (1), through which the excess steam is lead to the atmospheric dump condenser.

The control valve will automatically close in case of air or power failure. A hand wheel enables manual operation of the valve. Figure 2 shows a complete control valve arrangement consisting of valve, I/P positioner and actuator.

Arrangement of control valve, positioner and actuator

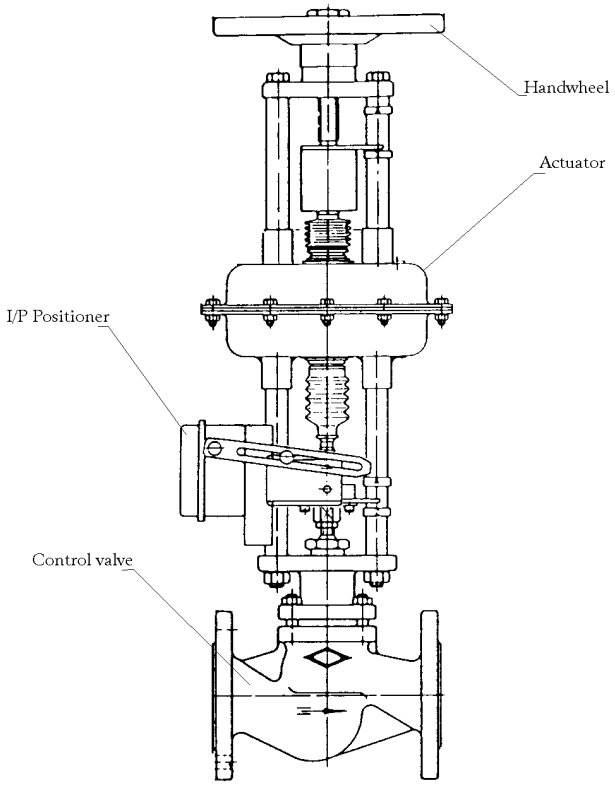


Figure 2 **om6050_03_k7462_x0056760en.wmf**

Under normal circumstances the control valve, actuator and I/P positioner is delivered as a complete unit already assembled.

The air supply to the actuator is controlled by the air reduction set (4). The compressed air at the inlet of the air filter must have a max. pressure of 17 bar and a temperature laying in the interval from -20 to +65°C. Furthermore, the supplied air must be instrument air.

Any adjustment of the system must be carried out on the process controller/local panel (5).

Note: All pipes must be thoroughly cleaned before commissioning

2 Steam dump valve

Depending on the amount of steam that the system is designed to be able to dump, the control valve can be of two different types, either type 23.440 DP or type 23.470 DP. The construction of the valves are slightly different as can be seen on Figure 3.

The steam dump valve together with actuator and positioner are suitable for installation in dry or damp locations, and in order to avoid damage to the drives it is recommended to install the components in an up-right position.

Ambient temperatures on the valve drive should not fall below -15°C or rice above 50°C. Precautions should however be taken when using the equipment where the ambient temperature are likely to drop below 0°C to prevent condensation of water in the instrument air.

Drawings of the two types of control valves

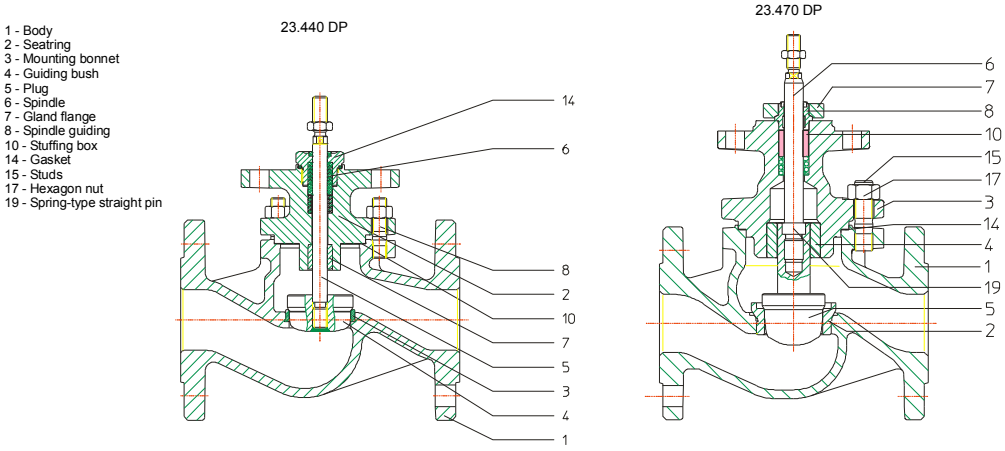


Figure 3 **om6050_03_k7462_x0056770en.wmf**

2.1 Fitting instructions

The installation point should allow sufficient space to ensure correct maintenance of the valve and actuator. The valve should be inserted so that the spindle has a vertical position and the actuator being up above. The valve can also be tilted to a maximum horizontal position if the installation point does not allow any better condition. If painting is necessary, ensure that valve and actuator spindle as well as mechanical links are free from paint. The flow direction is signalled through an arrow on the valve body. The valves should be insulated against high temperatures to guard the actuator. Sufficient space must be left to undertake maintenance on the spindle-sealing.

To guarantee a disturbance free function of the control valve, the inlet and outlet stretches of the piping should be of straight piping length min. 2 times pipe diameter by inlet and 6 times by outlet. The piping must be aligned to prevent any strain on the valve. Precautions to restrict strain on the piping should be regarded. In no case supporting must be fitted to the valve to hold the piping system.

The piping should be rinsed to clear out any pollution, welding beads, rust etc. before inserting the control valves. A strainer should be fitted in front of the control valve to catch remaining particles. Bolts should be re-tightened after taking into operation.

When the piping system is filled and set under pressure, the spindle sealing should be checked for leakage, and if necessary be carefully tightened until the leakage is stopped. The PTFE-V-ring unit does not require any re-tightening, the spring tension maintains the necessary force.

The bolts must be tightened gradually in steps, diametrically in pairs but not tighter than it is necessary for sealing.

Flange connections bolts should never be loosened or tightened when the valve is under temperature or pressure, even if a leakage may arise.

3 Actuator

Select the site of installation so that the actuator is readily accessible and that there is adequate room for later maintenance work.

The mounting position is preferably with the actuator and valve spindle in the vertical position. For assembly onto the valve please see the separate instructions described in the sections for valve and actuator (see also Figure 4).

The instrument air supply should be dry for low temperature service. A heat-guard should be installed for high temperature service.

Note: Please observe the maintenance instructions for valves.

3.1 Pneumatic connection

The pneumatic supply tube must be connected to the diaphragm housing.

The thread connection for the actuators DP 32 and DP 33 is R 1/4" and for the actuator DP 34 R 3/8".

Warning: The actuator diaphragm may only be pressure loaded on the side opposite of the springs. The vent hole in the other connection must stay free.

Assembling of the actuator on valve

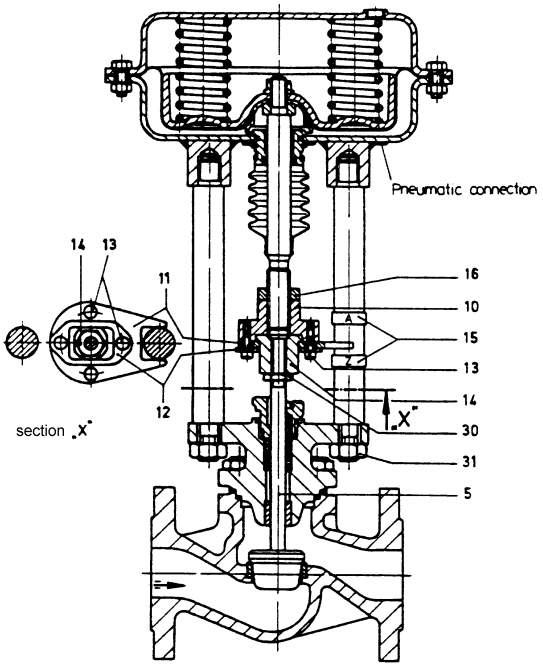


Figure 4 **om6050_03_acu_06x0056730en.wmf**

4 I/P positioner

The positioner must be installed and commissioned in exactly the same sequence as described in the section for the positioner. It is essential that the warnings in the relevant sections are heeded during this process.

Warning: This instrument must only be installed and commissioned by qualified personnel. The degree of electrical safety is determined solely by the devices supplying the power.

Warning: Pneumatic drives generate considerable positioning forces. Safety precautions must therefore be scrupulously observed during installation and commissioning in order to prevent injuries. Your attention is drawn, if applicable, to the relevant regulations regarding operation in hazardous areas.

5 Steam pipe connections to dump valve

Referring to the diagram in Figure 1, some remarks have to be made on the piping system before and after the dump valve. This is due to the fact that a proper functioning of the steam dump equipment (i.e. the equipment is able to blow off the required amount of steam) requires as low a resistance in the piping system as possible.

In order to obtain this low resistance the following topics should be considered:

- The dump valve should be placed as near the dump condenser as possible.
- According to the amount of steam that the system is dimensioned to dump the diameter of the pipe before the dump valve must be of a certain size, which can be deduced from Table 1 and Table 2.
- The steam pipe after the dump valve must as written in Table 1 and Table 2 be at least 2 sizes larger than the pipe before the dump valve.
- It is essential the transitions from pipes to the dump valve both before and after the valve are smooth and without any sudden contractions or expansions.
- Furthermore should the pipe section be as short as possible and preferably without bends.
- If there are valves placed in the system before and/or after the dump valve these should be of the straightway type and of the same size as the pipes.

Amount of dumped steam related to min. pipe diameter							
Dump pressure: 5 bar g							
Size of dump valve, DN	20	25	32	40	50	65	80
Max. steam amount, kg/h	260	400	640	1030	1600	2580	4000
Pipe size before valve, DN	32	40	50	65	80	100	125
Pipe size after valve, DN	50	65	80	100	125	150	175
Dump pressure: 6 bar g							
Size of dump valve, DN	20	25	32	40	50	65	80
Max. steam amount, kg/h	300	470	740	1180	1850	3000	4700
Pipe size before valve, DN	32	40	50	65	80	100	125
Pipe size after valve, DN	50	65	80	100	125	150	175
Dump pressure: 7 bar g							
Size of dump valve, DN	20	25	32	40	50	65	80
Max. steam amount, kg/h	335	515	840	1360	2100	3400	5300
Pipe size before valve, DN	32	40	50	65	80	100	125
Pipe size after valve, DN	50	65	80	100	125	150	175
Dump pressure: 8 bar g							
Size of dump valve, DN	20	25	32	40	50	65	80
Max. steam amount, kg/h	380	600	950	1550	2350	3800	6000
Pipe size before valve, DN	32	40	50	65	80	100	125
Pipe size after valve, DN	50	65	80	100	125	150	175
Dump pressure: 9 bar g							
Size of dump valve, DN	20	25	32	40	50	65	80
Max. steam amount, kg/h	420	660	1040	1650	2600	4150	6600
Pipe size before valve, DN	32	40	50	65	80	100	125
Pipe size after valve, DN	50	65	80	100	125	150	175

Table 1

Amount of dumped steam related to min. pipe diameter, continued							
Dump pressure: 10 bar g							
Size of dump valve, DN	20	25	32	40	50	65	80
Max. steam amount, kg/h	470	730	1160	1850	2900	4650	7300
Pipe size before valve, DN	32	40	50	65	80	100	125
Pipe size after valve, DN	50	65	80	100	125	150	175
Dump pressure: 11 bar g							
Size of dump valve, DN	20	25	32	40	50	65	80
Max. steam amount, kg/h	500	780	1250	2000	3150	5000	7800
Pipe size before valve, DN	32	40	50	65	80	100	125
Pipe size after valve, DN	50	65	80	100	125	150	175
Dump pressure: 12 bar g							
Size of dump valve, DN	20	25	32	40	50	65	80
Max. steam amount, kg/h	520	850	1360	2180	3400	5200	8500
Pipe size before valve, DN	32	40	50	65	80	100	125
Pipe size after valve, DN	50	65	80	100	125	150	175
Dump pressure: 13 bar g							
Size of dump valve, DN	20	25	32	40	50	65	80
Max. steam amount, kg/h	530	870	1380	2210	3450	5300	9100
Pipe size before valve, DN	32	40	50	65	80	100	125
Pipe size after valve, DN	50	65	80	100	125	150	175
Dump pressure: 14 bar g							
Size of dump valve, DN	20	25	32	40	50	65	80
Max. steam amount, kg/h	540	900	1410	2360	3530	5500	9800
Pipe size before valve, DN	32	40	50	65	80	100	125
Pipe size after valve, DN	50	65	80	100	125	150	175
Dump pressure: 15 bar g							
Size of dump valve, DN	20	25	32	40	50	65	80
Max. steam amount, kg/h	560	950	1470	2480	3670	5850	10400
Pipe size before valve, DN	32	40	50	65	80	100	125
Pipe size after valve, DN	50	65	80	100	125	150	175
Dump pressure: 16 bar g							
Size of dump valve, DN	20	25	32	40	50	65	80
Max. steam amount, kg/h	580	1020	1550	2550	3900	6250	11000
Pipe size before valve, DN	32	40	50	65	80	100	125
Pipe size after valve, DN	50	65	80	100	125	150	175

Table 2

6 Process controller/local panel

The process controller or local panel are installed in the boiler control panel. For instructions regarding one or the other please see the specified instructions in the control system sections.

Warning: This is an electrically-operated device. Certain parts in electrical devices carry dangerous voltages during operation. Severe injury or damage to property could therefore occur if the warnings are not observed. Staff working with this device should be suitably qualified. Reliable and safe operation of these devices depend on correct transport, storage, assembly and operation.

7 Pressure transmitter

The pressure transmitter converts the steam pressure to an electrical signal proportional with the pressure. The unit is supplied as two-wire transmitters with an output signal of 4-20 mA.

7.1 Installation conditions

The zero point is factory-set with the pressure connector pointing downwards. If the unit is installed in another position the zero point will be displaced approx. 1% as far as the lowest pressure range is concerned, decreasing in the higher pressure ranges. The displacement can be eliminated by using a zero-point potentiometer.

To protect the pressure element against temperatures higher than the maximum permissible temperature of the element (100°C), it is recommended to insert a water-filled loop. An example of such an installation is shown on Figure 5, which also shows an example of insulation against radiant heat.

Example of installation/connection of transmitter

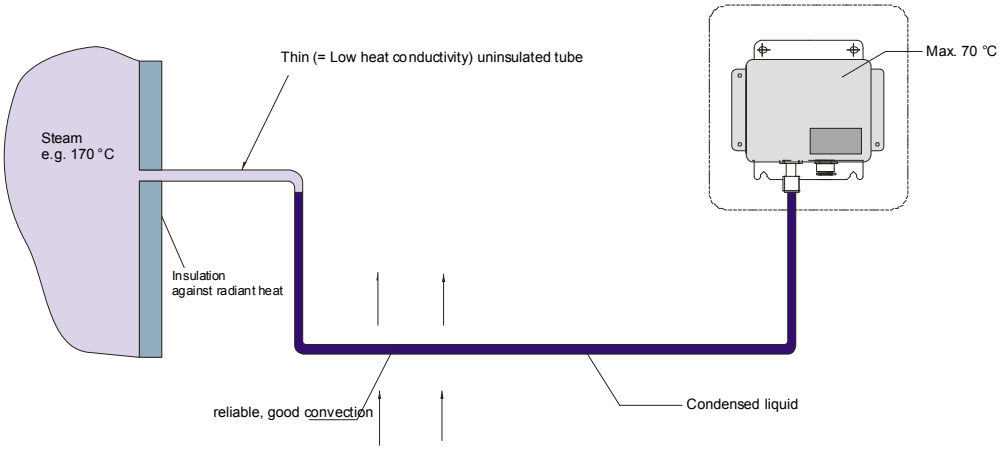


Figure 5 **om6050_03_emp2_2x0056750en.wmf**

There are facilities for adjusting zero point and span. Zero point adjustment is necessary to equalise pressure arising from any differences in level between the pressure transmitter and the medium being measured. Zero point adjustment results in a parallel adjustment of span.

8 Air reducing set

8.1 Installation

Before installation the operating conditions of temperature and pressure must be checked.The unit should be mounted securely in an accessible and visible location upstream from lubricators and near components being served. Strain on pipe work and fittings should be avoided and directional flow arrows observed.

With cyclic demand systems the filter-regulator should be installed upstream of directional control valves. Airline piping should be the same size as unit ports with airflow in the direction of the arrow.A pressure gauge may be connected to the appropriate 1/8 port after removing the plug and should have a range exceeding the maximum proposed outlet setting.Figure 6 shows an illustration of the filter-regulator.

Filter-regulator

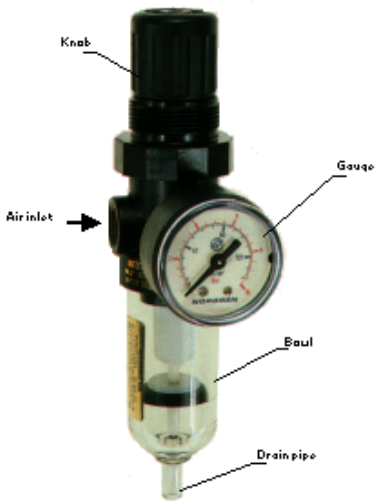


Figure 6 **om6050_03_b07_fx0056740en.wmf**

8.2 Adjustment

With the regulator adjustment completely backed-off the air supply can be turned on. The adjusting knob can be rotated clockwise to increase the spring load and the pressure increase observed on the gauge.

Minor adjustment after setting changes can be avoided by always approaching the desired setting from the lower level. When a lower setting is required, firstly reduce to a lower level and then increase to the desired setting.

Decreasing the pressure setting on a relieving type regulator will cause air to exhaust through the bonnet vent hole.

The non rising adjusting knob includes a locking feature;

- Push knob in after setting to lock and prevent adjustment.
- To release pull knob out.

If the adjustment knob is fitted with the tamper resistant screw option, the screw must be removed to enable the knob to be unlocked.

Auto drain units should have a 1/4" (6 mm) bore flexible tube pushed over the bottom protrusion to pipe away expelled liquid. Avoid restricting the drain pipe.

Manual drain units must be drained before the contaminant level reaches the element. Should this occur then liquid contaminant will be carried downstream.

Control valves, type 470/471

1 General

This type of control valve is suited to regulate fluids, gases and steams. The valve plug is normally a parabolic plug, but can also be supplied in a perforated design. Both types of plugs can have either linear or equal percentage flow characteristic.

The flow direction for parabolic plugs is always against the closing direction. However, with perforated plugs for steam and gases, it is in the closing direction. If a valve with a perforated plug is operated by means of a pneumatic actuator with the flow in the closing direction, the pneumatic actuator should have a stronger thrust force. This is necessary to prevent thumping near to the closing position.

All control valves can be fitted alternately with manual-, pneumatic-, electric- or hydraulic operation devices.

Illustration of control valves type 470 and 471

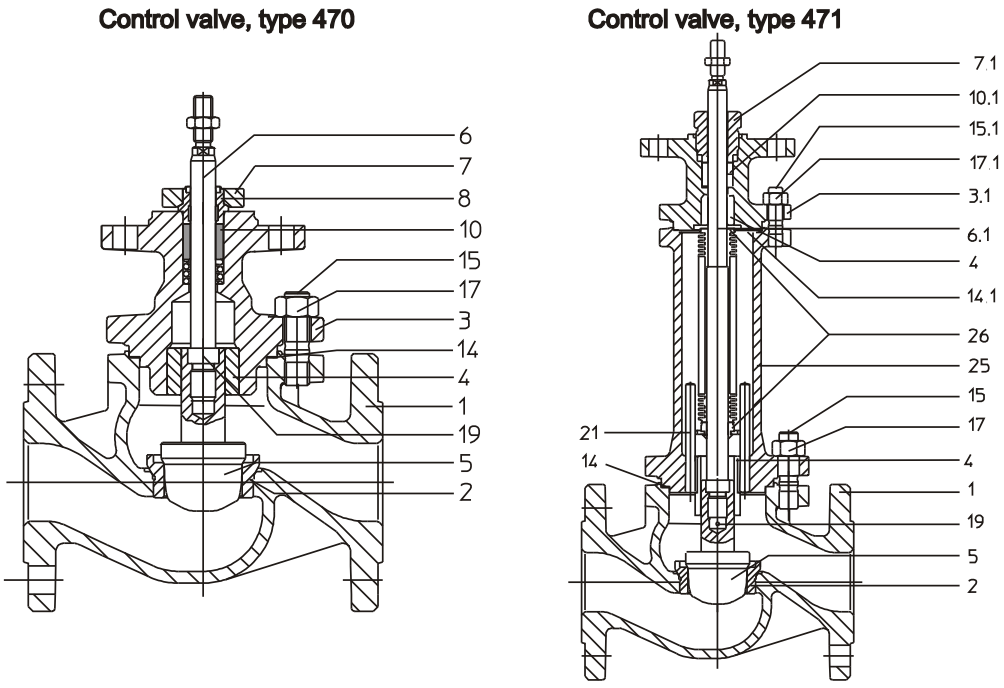


Figure 1 **om6010_02_val47xx0056570en..wmf**

Table of position numbers in Figure 2					
Part	**Designation**	**Part**	**Designation**	**Part**	**Designation**
1	Body	7	Gland flange	15.1	Studs
2	Seat ring	7.1	Screw joint	17	Hexagon nuts
3	Mounting bonnet	8	Spindle guiding	17.1	Hexagon nuts
3.1	Mounting bonnet	10	Stuffing box	19	Spring-type straight pin
4	Guiding bush	10.1	Stuffing-box packing	21	Set-pin
5	Plug	14	Gasket	25	Bellow housing
6	Spindle	14.1	Gasket	26	Bellow unit
6.1	Spindle	15	Studs		

Table 1

2 Operation

2.1 Fitting instructions

The valve should be inserted so that the spindle has a vertical position together with the actuator. The valve can also be tilted to a maximum horizontal position if the installation point does not allow any better condition.

To guarantee a disturbance free function of the control valve, the inlet and outlet stretches of the piping should be of straight piping length (min. two times the pipe diameter by inlet and six times by outlet). The piping should be rinsed to clear out any pollution, welding beads, rust, etc. before inserting the control valves. A strainer should be fitted in front of the control valve to catch the remaining particles. Bolts should be tightened after taking into operation.

The flow direction is signalled by an arrow on the valve body. The valves should be insulated against high temperatures to guard the actuator.

2.2 Actuator assembly

The control valves are normally delivered with actuators already fitted. For alternations or maintenance of actuator, the assembly should occur in accordance with the operation instructions for the actuator.

2.3 Setting into operation

When the piping system is filled, the spindle sealing should be checked for leakage and, if necessary, tightened. A PTFE-V-ring unit does not require any tightening as the spring tension maintains the necessary force.

The bolts must be tightened gradually in steps, diametrically in pairs, but not tighter than it is necessary for the sealing. Flange connection bolts should never be loosened or tightened when the valve is under temperature or pressure even if a leakage may arise.

For actuators please see to the appropriate actuator operation instructions.

3 Maintenance

Before any maintenance of the control valve is carried out, the piping system must be shut off and pressure free.

3.1 Exchange of the stuffing-box packing

A leak stuffing-box packing should initially be carefully tightened to stop the leakage. If this does not help, a new layer should be inserted, or the complete packing should be replaced.

3.1.1 Additional packing layer

Step A: Open the valve fully and unscrew the hexagon nuts (17).

Step B: Lift the gland flange (7) and the spindle guiding (8) upwards.

Step C: Insert adequate quantity of packing rings (split ring-displacement, splitting at 180° to avoid overlapping).

Step D: Fix the hexagon nuts (17) properly.

3.1.2 Exchange

Step A: Drive the actuator into middle position and dismantle the actuator.

Step B: Unscrew the hexagon nuts (17) from the studs (15).

Step C: Remove the gland flange (7), the spindle guiding (8) and the old stuffing box (10) and clean the packing compartment.

Step D: Clean the valve spindle and check for damage and if necessary replace. If the damaged spindle is not replaced, the new packing will leak after a short period.

Step E: Insert the new packing rings (split ring-displacement, splitting at 180° to avoid overlapping).

Step F: Fix the hexagon nuts (17) properly.

Note: Strenuous tightening will prevent leakage, but will also have a brake effect on the spindle which aggravates the movement of the spindle.

3.2 Exchange of a PTFE-V-ring sealing unit

A PTFE-V-ring unit is spring loaded and has enough set pressure to ensure a good seal even by low operation pressures. It is replaced as mentioned above.

The PTFE-V-ring sealing unit should be lubricated before it is inserted. The sealing lips must face against the pressure direction.

Note: Special care should be given to the spindle surface. Rough surfaces wear the sealing lips enormously and can be due to failure of the packing unit.

3.3 Exchange of the bellow unit

Step A: Drive the actuator into middle position and dismantle the actuator.

Step B: Unscrew the screw joint (7.1).

Step C: Unscrew the hexagon nuts (17) and remove the bellow housing (25). Dismantle the plug as described in the next section.

Step D: Unscrew the hexagon nuts (17.1) and dismantle the mounting bonnet (3.1).

Step E: The bellow unit (26) is removed from the bellow housing (25).

Step F: Replace the two gaskets (14.1) and the gasket (14).

Step G: When the bellow unit (26) is replaced, the proper position of the anti-twisting device must be observed.

Step H: The set pins (21) have to drive within the slots of the anti-twisting device. Check for friction-free movement.

Step I: Replace mounting bonnet (3.1) and screw down the hexagon nuts (17.1) crosswise.

3.4 Exchange of the plug-spindle unit

Step A: Drive the actuator into middle position and dismantle the actuator.

Step B: Unscrew the gland flange (7).

3.4.1 Control valve type 470

Step A: Unscrew the hexagon nuts (17) and dismantle the mounting bonnet (3).

Step B: Pull out the plug with the spindle and exchange this unit.

Step C: Remove the spring-type straight pin (19) and unscrew the spindle (6).

Step D: Replace the old parts and assemble it.

Step E: Drill a hole through the plug shaft and insert a new pin.

Step F: Replace the gasket (14) and assemble the mounting bonnet (3).

Step G: Tighten the nuts (17) evenly, crosswise.

3.4.2 Control valve type 471

Step A: Unscrew the hexagon nuts (17) and dismantle the bellow housing (25) with plug (5).

Step B: Drive the spindle in the bottom position and remove the spring-type straight pin (19).

Step C: Unscrew the plug.

Step D: Screw a new plug at the spindle and drill through the shaft. Drive the spring-type straight pin (19) into the hole.

Step E: Replace the gasket (14).

Step F: Assemble the bellow housing (25) with plug (5) together with the body (1) and fix it by screwing the hexagon nuts (17) crosswise.The spindle can only be completely replaced together with the bellow.

3.5 Changing the seat ring

The seat ring is screwed into the valve body. The seat ring can be obtained after removing the bonnet and can then be refinished or replaced as required.

Step A: Clean and lubricate the thread and conical sealing surface before insertion.

Pneumatic actuator, type dp

1 General

The pneumatic linear actuator is designed to be mounted directly on a control valve. The pneumatic actuator converts positioning command signals into stem thrust forces. The required back setting force is produced by the spring arrangement inside the actuator. The rolling-diaphragm produces linear spindle movements over the complete stroke.

The preferred mounting position is with the actuator and valve spindle in vertical position.

The mode of operation for the actuator depends on how the springs are inserted when the actuator is assembled. Even when the actuator is fitted in a piping system, the mode of operation can be changed.

The pneumatic actuator can be operated as:

- Spring opens valve/air closes valve operation mode
- Air opens valve/spring closes valve operation mode

Illustration of a pneumatic actuator

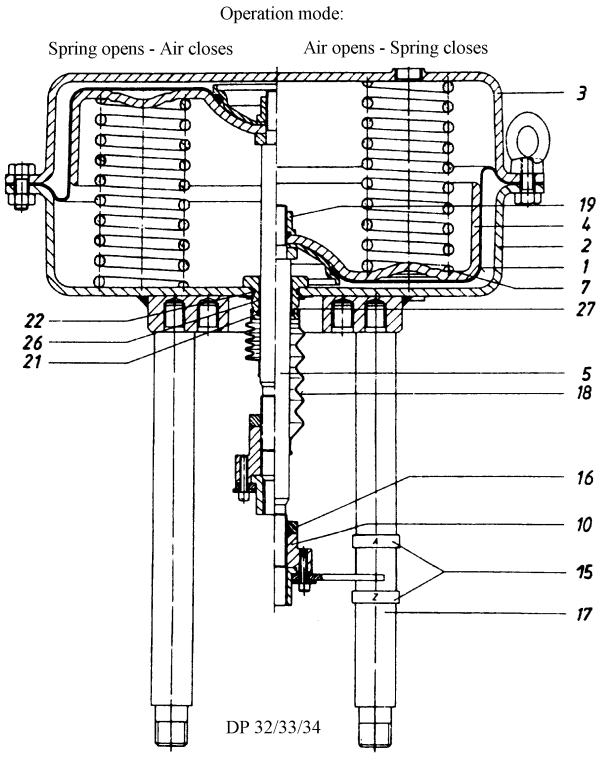


Figure 1 **om5520_01_dpactux0053610en.wmf**

Table 2 below shows a list of the position numbers in Figure 3 and Figure 3.

Table of position numbers in Figure 3			
Part	**Denomination**	**Part**	**Denomination**
1	Rolling diaphragm	15	Stroke indicator
2	Diaphragm housing	16	Hexagon nut
3	Diaphragm lid	17	Mounting rod
4	Diaphragm plate	18	Bellow
5	Spindle	19	Collar nut
7	Spring	21	O-ring (spindle)
10	Coupling flange	22	O-ring (bushing)
11	Guide flange	26	Slotted guide bearing
12	Rotation guard	27	Spindle guide
13	Socket screw	30	Hexagon nut
14	Threaded bushing	31	Hexagon nut

Table 1

1.1 Pneumatic connection

The air supply should be dry and at a low service temperature. A heat-guard should be installed to prevent high service temperature.

The pneumatic supply tube must be connected to the diaphragm housing (2) by operation mode “spring closes" and to the diaphragm lid (3) by operation mode “spring opens”.

By air failure the stem automatically returns into the original position caused by the inserted springs.

Warning: The actuator diaphragm may only be pressure loaded on the side opposite of the springs. The vent hole in the other connection must remain open.

1.2 Assembly of the actuator on the valve

The assembling of the actuator on the valve is shown in Figure 3. For both “spring closes” and “spring opens” operation modes the following assembling procedure should be followed:

Step A: If the actuator and the valve are separated, press the plug and spindle unit (5) into the closed position for operation mode “spring closes” or into the open position for operation mode “spring opens”.

Warning: Make sure that the plug does not turn while pressing on the seat during assembly.

Step B: Loosen the socket screws (13), remove the rotation guard (12) and the guide flange (11). The threaded bushing (14) is now free.

Step C: Turn the locking hexagon nut (30) onto the valve spindle. Place the rotation guard (12) and the guide flange (11) over the valve spindle and then turn the threaded bushing (14) onto the valve spindle.

Step D: Check the actuator for proper operation mode and connect the pneumatic supply to the connection piece in the diaphragm housing (2) for operation mode “spring closes” or in the diaphragm lid (3) for operation mode “spring opens”.

Step E: Drive the actuator into approximately mid-stroke position over the air supply and mount it onto the valve (read the value from the pressure gauge - middle of the spring range).

Step F: Tighten the hexagon nuts (31).

Assembly of the actuator on the valve

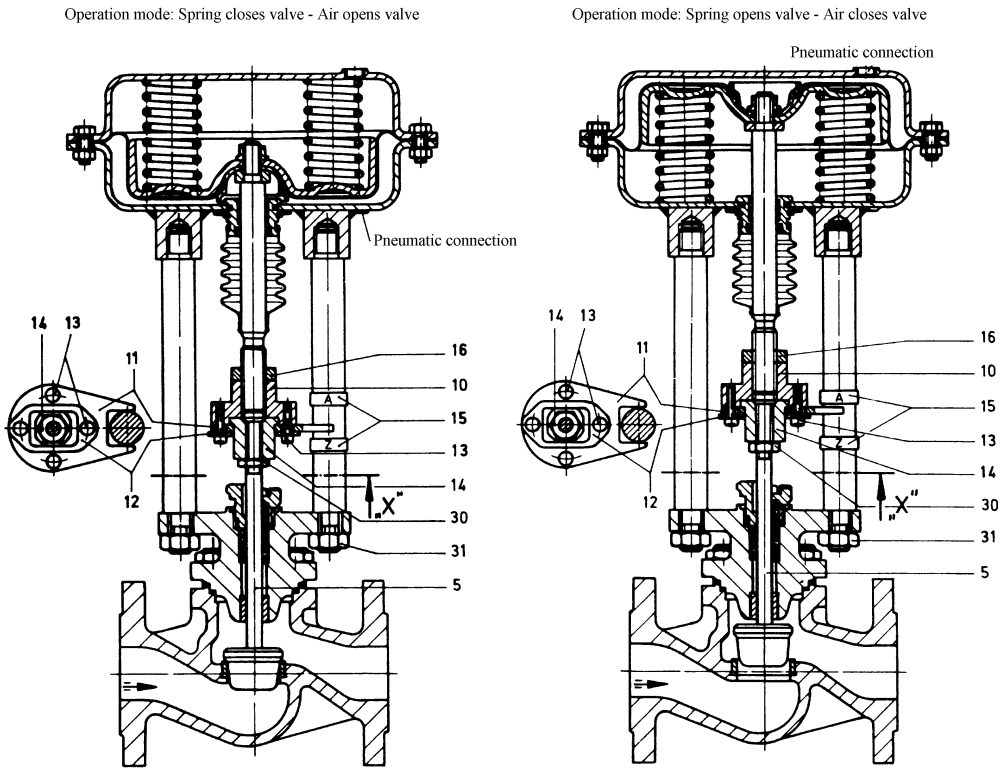


Figure 2 **om5520_01_dpactsx0053600en.wmf**

1.3 Adjustment of the starting pressure signal

Step A: Drive the actuator to the required spring-starting point over the air supply.

Step B: Turn the threaded bushing (14) up against the coupling flange (l0) so that the collar enters into the flange and presses against it. Make sure that the plug is lying on the valve seat.

Attention: Note that sufficient thread of the valve spindle is inside the threaded bushing (14). If not, turn the coupling flange (10) downwards from the actuator spindle and pull the threaded bushing (14) against it.

Step C: For operation mode: “spring closes”:
- Attach the guide flange (11) and the rotation guard (12) with the socket screws (13) to the coupling flange (10).
- Check that the plug lifts off the seat at the required spring starting point.

Step D: For operation mode: “spring opens”:
- Check that the plug leaves the end position at the required spring starting point, and finishes the valve stroke at the spring-range end value.
- The plug must then also press on the valve seat.

Step E: After the test operation set the stroke indicators (15) into the end positions.

Step F: Lock the hexagon nuts (16 + 30) at the valve mid-stroke.

Step G: Do not turn the plug on the seat when it is under force.

2 Reversal of the actuator action

The actuator action can be reversed even when the valve is installed in a piping system. The position numbers mentioned in this section refer to Figure 3 and Figure 3.

Step A: Drive the actuator into approximately mid-stroke position with the air supply.

Step B: Loosen and remove the socket screws (13) from the coupling flange (10) and drop the rotation guard (12) over the valve spindle.

Step C: Remove the hexagon nuts (31) from the actuator and lift off the valve.

Step D: Reduce the air supply until the chamber is pressure free.

Step E: Loosen and remove the diaphragm lid screws.

Step F: Remove the diaphragm lid (3).

Warning: The actuators DP 32 and DP 33 have two longer screws when fitted with stronger spring ranges. The actuator DP 34 has four. These screws should be the last screws to be loosened, and must be loosened evenly to reduce the high spring tension.

Step G: For reversal from “spring closes” into “spring opens”:

- Remove the springs (7) and the diaphragm plate (4) with the diaphragm (1) and the spindle (5).
- Loosen and remove the seal lock nut (19) and remove the spindle (5). Turn over the diaphragm plate (4) with the diaphragm (1) and the diaphragm clamping flange, and place it over the spindle (5).
- Tighten with the seal lock nut (19). Make sure that the spindle surface is not damaged.
- Grease the spindle surface and the 0-ring.
- Place the diaphragm plate (4) with the diaphragm (1) into the diaphragm lid (3).
- Arrange the springs (7) onto the moulds pressed into the diaphragm plate (4).
- Place the diaphragm housing with the spindle sealing unit over the spindle, and screw it together. Make sure that the springs stay properly arranged.
- Turn the hexagon nut (16) and the coupling flange (10) onto the spindle (5).
- Mount the actuator as described previously, and connect the air supply tube to the diaphragm lid (3).

Step H: For reversal from “spring opens” into “spring closes”:

- Remove the diaphragm (1) and the diaphragm plate (4) with the spindle (5) and the springs (7).
- Loosen and remove the seal lock nut (19) from the spindle (5). Turn over the diaphragm plate (4) with the diaphragm (1) and the diaphragm clamping flange, and place it on the spindle (5).
- Tighten with the seal lock nut (19). Make sure that the spindle surface is not damaged.
- Grease the spindle surface and the 0-ring.
- Stick the diaphragm plate (4) with the diaphragm (1) and the spindle (5) into the diaphragm housing (2).
- Arrange the springs (7) onto the moulds pressed into the diaphragm plate (4).Place the diaphragm lid (3) on the top, and screw it together. Make sure that the springs (7) stay properly arranged.
- Turn the hexagon nut (16) and the coupling flange (10) onto the spindle (5).
- Mount the actuator as described previously, and connect the air supply tube to the diaphragm housing (2).

3 Manual operation device

Some actuators are fitted with a manual operation device. The device is connected to the actuator by means of a new diaphragm lid, a spindle extension with a USIT-ring and a spindle sealing unit.

The manual operation device is equipped with stroke indicators. The stroke indicators of both the actuator and the manual operation device must be in the same end positions when the actuator is pressure free.

The manual operation device must be set into neutral position when the actuator is running automatically.

The locking device of the manual operation device must be unlocked before operating.

The locking device prevents an unwanted disarrangement of the setting during operation, e.g. due to vibration, etc.

4 Maintenance

The pneumatic actuator is maintenance free. To maintain a disturbance free operation, the air should be supplied by an air-supply station.

The diaphragm, spindle sealing unit and springs are wear parts and should be replaced when necessary.

4.1 Exchange of spindle sealing

When the spindle sealing is changed, the slotted PTFE-guide bearing and the 0-ring should be replaced. The spindle surface must be clean and undamaged. Before the actuator is assembled, the spindle unit and the spindle must be greased.

Positioner, SIPART PS2 6DR5000

1 General

The following instruction is a general description of SIPART positioners and covers the complete range in the PS2 6DR5000 series.

The electronic pneumatic positioner is used as the final control element of a pneumatic linear actuator or a part-turn actuator (rotary movements). The positioner converts a current output signal (4 to 20 mA) from a process controller or control system to a set point value and into a corresponding movement. The positioner changes the pressure in a pneumatic actuator chamber or cylinder until the position corresponds to the set point value.

The positioner can be set up either as a single-action positioner or a double-action positioner. The single-action positioner is mainly used together with a control valve. The opposite movement for the control valve is supplied by means of springs. The double-action positioner is mainly used to control an air damper via a pneumatic cylinder (actuator). All movements of the pneumatic cylinder are supplied by the positioner. An illustration of the function diagram for the positioner is shown in Figure 8. The function diagram is shown with option modules.

1.1 Mode of operation

Comparison of the set point and the actual value takes place electronically in a micro controller. If the micro controller detects a deviation, it uses a 5-way switch procedure to control the piezoelectric valves, which in turn regulate the flow of air into the actuating chambers. When connected in a two-wire system, the SIPART PS2 draws its power exclusively from the 4 to 20 mA set point signal.

The piezoelectric valve converts the command into a pneumatic positional increment. The positioner outputs a continuous signal in the area where there is a large control deviation (high-speed zone). In areas of moderate control deviation (slow-speed zone) it outputs a sequence of pulses. No positioning signals are output in the case of a small control deviation (adaptive or variable dead zone).

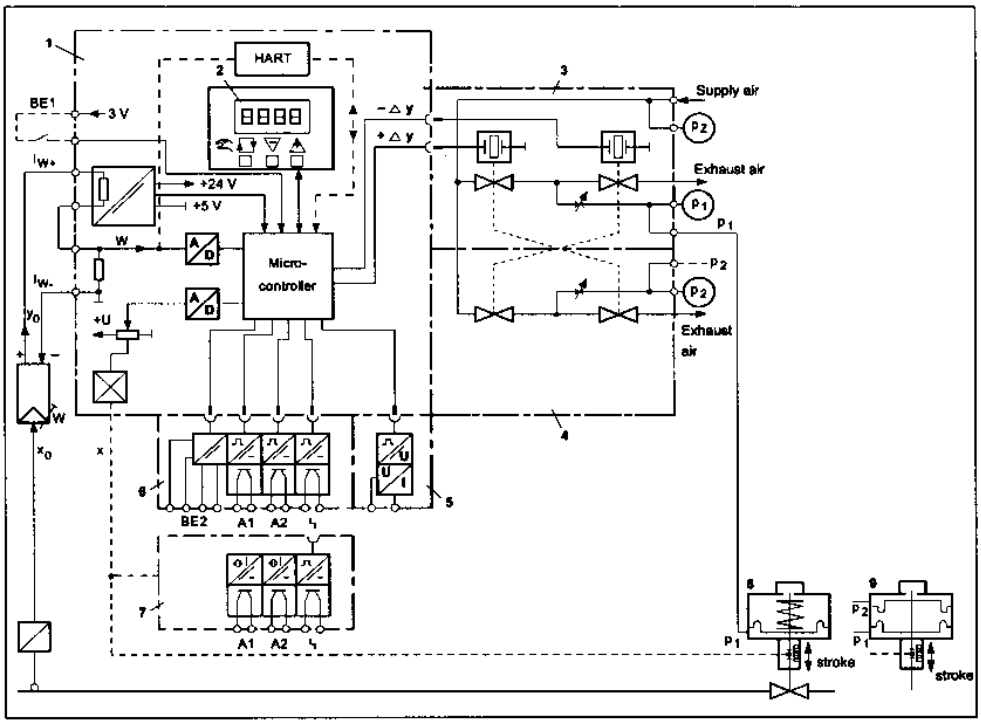
Commissioning (initialisation) is carried out automatically to a large extend. During initialisation, the micro controller automatically determines the zero, full-scale value, direction of action, and positioning speed of the actuator. It uses these to determine the minimum pulse time and dead zone, thus optimising the control.

The positioner can also be operated manually by the pushbuttons and the LCD of the SIPART PS2.

The installation of the positioner must be carried out in the following order:

- Mechanic connection
- Electric connection
- Pneumatic connection
- Commissioning

Illustration of a function diagram



1 Motherboard with microcontroller and input circuit
2 Control panel with LC-display and momentary action switch
3 Piezo-valve unit, always built-in
4 Valve unit with double action positioner always built-in
5 Iy-module for positioner SIPART PS2
6 Alarm module for three alarm outputs and one digital input
7 SIA-module (Slot Initiator-Alarm-module)
8 Spring-loaded pneumatic actuator (single action)
9 Spring-loaded pneumatic actuator (double action)

Figure 1 **om5510_05_sips2_x0053470en.wmf**

2 Mechanic connection of the positioner

Normally the positioner is pre-mounted on the actuator or cylinder. If not, follow the installation guide lines below.

2.1 Mechanic connection to an actuator

Figure 8 shows the mechanic connection of the positioner to an actuator for a control valve.

Step A: Mount clamping assembly (3) with hexagon socket cap screws (17) and lock washers (16) on the actuator spindle.

Step B: Insert the pick-up bracket (2) into the recesses of the clamping assembly. Set the necessary length and tighten the screws so that the pick-up bracket can still be shifted.

Step C: Push the roll (5), spring (13), and guide washer (22) onto the pin (4).

Step D: Insert the pin in the lever (6) and assemble with nut (18), spring washer (14), and U-washer (12).

Step E: The value of the stroke range specified on the actuator should be set or if this does not exist as a scaling value, the next greatest scaling value should be set. The centre of the pin must be in line with the scaling value. The same value can be set later under parameter "3.YWAY" in commissioning to display the way in [mm] after initialisation.

Step F: Assemble the hexagon socket cap screw (17), spring washer (16), washer (12), and square nut (19) on the lever.

Step G: Push the pre-mounted lever onto the positioner axis up to the stop and fix with the hexagon socket cap screw (17).

Step H: Fit the mounting bracket (1) with two hexagon head screws (9), lock washer (10), and flat washer (11) on the rear of the positioner.

Step I: Selection of the row of holes depends on the width of the actuator yoke. The roll (5) should engage in the pick-up bracket (2) as close as possible to the spindle but may not touch the clamping assembly.

Step J: Hold the positioner with the mounting bracket on the actuator so that the pin (4) is guided within the pick-up bracket (2).

Step K: Tighten the pick-up bracket.

Step L: Position the mounting parts according to the type of actuator.
- Actuator with ledge: hexagon head screw (8), flat washer (11), and lock washer (10).
- Actuator with plane surface: four hexagon head screws (8), flat washer (11), and lock washer (10).
- Actuator with columns: two U-bolts (7), four hexagon nuts (21) with flat washer (11), and lock washer (10).

Step M: Secure the positioner onto the yoke using the previously positioned mounting parts.

Note: Set the height of the positioner so that the horizontal lever position is reached as close to the stroke centre as possible. The lever scale can be used as orientation. It must be guaranteed that the horizontal lever position is passed through within the stroke range.

Mechanic connection of the positioner (linear actuator)

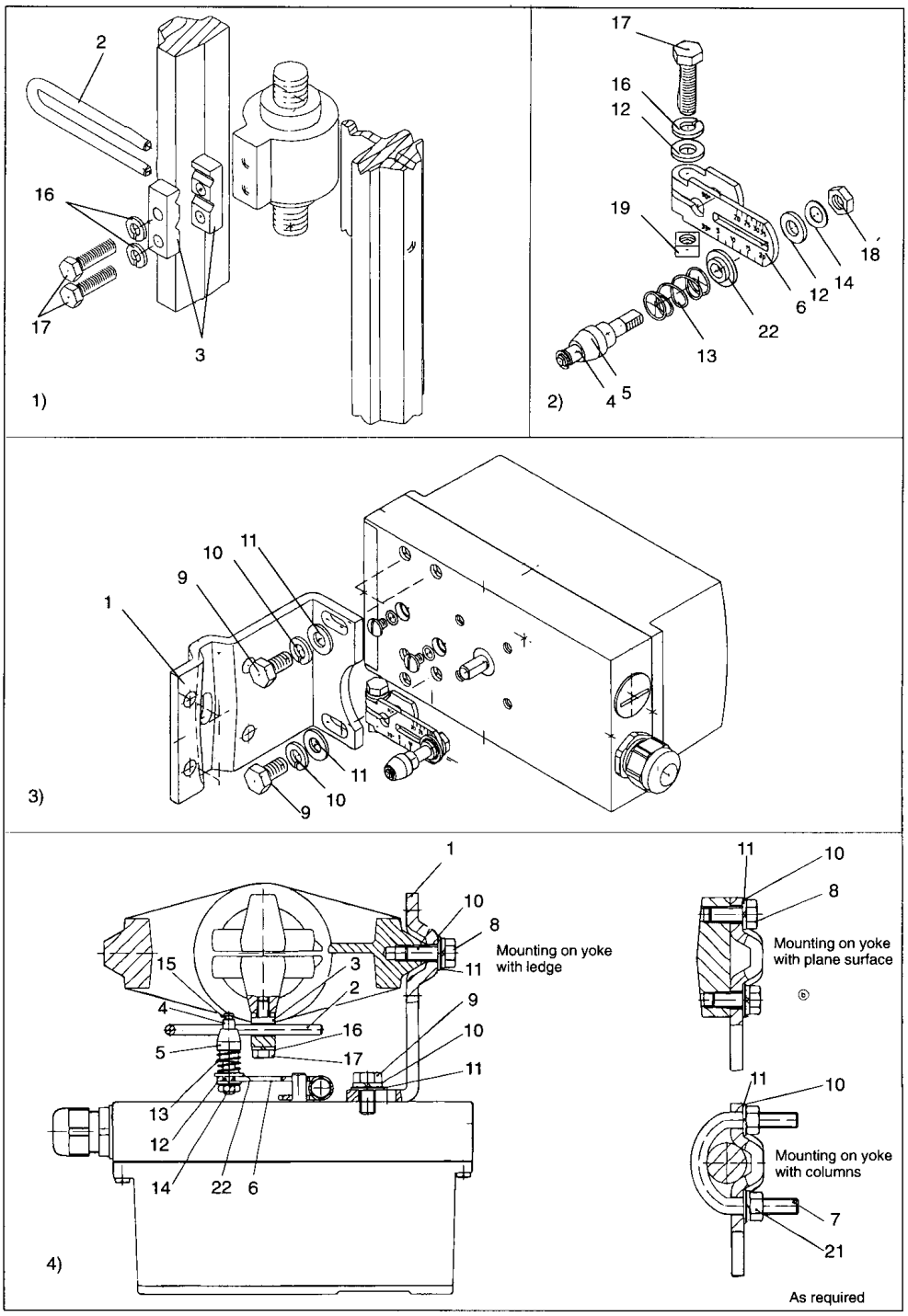


Figure 2 **om5510_05_sips2_x0053480en.wmf**

2.2 Mechanic connection to a pneumatic cylinder

The positioner is connected to a pneumatic cylinder by means of fixing bracket, lever arm with Allen screw, extension arm, and roller.

The pneumatic piston is connected to a guide rail with an oblique angle via a linkage. The guide rail moves together with the piston, and the roller/lever connection senses the position of the piston. By operating both sides of the pneumatic cylinder, the set point is reached. A spring inserted between the fixing bracket and the lever arm secures that the roller is pressed down against the guide rail.

2.3 Mechanic connection to a rotary actuator

Figure 8 shows the mechanic connection of the positioner to a rotary actuator.

Step A: Attach the mounting console (9, actuator specific) onto the rear of the positioner and secure using the hexagon head screws (14) and lock washers (15).

Step B: Adhere pointer (4.2) onto the mounting console in the centre of the centring hole.

Step C: Push coupling wheel (2) onto the positioner axis, pull back by about 1 mm and tighten the hexagon socket head screw (18) with the Allen key provided.

Step D: Place the carrier (3) onto the end of the actuator and secure using Fillister head screw (16) and washer (17).

Step E: Carefully place the positioner with mounting console onto the actuator such that the pin of the coupling wheel engages in the driver.

Step F: Align the positioner/mounting console assembly in the centre of the actuator and screw tight (screws are not included in the delivery, they are part of the actuator mounting console).

Step G: Follow the start-up sequence as described later. Drive the actuator to the end position and adhere the scale (4.1) onto the coupling wheel (2) according to the direction of rotation and rotaryactuator. The scale is self-adhesive.

Mechanic connection of the positioner (rotary actuator)

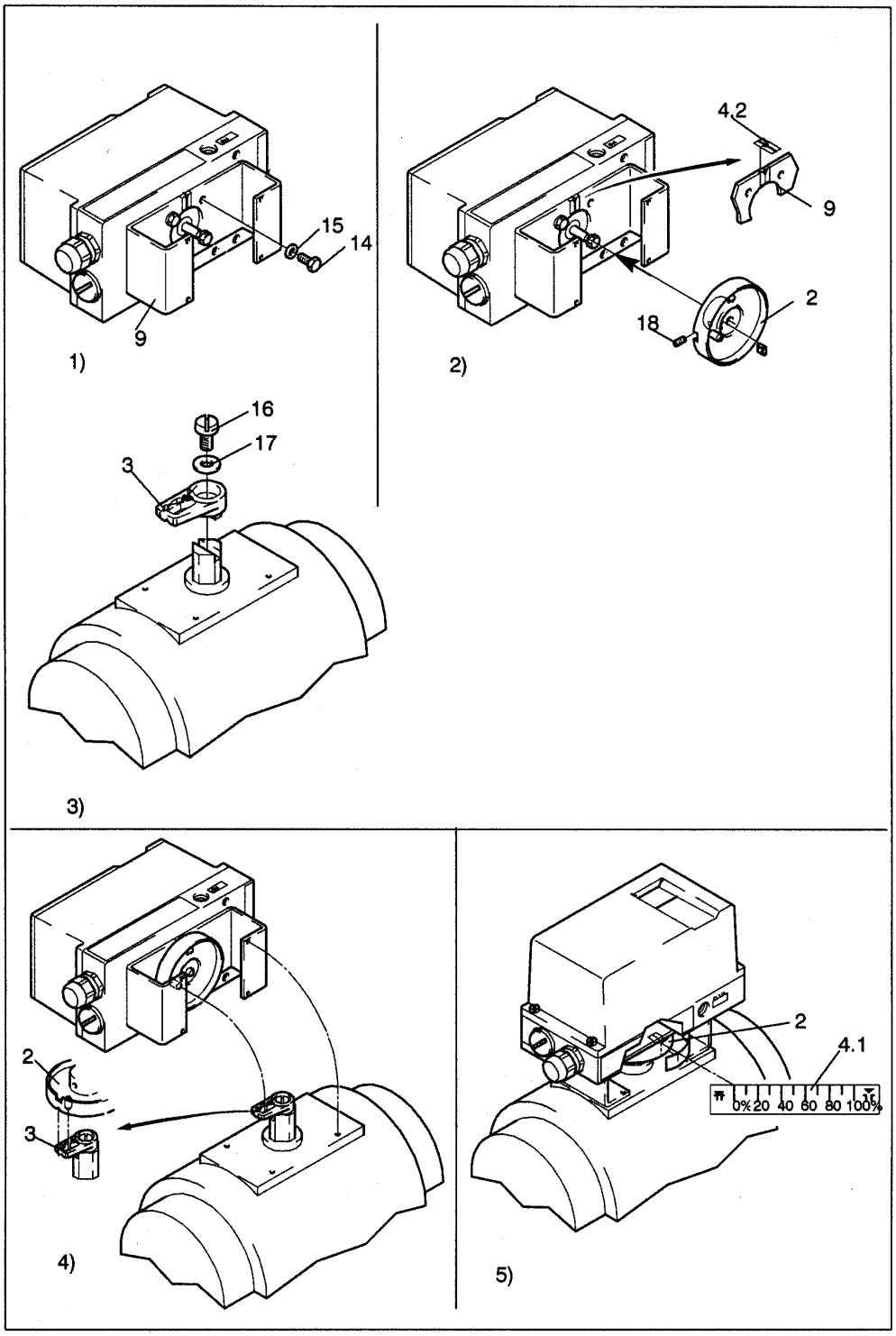
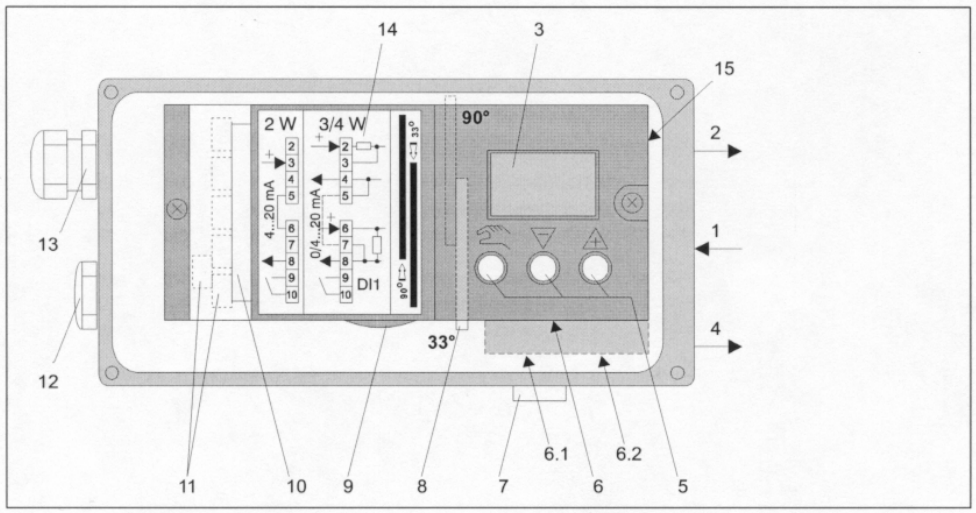


Figure 3 **om5510_05_sips2_x0053490en.wmf**

3 Electric connection of the positioner

When the positioner is connected in a two-wire system, the positioner draws its power exclusively from the 4 to 20 mA set point signal. Figure 8 indicates the input circuits for the positioner.

View of the controls and connections



1	Input: Supply air	7	Silencer
2	Output: Actuating pressure Y1	8	Transmission ratio selector
3	Display	9	Adjusting wheel slip clutch
4	Output: Actuating pressure Y2 *)	10	Terminals options modules
5	Operating keys	12	Dummy plug
6	Restrictor	13	Screw-type cable gland
6.1	Restrictor Y1	14	Terminal plate on cover
6.2	Restrictor Y2 *)	15	Purging air switch

Figure 4 **om5510_05_sips2_x0053500en.wmf**

4 Pneumatic connection

Ensure that the air quality is suitable. Grease-free instrumental air with a solid content <30 µm and a pressure dew point 20 K below the lowest ambient temperature must be supplied.

Warning: For reasons of safety, pneumatic power may only be supplied after assembly when the positioner is switched to operating level "P manual" operation with electrical signal applied.

4.1 Selection of P manual mode

4.1.1 Selection of P manual mode

Before pneumatic power is connected, the positioner must be in P manual mode. The display must show “NOINIT” in the bottom line.

4.1.2 Pneumatic connections

Figure 8 shows a view of the positioner controls and connections.

Step A: If required, connect a manometer block for supply air and actuating pressure.
Step B: The silencer in the exhaust output can be removed if necessary.
Step C: Connect actuating pressure Y1 and/or Y2 (Y2*) is only used with double-acting actuators) according to the desired safety position.
Step D: Connect the supply air (1). The pressure should be between 1.4 to 7 bar.

Note: In order for spring-loaded pneumatic actuators to be able to reliably exploit the maximum possible actuating path, the supply pressure must be sufficiently greater than the maximum required final pressure of the actuator.

4.1.3 Safety positionwhen the electric power supply fails

For a single-action actuator is Y1 deaerated. For a double-action actuator is Y1 equal to the supply air pressure and Y2 is deaerated.

4.1.4 Restrictors

To increase the positioning times for fast actuators when necessary, the air flow can be reduced with the restrictors Y1 and Y2 (only for double-action valves). Turning the restrictors in the clockwise direction reduces the air flow until it is shut off. To set the restrictors it is recommended to first close them and then open them again slowly (see initialisation process RUN 3).

4.1.5 Purging air switchover

The purging air changeover switch located above the pneumatic terminal block on the valve manifold can be accessed when the housing is open. When the switch is in position “IN” the interior of the housing is purged with very small quantities of clean and dry instrument air. In position “OUT” the purging air is led directly out of the instrument.

5 Commissioning

Commissioning (initialisation) is carried out automatically to a large extend. During initialisation, the micro controller automatically determines the zero value, full-scale value, direction of action and positioning speed of the actuator. It uses these to determine the minimum pulse time and dead zone, hereby optimising the control.

The positioner can also be operated manually by the pushbuttons and the LCD of the SIPART PS2.

The commissioning of the positioner can be divided into the following steps:

- Preparation for initialisation
- Start the automatic initialisation procedure
- Set additional parameters if required
- Select automatic mode

Figure 8 shows the possible operation modes for the positioner and gives an overview of how to change between them. The levels are P-manual mode, configuration and initialisation, manual mode, automatic mode, and diagnostic display. From these modes it is possible to select operation mode, set operation parameters, restore to factory setting, run an automatic initialisation, etc.

Operation levels

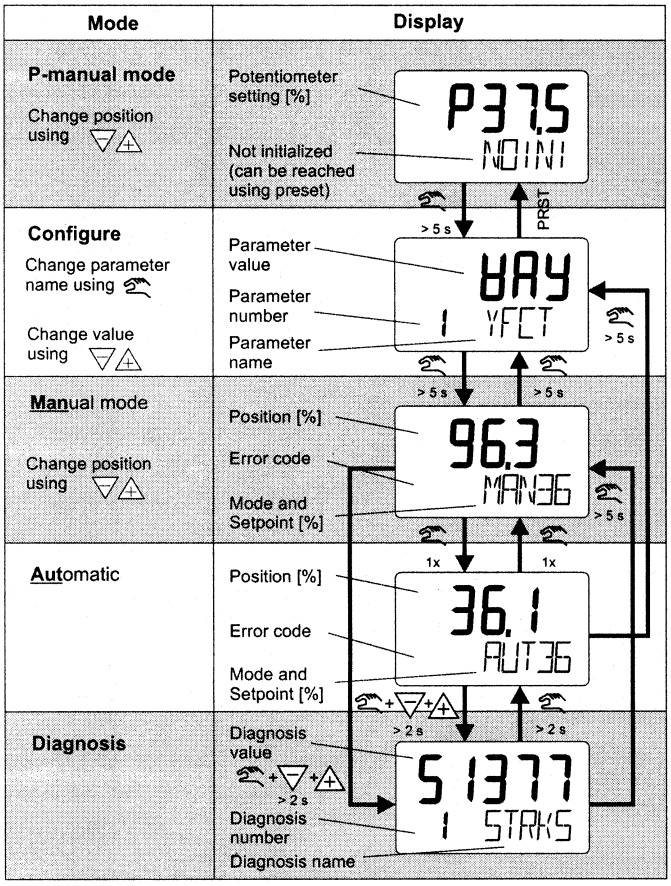


Figure 5 **om5510_05_sips2_x0053510en.wmf**

5.1 Preparation for initialisation

Step A: Check and set the gear transmission switch to the correct position. Figure 8(position 8) indicates the location of the switch. For linear actuators the gear transmission switch is set according to the stroke range as described in Table 4 for the parameter "3.YWAY". For part-turn actuators 90° must be selected.

Step B: Check that the pneumatic supply power (inlet air) is present. The operating pressure should be at least one bar greater than is necessary for closing/ opening the valve during initialisation.

Step C: Without initialisation the positioner is in "P manual mode" and "NOINIT" flashes in the display. This level can also be reached by using "55.PRST"function (see Table 4).

Step D: Check the free running of the mechanics in the whole actuating range by moving the actuator with the keys "↑" and "↓" and driving to the respective end position.

Step E: With linear actuators drive the actuator to horizontal lever position. The display must indicate 48% to 52%. If necessary, correct the value by adjusting the sliding clutch. After the check is completed, the actuator must be approximately half way along its stroke. This is due to establishment of the action direction during automatic initialisation.

5.2 Automatic initialisation

Figure 8 shows the configuration modeincluding the operation in this mode and Table 4 shows the parameter/configuration list. Figure 8 shows the initialisation process of the positioner. The initialisation process is stored in the microprocessor. This means that an additional initialisation only is necessary if any parts of the unit have been changed.

Note: The numerical values used in Figure 8, Figure 8, and Figure 8 are examples.

Step A: Call the configuration mode by pressing the hand symbol key for longer than 5 seconds.

Step B: Set the actuator type, linear or part-turn, in the menuitem line "1.YFCT".

Step C: Switch to the second parameter by pressing the hand symbol key briefly.

Step D: Set the rated angle of rotation for feedback in the menu item line "2.YAGL". It is vital that this value corresponds to the setting of the gear transmission ratio selector (Figure 8, position 8), 33° or 90°.

Step E: Switch to the next parameter by pressing the hand symbol key briefly.

Step F: This parameter ("3.YWAY") is only set for linear actuators and if the total stroke in mm should be displayed at the end of the initialisation phase. To do this, select the same value in the display to which the carrier pin to the scale on the lever is set to.

Step G: Switch to the following parameter by pressing the hand symbol key briefly.

Step H: Start the initialisation ("4.INITA") by pressing the "↑" key for longer than 5 seconds.

Step I: During the initialisation phase "RUN1" to "RUN5" appear one after another in the bottom of the display. Please note that the initialisation process may last up to 15 minutes depending on the actuator.

Note: The ongoing initialisation can be aborted at any time by pressing the hand symbol key. The previous settings are retained. All the parameters are reset to the factory setting only after performing a preset "55.PRST".

Step J: If problems occur, carry out the measures as described in the table "Possible messages" shown in Figure 8.

Step K: The initialisation is completed when "FINSH" appears in the bottom of the display.

Step L: When pressing the hand symbol key briefly the menu item line "4.INITA" is displayed.

Step M: To exit the configuration operating mode, press the hand symbol key for longer than 5 seconds. The software version is displayed after about 5 seconds. The instrument is in manual operationafter releasing the key.

Step N: The positioner can be changed to automatic mode by pressing the "↓"key once as indicated in Figure 8.

Step O: The automatic mode is the normal mode. In this mode the positioner compares the set point current with the current position and moves the actuator until the control deviation reaches the dead zone.

Operation in the configuration mode

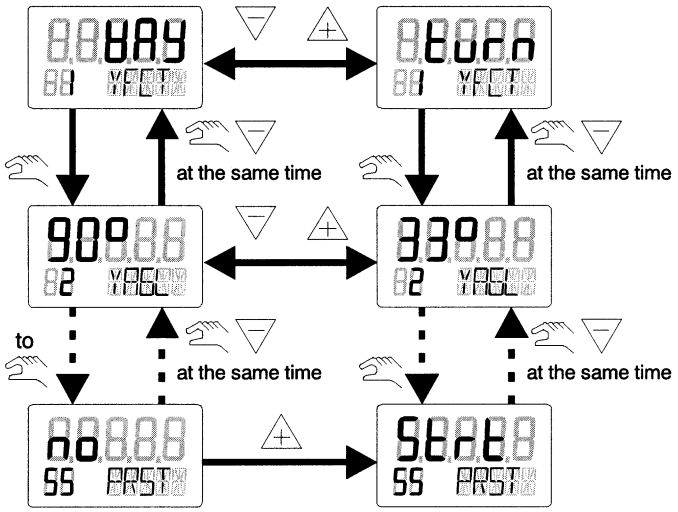


Figure 6 **om5510_05_sips2_x0053520en.wmf**

Initialisation process

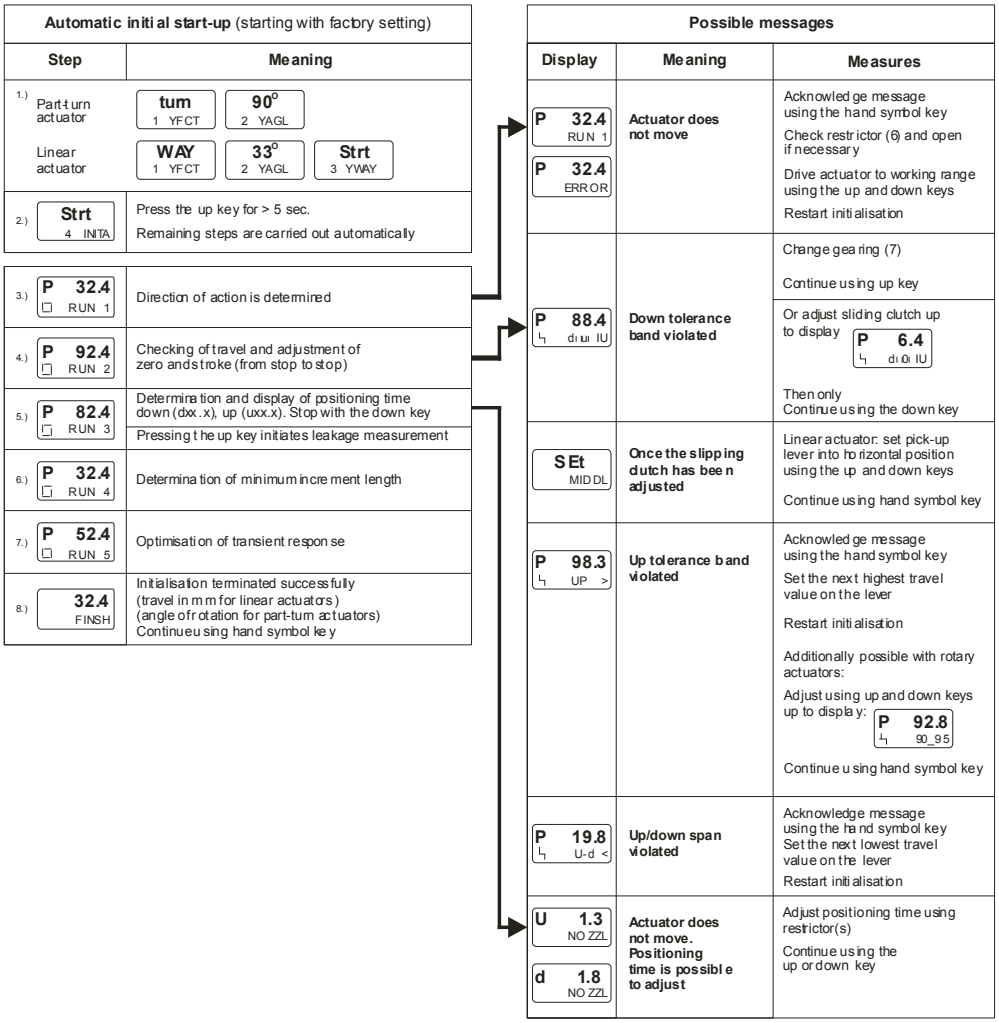


Figure 7 **om5510_05_sips2_x0053530en.wmf**

5.3 Parameters

Table 4 shows the parameter list for the positioner. The parameter name is written in plain text in the “menu line” column. The function of the parameter is described briefly in the “Function column”. In addition, the possible parameter values, the physical unit and the factory setting of the parameters are shown.

After the initialisation process, the positioner can be configured to meet the requirements of a specified task. The factory settings correspond to the requirements for a typical application. This means that normally only a few parameters will need to be changed.

The positioner can be installed and configured to fit linear and part-turn actuators with reverse action. E.g. linear actuators with the set point in the falling direction or part-

turn actuators for counter clockwise operation direction. In this case the parameters “7.SDIR” and 38.”YDIR” should be set to “FALL”.

Parameter list

Menu line	Function	Parameter values	Unit	Factory setting	Customer setting
1.YFCT	Type of actuator	turn (part-turn actuator) WAY (linear actuator) LWAY (linear actuator without sine correction) ncSt (part-turn actuator with NCS) -ncSt (part-turn actuator with NCS, inverted)		WAY	
2.YAGL[1)]	Rated angle of rotation for feedback (must correspond to gear ratio)	90° 33°	Degrees	33°	
3.YWAY[2)]	Stroke range (optional setting) When used, the value must correspond with the set of the leverage ratio on the actuator Driver pin must be set to the value of the actuator travel or, if this value is not scaled, to the next lager scale value	OFF 5 , 10 , 15 , 20 (short lever 33°) 25 , 30 , 35 (short lever 90°) 40 , 50 , 60 , 70 , 90 , 110 , 130 (long lever 90°)	mm	OFF	
4.INITA	Initialisation (automatically)	noini / no / ###.# / Strt		no	
5.INITM	Initialisation (manually)	noini / ###.# / Strt		no	
6.SCUR	Current range of set point 0 to 20 mA 4 to 20 mA	0 MA 4 MA		4 MA	
7.SDIR	Set point direction rising falling	riSE FALL		riSE	
8.SPRA	Set point for start of split range	0.0 to 100.0	%	0.0	
9.SPRE	Set point for end of split range	0.0 to 100.0	%	0.0	
10.TSUP	Set point ramp up	Auto 0 to 400	s	0	
11.TSDO	Set point ramp down	0 to 400	s	0	
12.SFCT	Set point function Linear Equal-percentage 1:25, 1:33, 1:50 Inverse equal-percentage 1:25, 1:33, 1:50 Freely adjustable	Lin 1–25 , 1–33 , 1–50 n1–25 , n1–33 , n1–50 FrEE		Lin	
13.SL0[3)] 14.SL1 to 32.SL19 33.SL20	Set point turning point at 0% 5% to 95% 100%	0.0 to 100.0	%	0.0 5.0 to 95.0 100.0	
34.DEBA	Dead zone of controller	Auto 0.1 to 10.0	%	Auto	
35.YA	Start of manipulated variable limiting	0.0 to 100.0	%	0.0	

Parameter list						
36.YE	End of manipulated variable limiting		0.0 to 100.0	%	100.0	
37.YNRM	Standardisation of manipulated variable	To mech. travel To flow	MPOS FLOW		MPOS	
38.YDIR	Direction of manipulated variable for display	Rising Falling	riSE FALL		riSE	
39.YCLS	Tight closing with manipulated variable	Without Top only Bottom only Top and bottom	no uP do uPdo		no	

Table 1

Parameter list continued					
Menu line	**Function**	**Parameter values**	**Unit**	**Factory setting**	**Customer setting**
40.YCDO	Value for tight closing, bottom	0.0 to 100.0	%	0.5	
41.YCUP	Value for tight closing, top	0.0 to 100.0	%	99.5	
42.BIN1[4)]	Function of BI 1: None Only message (NO/NC contact) Block configuring (NO contact) Block configuring and manual (NO contact) Drive valve to pos. up (NO/NC contact) Drive valve to pos. down (NO/NC contact) Block movement (NO/NC contact)	OFF on / -on bLoc1 bLoc2 uP / -uP doWn / -doWn StoP / - StoP		OFF	
43.BIN2[4)]	Function of BI 2: None Only message (NO/NC contact) Drive valve to pos. up (NO/NC contact) Drive valve to pos. down (NO/NC contact) Block movement (NO/NC contact)	OFF on / -on uP / -uP doWn / -doWn StoP / -StoP		OFF	
44.AFCT[5)]	Alarm function: Without A1=min. A2=max. A1=min. A2=min. A1=max. A2=max.	oFF N , NA N , N NA , NA		OFF	
45.A1	Response threshold of alarm 1	0.0 to 100.0	%	10.0	
46.A2	Response threshold of alarm 2	0.0 to 100.0	%	90.0	
47. ↳ FCT [6)]	Function of alarm output On fault Fault + not automatic Fault + not automatic + BI (“+” means logical OR operation)	↳ ↳ nA ↳ nAb		↳	
48. ↳ TIM	Monitoring time for fault message “control deviation”	Auto 0 to 100	s	Auto	
49. ↳ LIM	Response threshold for fault message “control deviation”	Auto 0.0 to 100.0	%	Auto	
50. ↳ STRK	Limit for stroke integral	OFF 1 to 1.00E9		OFF	
51. ↳ DCHG	Limit for direction change	OFF 1 to 1.00E9		OFF	
52. ↳ ZERO	Limit for end stop monitoring, bottom	OFF 0.0 to 100.0	%	OFF	
53. ↳ OPEN	Limit for end stop monitoring, top	OFF 0.0 to 100.0	%	OFF	
54. ↳ DE-BA	Limit for dead zone monitoring	OFF 0.0 to 100.0	%	OFF	

Parameter list continued					
55.PRST	Preset (factory setting) “no” nothing activated “Strt” start of factory setting after pressing key for 5 sec. “oCAY” display following successful factory setting CAUTION: preset results in “NO INIT”	no Strt oCAY			

[1] If turn is selected it is not possible to set 33°.
[2] Parameter does not appear if 1.YFCT = turn has been selected.
[3] Turning points only appear with selection 12.SFCT = FrEE.
[4] Alternatively “no” if initialisation has not yet been carried out.
[5] NC contact means; action with opened switch or low level. NO contact means; action with closed switch or high level.
[6] Normal means: high level without fault. Inverted means: low level without fault.

Table 2

6 Diagnosis

In the diagnostic mode the current operating data (such as number of strokes, number of changes in direction, number of fault messages, etc.) can be displayed.From the automatic or manual modes the diagnostic mode can be reached by simultaneously pressing all three keys for at least 2 seconds.

Table 4 shows an overview of the displayable values. The diagnostic display has a similar structure as the parameter menu displays. The respective next diagnostic value can be selected with the hand symbol key. Certain values can be set to zero by pressing the “↑” key for at least 5 seconds. These are menu item line “1, 2, 3, and 4”. Some diagnostic values may be greater than 99999. In this case the display switches to exponential display.

Diagnostic list				
No.:	**Abbreviation**	**Meaning**	**Displayable value**	**Unit**
1	STRKS	Number of strokes	0 to 4.29E9	-
2	CHDIR	Changes of direction	0 to 4.29E9	-
3	↳CNT	Fault counter	0 to 4.29E9	-
4	A1CNT	Alarm counter 1	0 to 4.29E9	-
5	A2CNT	Alarm counter 2	0 to 4.29E9	
6	HOURS	Operating hours	0 to 4.29E9	Hours
7	WAY	Determined actuating path	0 to 130	mm or °
8	TUP	Travel time up	0 to 1000	s
9	TDOWN	Travel time down	0 to 1000	s
10	LEAK	Leakage	0.0 to 100.0	%
11	P0	Potentiometer value below stop (0%)	0.0 to 100.0	%
12	P100	Potentiometer value bottom stop (100%)	0.0 to 100.0	%

Diagnostic list				
13	IMPUP	Impulse length up	2 to 100	ms
14	IMPDN	Impulse length down	2 to 100	ms
15	DBOP	Dead zone up	0.1 to 100.0	%
16	DBDN	Dead zone down	0.1 to 100.0	%
17	SSUP	Short step zone up	0.1 to 100.0	%
18	SSDN	Short step zone down	0.1 to 100.0	%
19	TEMP	Current temperature	-45 to 85	°C
20	TMIN	Minimum temperature	-45 to 85	°C
21	TMAX	Maximum temperature	-45 to 85	°C
22	T1	Number of operating hours in Temperature range 1	0 to 4.29E9	Hours
23	T2	Number of operating hours in Temperature range 2	0 to 4.29E9	Hours
24	T3	Number of operating hours in Temperature range 3	0 to 4.29E9	Hours
25	T4	Number of operating hours in Temperature range 4	0 to 4.29E9	Hours
26	T5	Number of operating hours in Temperature range 5	0 to 4.29E9	Hours
27	T6	Number of operating hours in Temperature range 6	0 to 4.29E9	Hours
28	T7	Number of operating hours in Temperature range 7	0 to 4.29E9	Hours
29	T8	Number of operating hours in Temperature range 8	0 to 4.29E9	Hours
30	T9	Number of operating hours in Temperature range 9	0 to 4.29E9	Hours
31	VENT1	Number of cycles pre-control valve 1	0 to 4.29E9	-
32	VENT2	Number of cycles pre-control valve 2	0 to 4.29E9	-
33	STORE	Store current values as “last maintenance” Press the up key for at least 5 seconds (store)	-	-

Table 3

7 Service and maintenance

The positioner is largely maintenance-free. The positioner is fitted with filters in the pneumatic connection as protection against coarse particles of dirt. If the pneumatic energy supply contains particles of dirt, the filters may be clog and impair the function of the positioner. In this case the filters can be cleaned as follows:

Step A: Switch off the pneumatic power supply and remove the pipes.

Step B: Unscrew the cover.

Step C: Remove the three screws from the pneumatic connector strip.

Step D: Remove the filters and O-rings behind the connector strip.

Step E: Clean the filters (e.g. with compressed air).

Step F: After cleaning first insert the filters in the recesses in the housing and then place the O-rings on the filters.

Step G: Align the pneumatic connector strip on the two lugs and screw tight with the three self-tapping screws.

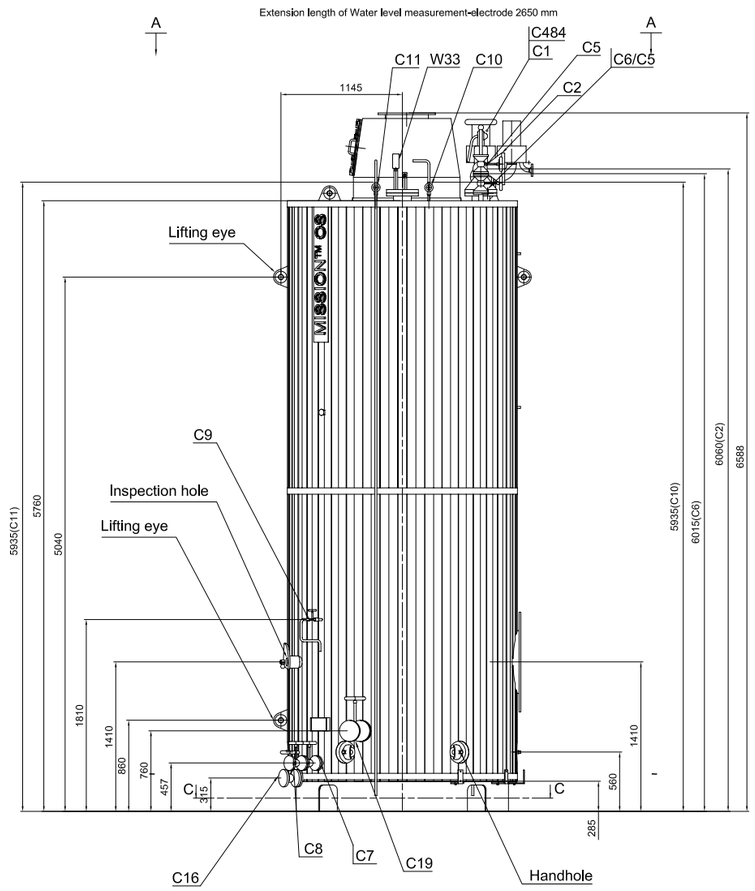
Note: Make sure that the same thread is used. To do this, turn the screws anti-clockwise until they snap into the thread audibly. Only then should the screws be tightened.

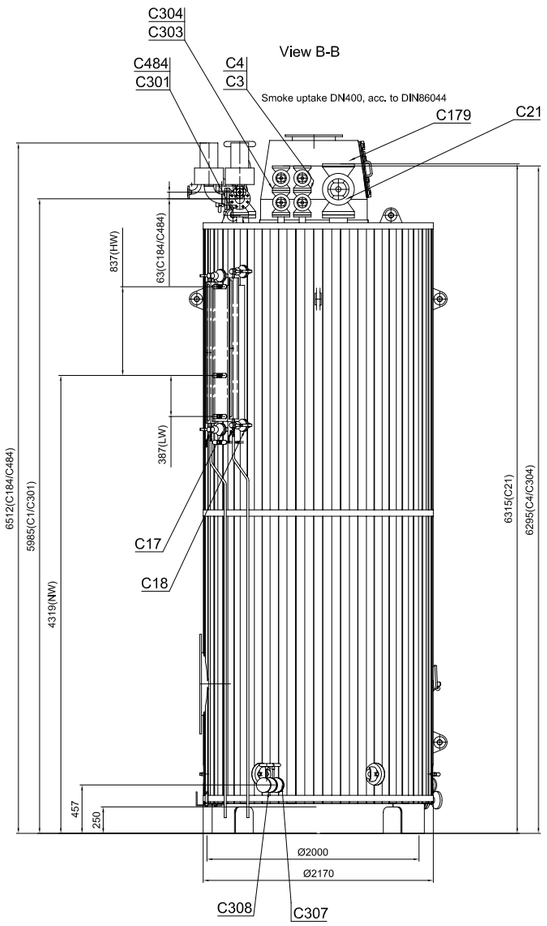
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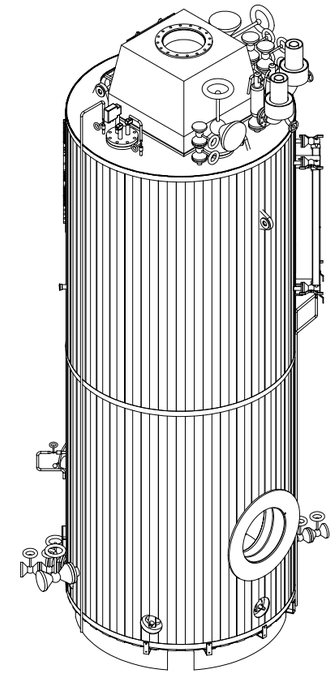
Drawings

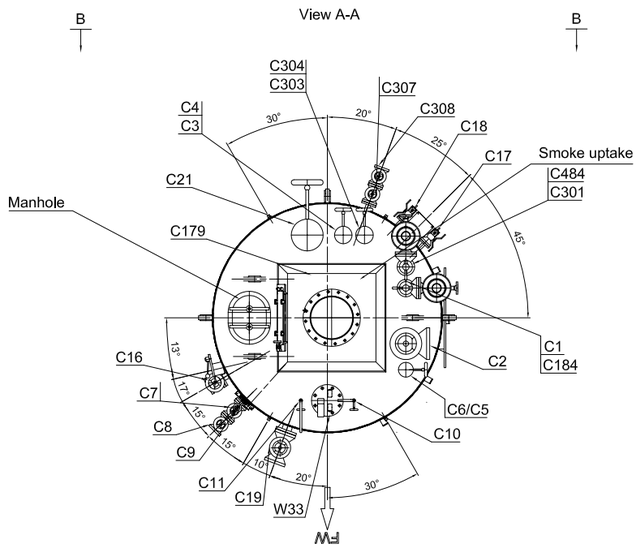
01Y_042283 General arrangment.....15-2

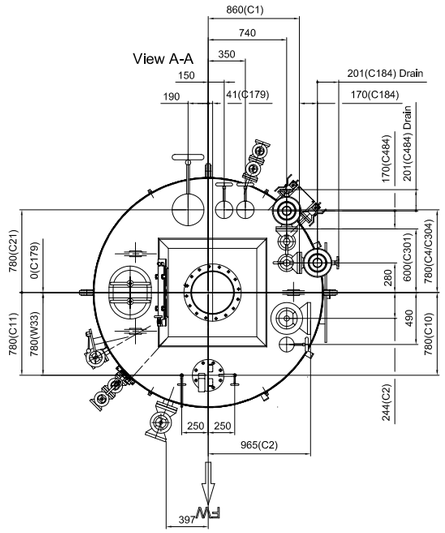
Alteration	Affix	Date	Drawn	Appr.
Internal revision	a	10JYL06	PEA	BeP
Tag No. (L2) Local Control Panel has been removed	b	12 OCT 06	YAT	OGS
C5 scum valve added, C8 + C308 blowdown valves added	c	12. jan 07	SVR	HeJ
C19 rotated 45 deg. antl clockwise, C16 rotated 30 deg. antl clockwise	d	12. jan 07	SVR	HeJ
Burner hole changed from Ø500 to Ø560	e	11Dec07	MSJ	OGS

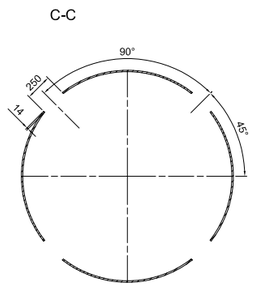


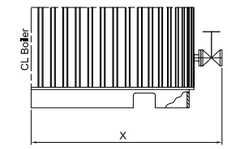












TAG No.	X = mm
C7/C307	1330
C9	1250
C16	1300
C19	1460

Size of lifting eye = 16 ton

Approx. weight (excl. water)	10.6 ton
Approx. weight (incl. water)	17.05 ton

TAG No., see List of Parts.

Dimensions shown without tolerances shall be according to EN 22768-coarse

First angle projection

Customer	Jiangnan Shipyard (Group) Co., Ltd.-Shanghai							
Society	GL + CCS	GL + CCS	CCS	CCS	CCS	CCS	CCS	CCS
Newb. No.	H2390	H2391	H2392	H2393	H2403	H2404	H2405	H2406
Project No.	551868-01	551868-02	551868-03	551868-04	551868-05	551868-06	551868-07	551868-08
Boiler No.	18111	18112	18113	18114	18115	18116	18117	18118
Boiler No.								

RQ No.	RQ051868
Config No.	CF1
Boiler	

AALBORG INDUSTRIES

First Data:

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Title:
MISSION™ OS
Small oilfired boiler
4000 kg/h 9 barg
General arrangement

Drawn	PEA	Date	10/07/2006
Appr.	BeP	Date	10/07/2006
Weight		Scale: 1:20	Size: A0
Article/Drawing No.:	01Y:042283		Index: e

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8500000115	T-piece for salinity alarm equipment	16-40
8800050	Water test equipment, AGK 100 with armerzine test	16-41
2941001	Water washing hose with nozzle	16-42

Type:

- Safety valve, full lift
- 25.912

Size:

- Nominal diameter: DN 50/80

Application:

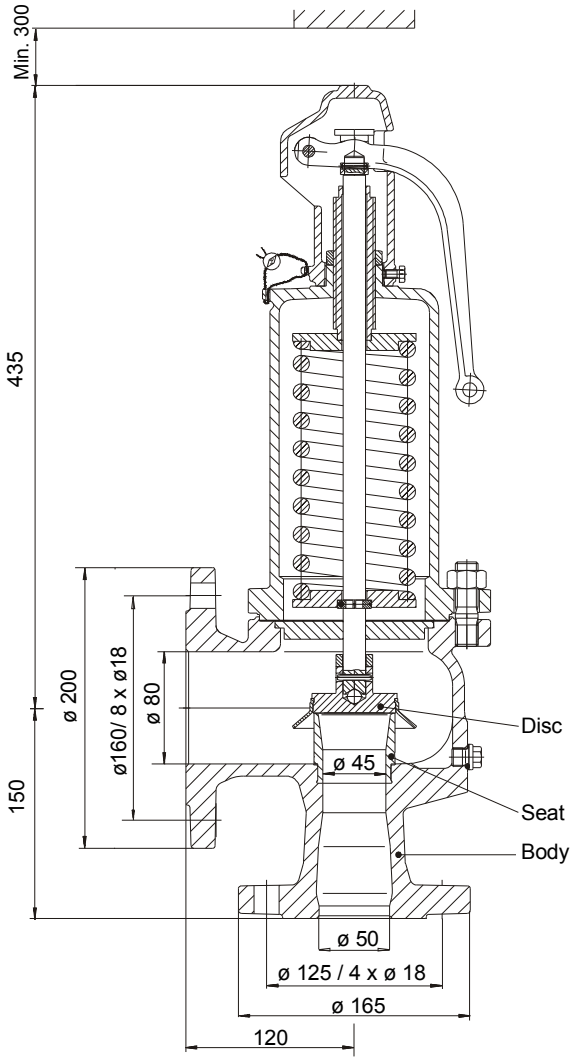
- To blow off saturated steam, air or water

Material:

- Body: GGG 40.3
  DIN-Material No.: 0.7043
- Seat: X6 Cr Ni Mo Ti 17122
  DIN-Material No.: 1.4571
- Disc: X35 Cr Mo 17
  DIN-Material No.: 1.4122.05

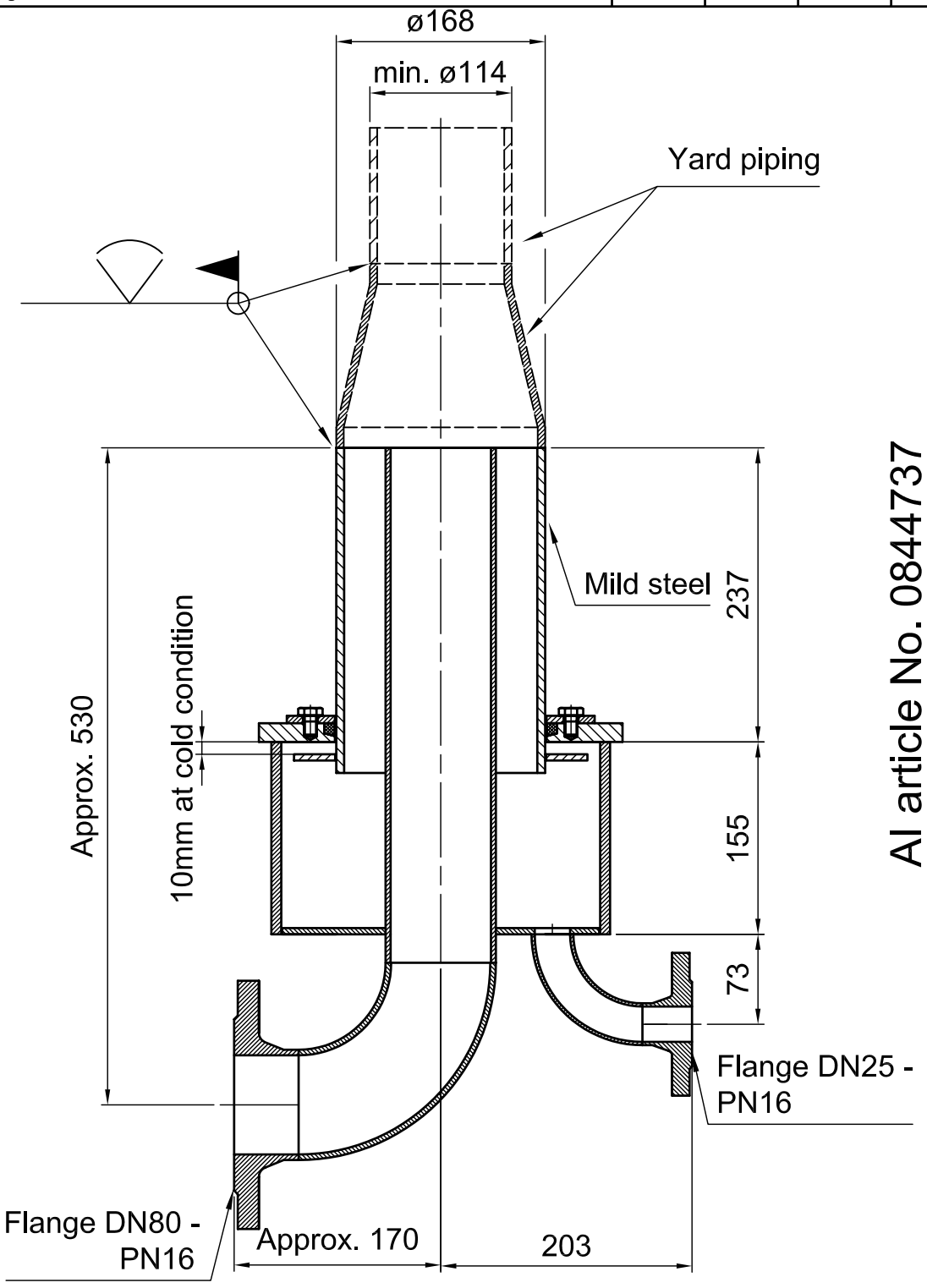
Technical data:

- Nominal pressure: PN 40/16
- Weight: 28 kg
- Flanges according to DIN
- Inlet: DN 50, PN40
- Outlet: DN 80, PN16



Type No.: 6040 **Version: A.2**	**Safety valve, DN 50/80, PN 40/16**	**2611173**

Description	Index	Date	Drawn	Appr.
Drain connection changed to flange	a	020702	JNJ	JA
Sealing ring added	b	041104	JA	BZ



AI article No. 0844737

AALBORG INDUSTRIES

Plot Date:

Title:

Expansion joint with sealing ring

STANDARD

For safety valve DN50/80, PN16 outlet flange

General arrangement

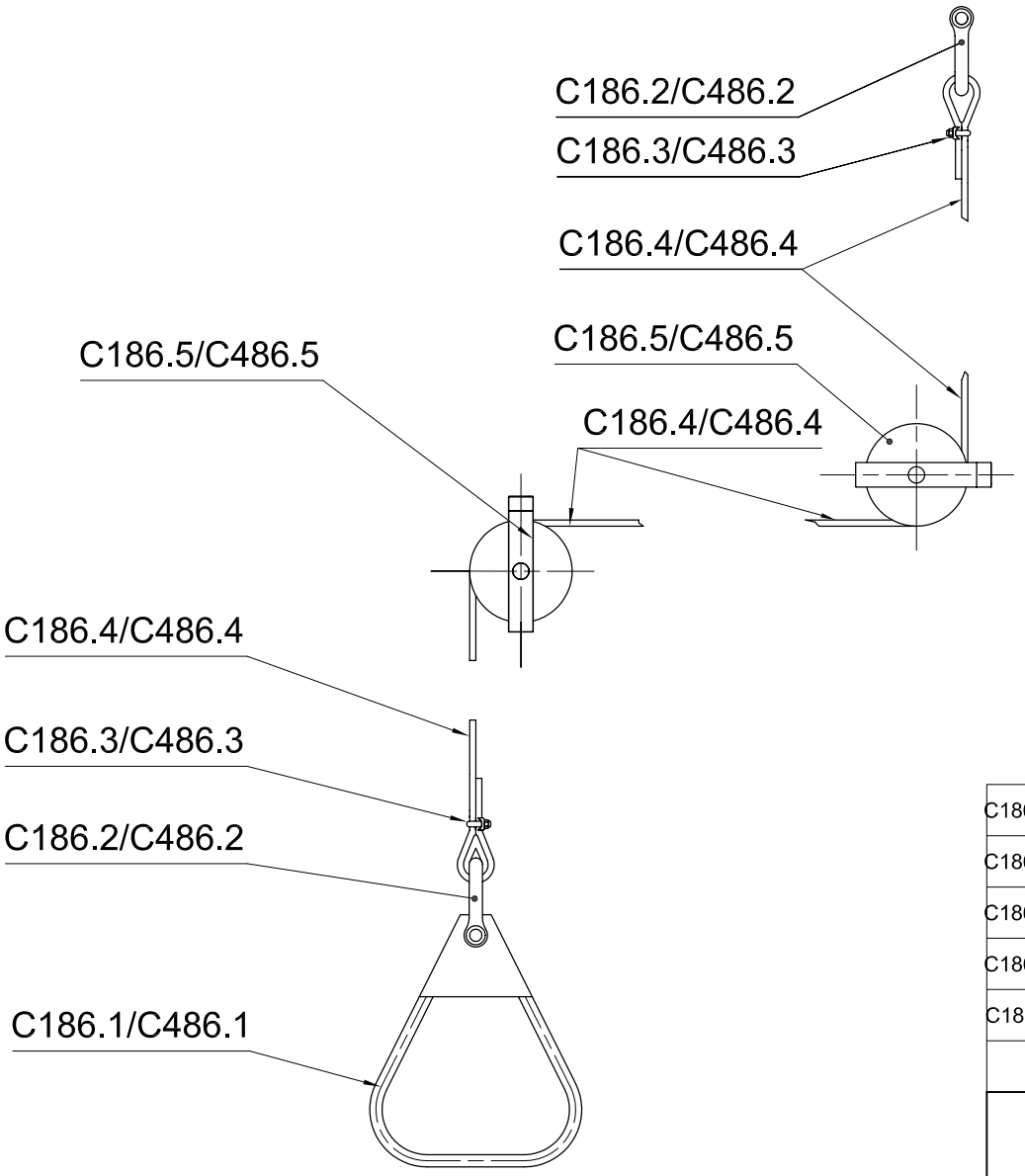
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Drawn	Date
MRJ	20.09.2000
Appr.	Date
LD	30.11.2000

Weight	Scale:	Size
34 kg	1:5	A4R

Article/Drawing No:	Index
85Y : 013425	b

Description	Index	Date	Drawn	Appr.



C186.5/C486.5	Pulley Hot-dip galvanized ø50 mm vertical	2	Steel		4337301
C186.4/C486.4	Wire stainless steel ø3 mm Specified in metre	8	AISI 316		4551052
C186.3/C486.3	Wire clip Hot-dip galvanized 3 mm	2	Steel		4576110
C186.2/C486.2	Shackle Hot-dip galvanized 3/16"	2	Steel		4573311
C186.1/C486.1	Handle ø6x261	1			6451004
Tag No.	Designation Dimension	Pcs.	Material code Material type	Cert.	Article No. Detail drawing No.

AALBORG INDUSTRIES

Title:

STANDARD

Remote pull for safety valve

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Drawn: JA	Date: 040608	
Appr.: BZ	Date: 040608	
Weight	Scale: 1:1	Size: A3
Article/Drawing No: K03 : 032121		Affix

Type:

- Stop globe valve
- Orientation: angle
- 3541

Size:

- Connection, nominal: DN 150

Pressure rating:

- Pressure, nominal:PN 25

Connection type:

- Connection type: flanges according to DIN

Application:

- For steam and/or water flow

Material:

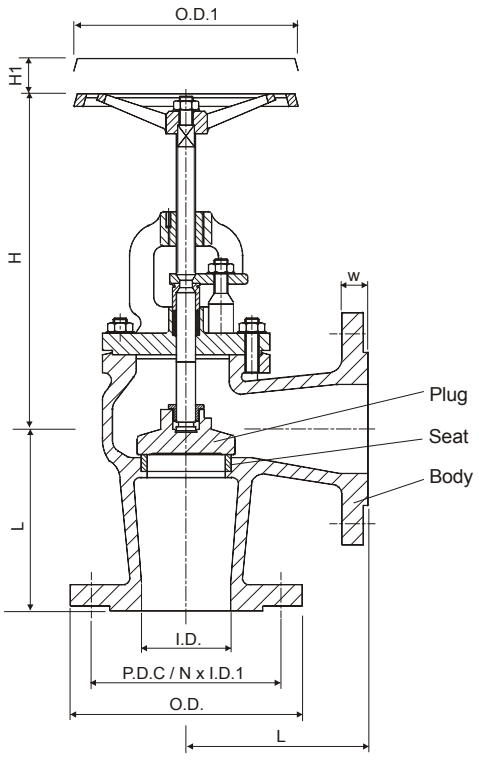
- Body: GS-C25N
- Body material code: No. 1.0619.1
- Seat: H1Cr18Ni9Ti
- Plug: 2Cr13

Technical data:

- Weight:76kg

Dimension:

- L = 225
- H = 430
- H1 = 42
- W = 28
- I.D. = ø150
- O.D. = ø300
- O.D.1 = ø350
- P.D.C. = ø250
- N x I.D.1 = 8 x ø26



Type No.: 6010 Version: A.2	**Stop valve, angle, DN 150, PN 25**	**6010000255**

Type:
- Stop globe valve
- Orientation: straight
- 3540

Size:
- Connection, nominal: DN 50

Pressure rating:
- Pressure, nominal:PN 25

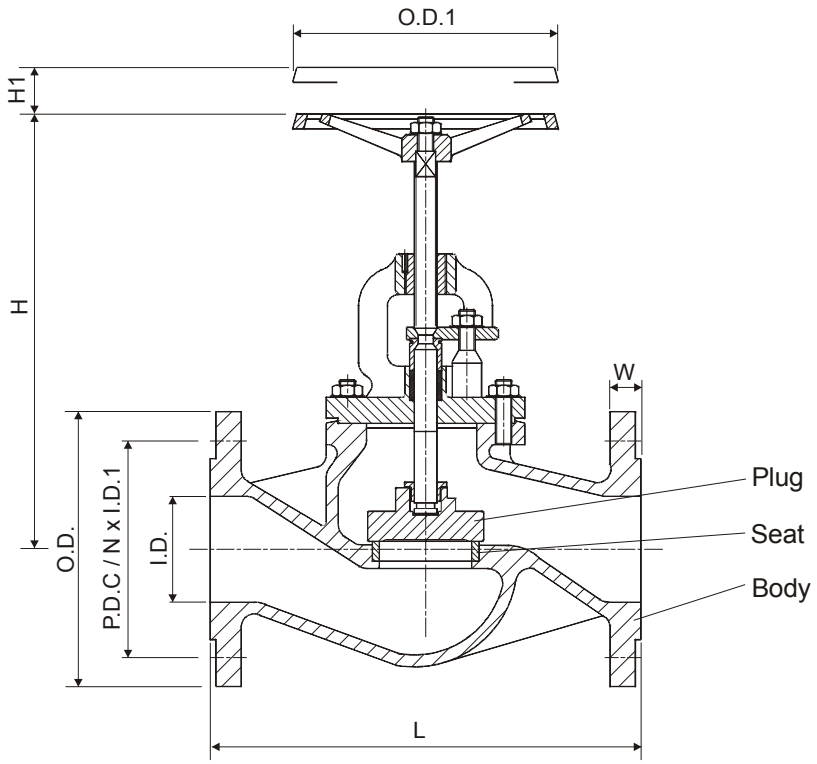
Connection type:
- Connection type: flanges according to DIN

Application:
- For steam and/or water flow

Material:
- Body: GGG 40.3
- Body material code: No. 0.7043
- Seat: H1Cr18Ni9Ti
- Plug: 2Cr13

Technical data:
- Weight:15.6 kg

Dimension:
- L = 230
- H = 266
- H1 = 14
- W = 20
- I.D. = ø50
- O.D. = ø165
- O.D.1 = ø160
- P.D.C. = ø125
- N x I.D.1 = 4 x ø18



Type No.: 6010 Version: A.2	**Stop valve, straight, DN 50, PN 25**	**6010000235**

Type:

- Stop check globe valve, screw down non return
- Orientation: straight
- 3542

Size:

- Connection, nominal: DN 50

Pressure rating:

- Pressure, nominal:PN 25

Connection type:

- Connection type: flanges according to DIN

Application:

- For steam and/or water flow

Material:

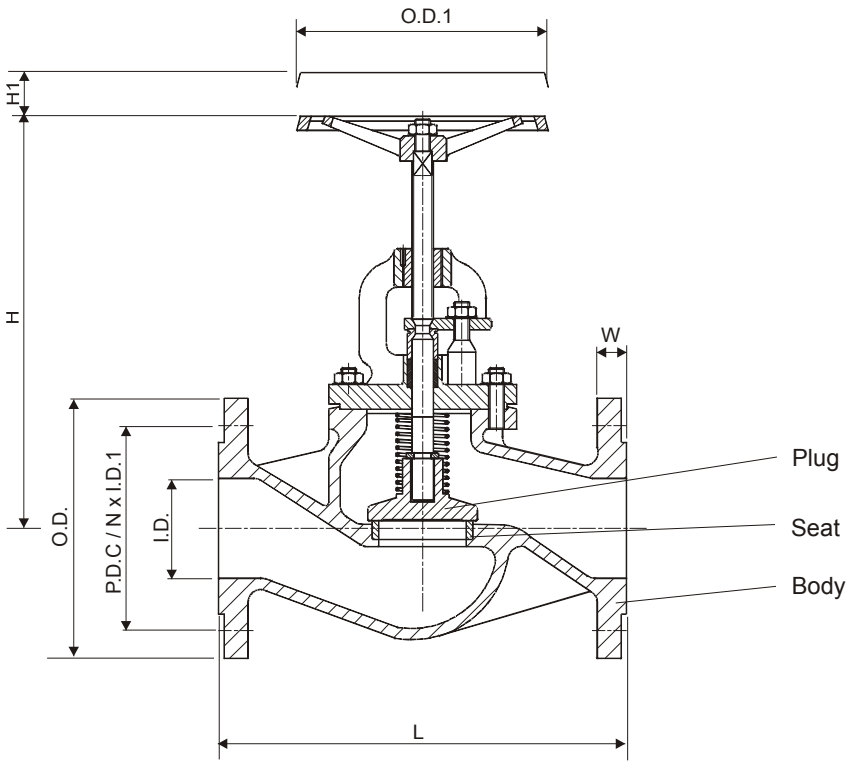
- Body: GGG 40.3
- Body material code: No. 0.7043
- Seat: H1Cr18Ni9Ti
- Plug: 2Cr13

Technical data:

- Weight:15.6kg

Dimension:

- L = 230
- H = 266
- H1 = 14
- W = 20
- I.D. = ø50
- O.D. = ø165
- O.D.1 = ø160
- P.D.C. = ø125
- N x I.D.1 = 4 x ø18



Type No.: 6030 **Version: A.2**	**Stop valve, straight, non return, DN 50, PN 25**	**6030000075**

Type:

- Stop check globe valve, screw down non return
- Orientation: straight
- 3542

Size:

- Connection, nominal: DN 32

Pressure rating:

- Pressure, nominal:PN 25

Connection type:

- Connection type: flanges according to DIN

Application:

- For steam and/or water flow

Material:

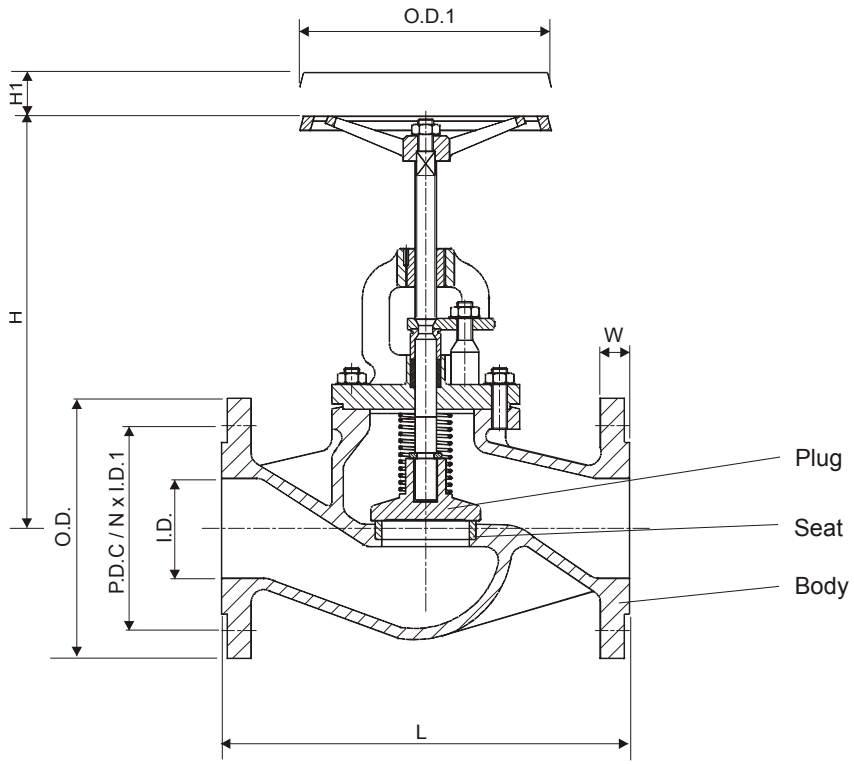
- Body: GGG 40.3
- Body material code: No. 0.7043
- Seat: H1Cr18Ni9Ti
- Plug: 2Cr13

Technical data:

- Weight:9.6kg

Dimension:

- L = 180
- H = 230
- H1 = 9
- W = 18
- I.D. = ø32
- O.D. = ø140
- O.D.1 = ø140
- P.D.C. = ø100
- N x I.D.1 = 4 x ø18



Type No.: 6030 **Version: A.2**	**Stop valve, straight, non return, DN 32, PN 25**	**6030000073**

Type:

- Stop globe valve
- Orientation: straight
- 3540

Size:

- Connection, nominal: DN 32

Pressure rating:

- Pressure, nominal:PN 25

Connection type:

- Connection type: flanges according to DIN

Application:

- For steam and/or water flow

Material:

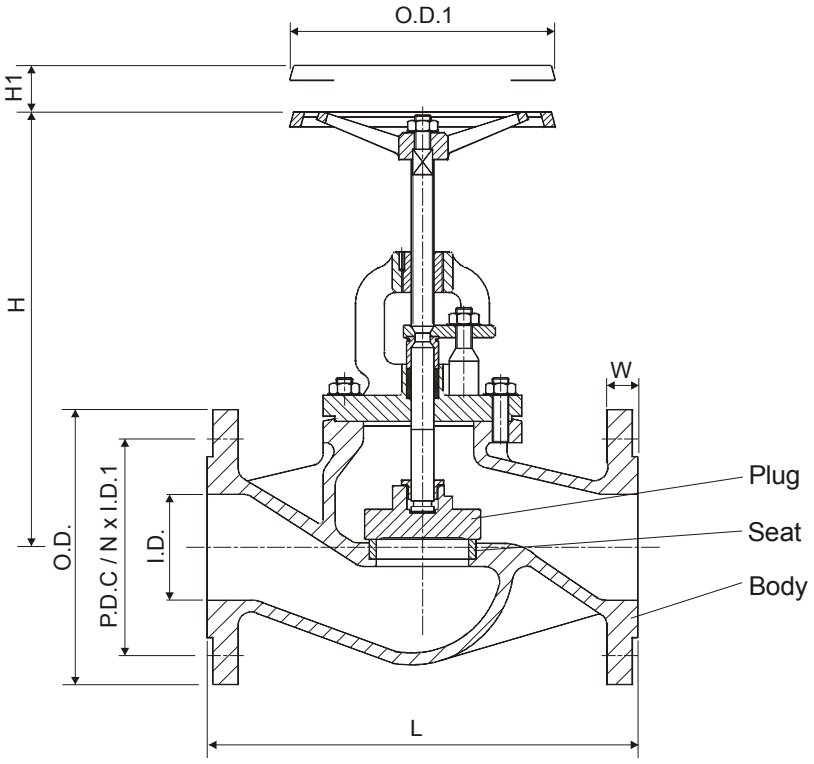
- Body: GGG 40.3
- Body material code: No. 0.7043
- Seat: H1Cr18Ni9Ti
- Plug: 2Cr13

Technical data:

- Weight:9.6 kg

Dimension:

- L = 180
- H = 230
- H1 = 9
- W = 18
- I.D. = ø32
- O.D. = ø140
- O.D.1 = ø140
- P.D.C. = ø100
- N x I.D.1 = 4 x ø18



Type No.: 6010 **Version: A.2**	**Stop valve, straight, DN 32, PN 25**	**6010000233**

Type:

- Instrument stop cone valve, straight, with security plate

Size:

- G ½" x ø 12
- Nominal diameter: DN 8

Application:

- For steam, water and/or air

Material:

- Body: C 22.8

DIN- Material No. 1.0460

- Seat: X20 Cr13

DIN- Material No. 1.4021

- Needle tip: X35 CrMo17

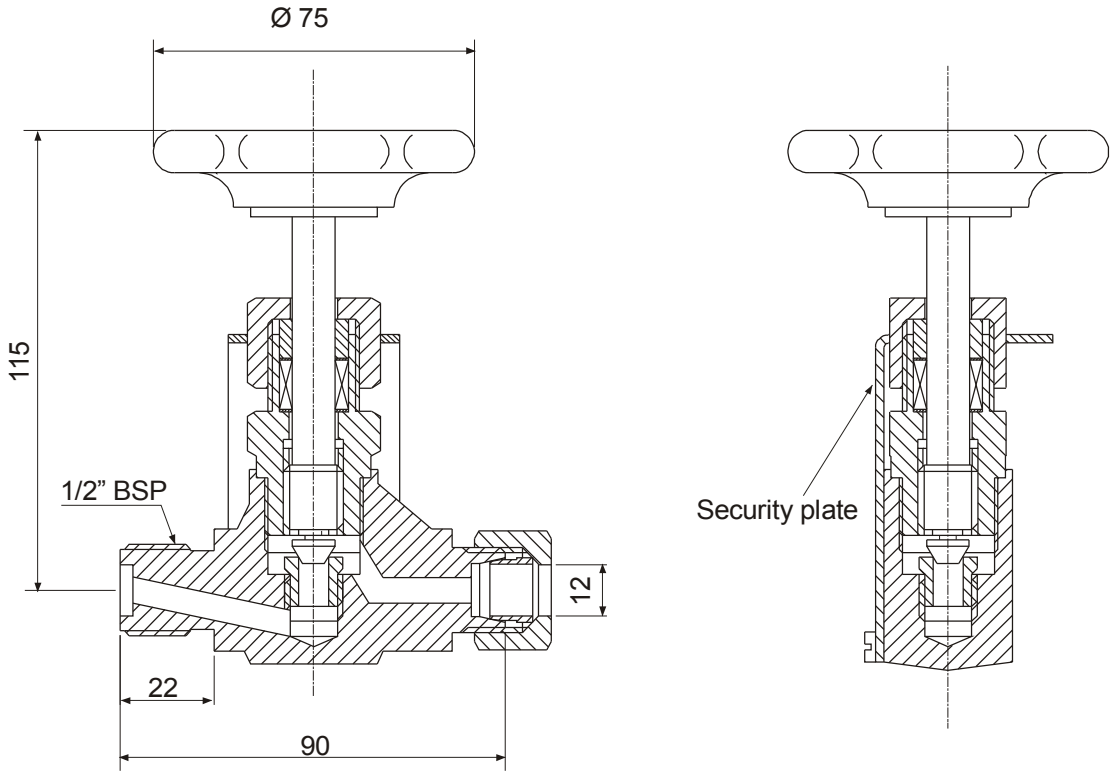
DIN- Material No. 1.4122

Technical data:

- Nominal pressure: PN 160
- Inlet: G ½" male DIN

19207, form R

- Outlet: For steel tube ø 12
- Weight: 0.8 kg



Type No.: 6220 **Version: A.2**	**Stop valve, straight, DN 8, PN 160**	**6220000002**

Type:

- Stop valve, gate straight

Size:

- Nominal diameter: DN 50

Application:

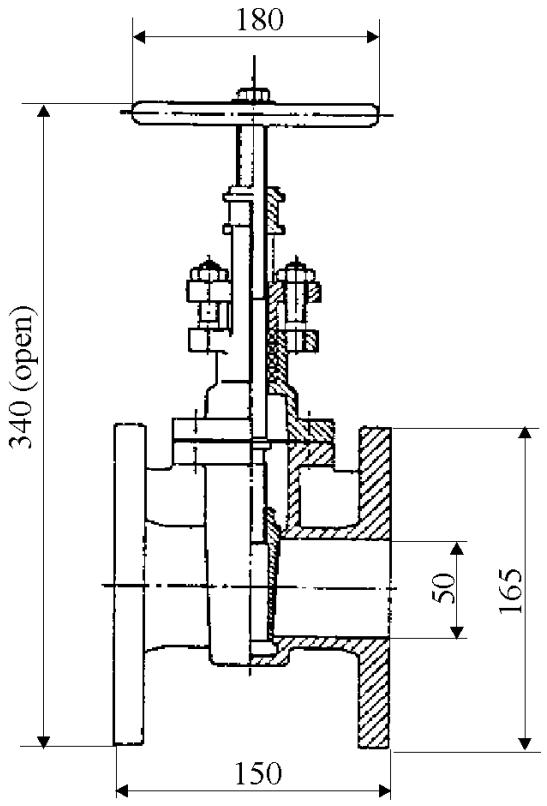
- Sea water, fresh water, oil, steam etc.

Material:

- Body: GG 25

Technical data:

- Nominal pressure: PN 10
- Max. temperature: 150 °C
- Weight: 11.5 kg



Type No.: 6010 Version: A.2	**Stop valve, gate straight, DN 50, PN 10**	**2531005**

Type:

- Reflective water level gauge
- Orientation: left
- Model size:48
- 9020

Size:

- Connection, nominal: DN 25
- Connection, drain: ø 10

Pressure rating:

- Pressure of unit, nominal: PN 25
- Pressure of connection valves, nominal: PN 40
- Pressure of drain valve, nominal:PN 40

Connection type:

- Connection type: Flanges according to DIN

Application:

- For boiler water level indicator

Material:

- Body: Carbon steel 45#
- Connection valve body: WCB
- Drain valve body: WCB

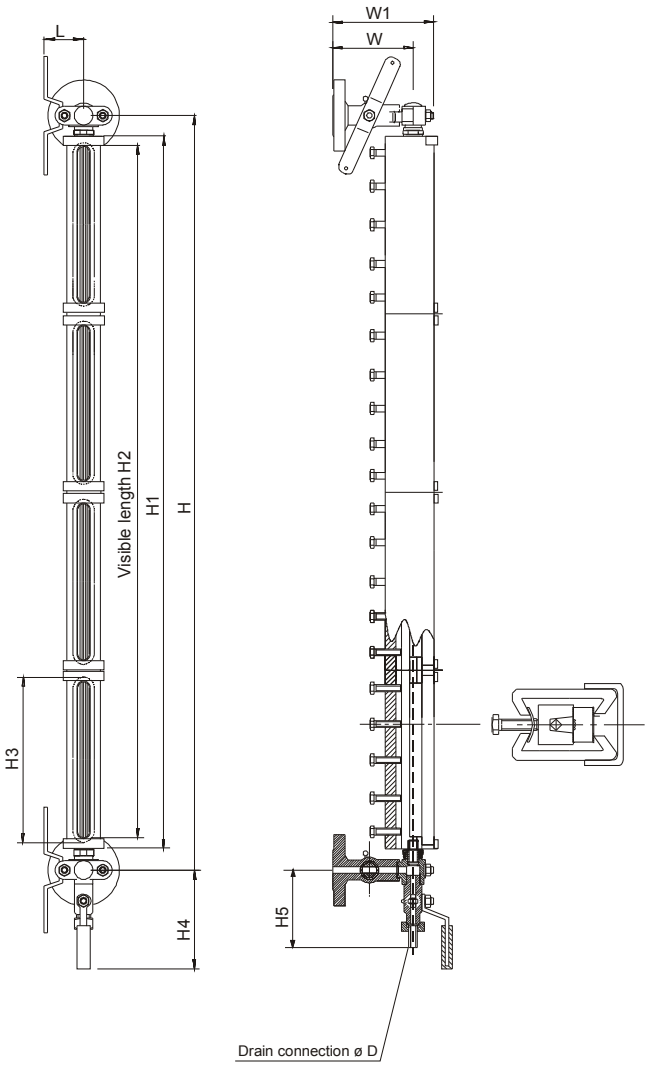
Technical data

- Connection valves type: PX
- Weight:28.9 kg

Dimension:

- H:1450
- H1:1340
- H2:1303
- H3:320
- H4:160
- H5:115
- L: 84.5
- W:125
- W1:150
- D: ø 10

Type No.: 7010 **Version: A.2**	**Water level gauge, left, 4 x 8, DN 25, PN 25**	**7010000476**



Type No.: 7010 **Version: A.2**	**Water level gauge, left, 4 x 8, DN 25, PN 25**	**7010000476**

Type:

- Reflective water level gauge
- Orientation: right
- Model size:48
- 9020

Size:

- Connection, nominal: DN 25
- Connection, drain: ø 10

Pressure rating:

- Pressure of unit, nominal: PN 25
- Pressure of connection valves, nominal: PN 40
- Pressure of drain valve, nominal:PN 40

Connection type:

- Connection type: Flanges according to DIN

Application:

- For boiler water level indicator

Material:

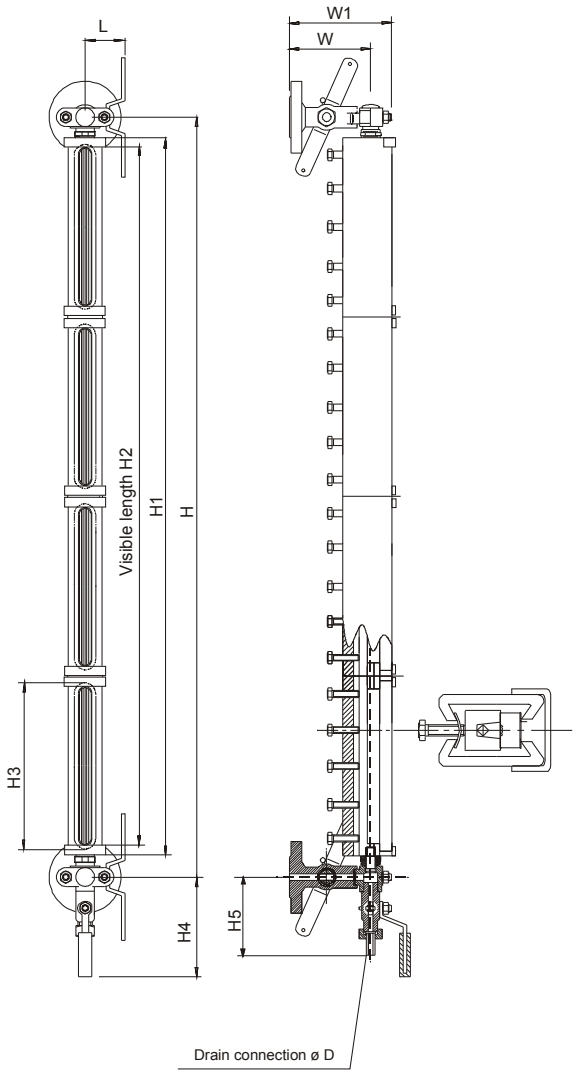
- Body: Carbon steel 45#
- Connection valve body: WCB
- Drain valve body: WCB

Technical data

- Connection valves type: PX
- Weight:28.9 kg

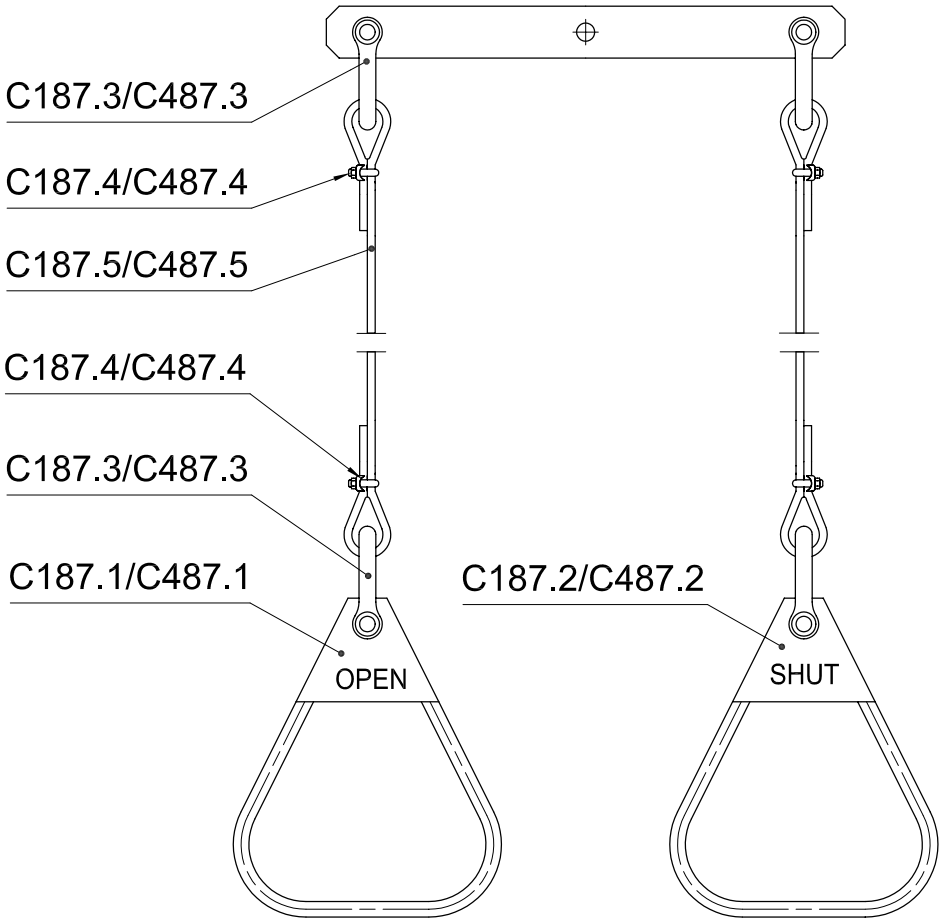
Dimension:

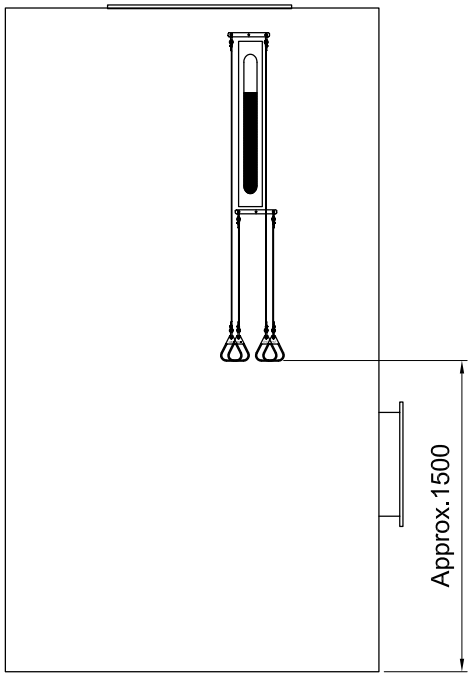
- H:1450
- H1:1340
- H2:1303
- H3:320
- H4:160
- H5:115
- L: 84.5
- W:125
- W1:150
- D: ø 10



Type No.: 7010 **Version: A.2**	**Water level gauge, right, 4 x 8, DN 25, PN 25**	**7010000475**

Description	Index	Date	Drawn	Appr.





Tag No.	Designation Dimension	Pcs.	Material code Material type	Cert.	Article No. Detail drawing No.
C187.5/C487.5	Wire stainless steel ø3 mm Specified in metre	20	AISI 316		4551052
C187.4/C487.4	Wire clip Hot-dip galvanized 3 mm	8	Steel		4576110
C187.3/C487.3	Shackle Hot-dip galvanized 3/16"	8	Steel		4573311
C187.2/C487.2	Handle - "SHUT"	2			6451003
C187.1/C487.1	Handle - "OPEN"	2			6451002

AALBORG INDUSTRIES

Title:

STANDARD

Remote pull for water level gauge

THIS DRAWING AND DESIGN SHOWN HEREIN IS THE PROPERTY OF AALBORG INDUSTRIES AND MUST NOT BE USED BY OR REPRODUCED FOR THIRD PARTY

Drawn: JA	Date: 040608	
Appr.: BZ	Date: 040608	
Weight	Scale: 1:1	Size: A3
Article/Drawing No.: K03 : 032122		Affix

Type:
- Stop globe valve
- Orientation: straight
- 3540

Size:
- Connection, nominal: DN 80

Pressure rating:
- Pressure, nominal:PN 25

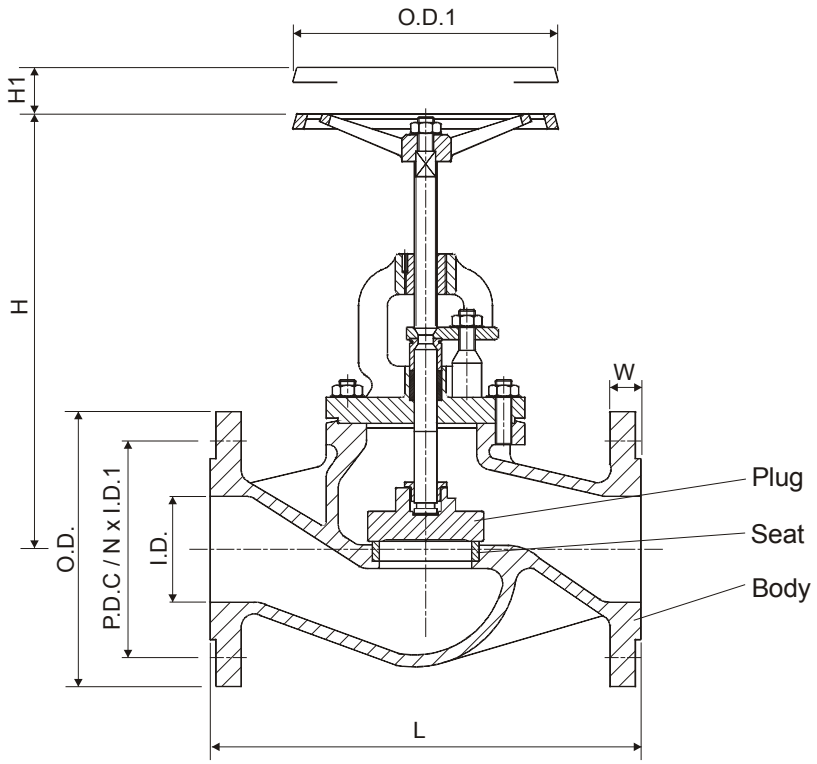
Connection type:
- Connection type: flanges according to DIN

Application:
- For steam and/or water flow

Material:
- Body: GGG 40.3
- Body material code: No. 0.7043
- Seat: H1Cr18Ni9Ti
- Plug: 2Cr13

Technical data:
- Weight:25.8 kg

Dimension:
- L = 310
- H = 335
- H1 = 24
- W = 24
- I.D. = ø80
- O.D. = ø200
- O.D.1 = ø200
- P.D.C. = ø160
- N x I.D.1 = 8 x ø18



Type No.: 6010 **Version: A.2**	**Stop valve, straight, DN 80, PN 25**	**6010000237**

Type:

- Stop globe valve
- Orientation: straight
- 3540

Size:

- Connection, nominal: DN 150

Pressure rating:

- Pressure, nominal:PN 25

Connection type:

- Connection type: flanges according to DIN

Application:

- For steam and/or water flow

Material:

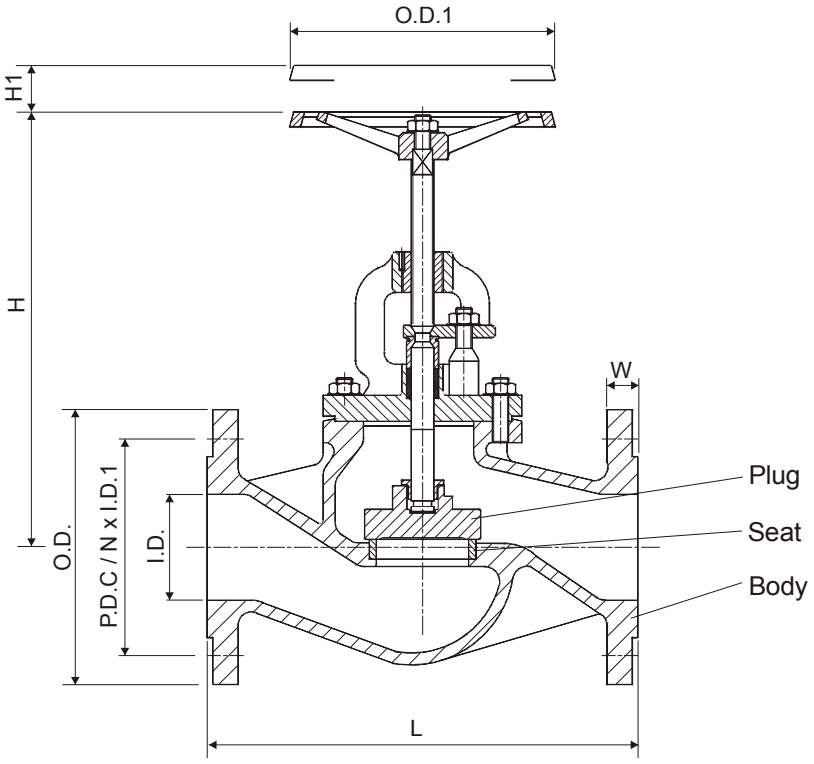
- Body: GS-C25N
- Body material code: No. 1.0619.1
- Seat: H1Cr18Ni9Ti
- Plug: 2Cr13

Technical data:

- Weight:88 kg

Dimension:

- L = 480
- H = 505
- H1 = 42
- W = 28
- I.D. = ø150
- O.D. = ø300
- O.D.1 = ø350
- P.D.C. = ø250
- N x I.D.1 = 8 x ø26



Type No.: 6010 **Version: A.2**	**Stop valve, straight, DN 150, PN 25**	**6010000240**

Type:

- Control globe valve, straight with pneumatic actuator and I/P positioner
- 23.470, DP 32

Size:

- Nominal diameter: DN 25

Application:

- For control of air, gas, water, steam and oil flow

Material valve:

- Body: GGG 40.3
  DIN -Material No. 0.7043
- Seat: X20 Cr13
  DIN –Material No. 1.4021.05
- Plug: X20 Cr13
  DIN –Material No. 1.4021.05
- Stuffing box: PTFE V-ring unit(-10°C to + 220°C)

Technical data, valve:

- Nominal pressure: PN 25
- Positioning ratio: 50:1
- Flow characteristic: Equal percentage
- Kvs value:6.3 m³/h
- Stroke:20 mm
- Plug type: Parabolic shaft guided
- Flanges according to DIN

Technical data, actuator:

- Control signal: 0.8 – 2.4 bar
- Max. permissible closing pressure: 40 bar
- Diaphragm area: 250 cm²
- Max. air supply pressure: 6 bar
- Action:Spring closes on air failure

Technical data, I/P positioner:

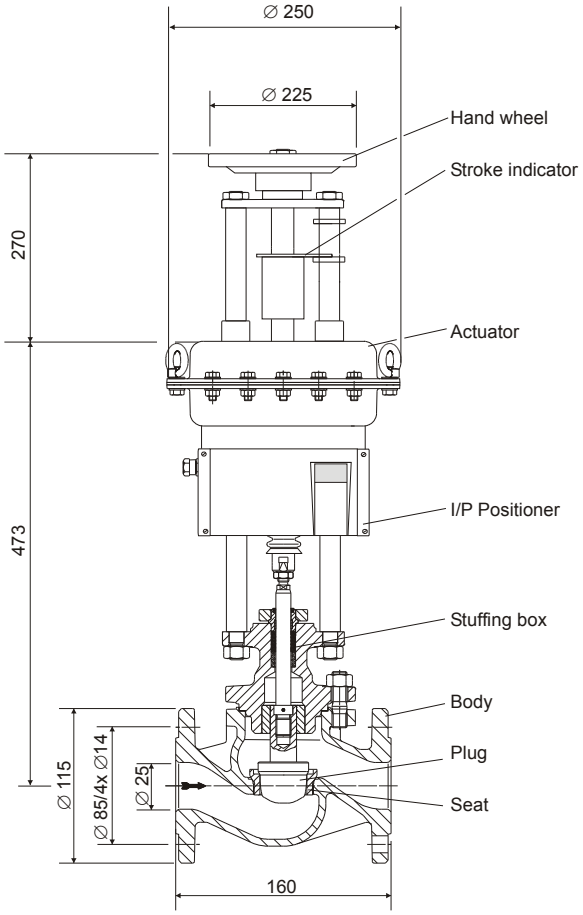
- Air connection inlet: G ¼”
- Inlet air supply: 1.4 to 7 bar, instrument air
- Air inlet consumption in stable state: 0.036 Nm³/h
- Cable inlet: M20 x 1.5
- Input signal: 4-20 mA
- Ambient temperature: -30°C to +80°C
- Protection: IP65

Technical data unit:

- Weight: 20 kg

Installation:

- Only as shown in the picture



Type No.: 6050 Version: A.2	**Pneumatic control valve, DN 25, PN 25, with DP actuator and I/P positioner**	**6050000125**

Type:

- Filter regulator with automatic drain

Size:

- Connections ports 1/4” BSP
- Gauge ports 1/8” BSP

Application:

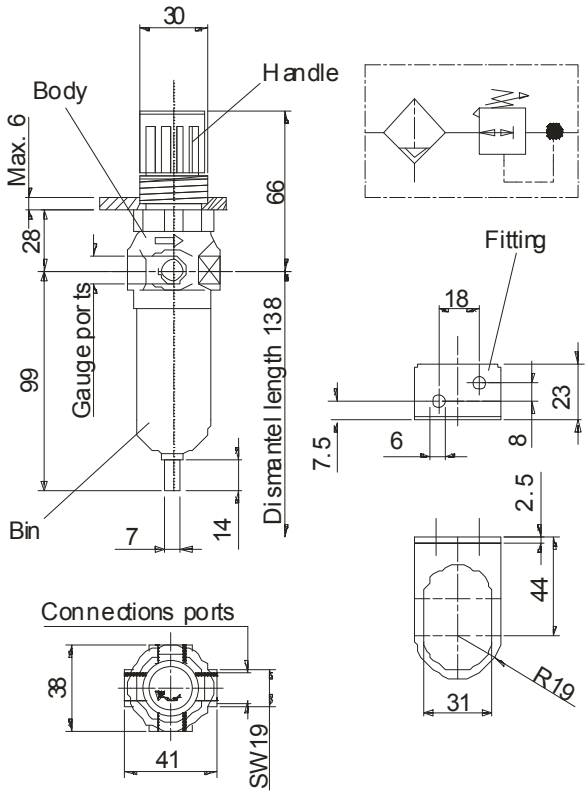
- Instrument air for regulating pressure

Technical data:

- Medium: instrument air only
- Max. inlet pressure: 17 bar
- Operating temp.: –20 °C to + 65 °C
- Filter element: 5 µm
- Recommend pressure regulating range: 0.14-7.0 bar
- Pressure gauge: 0 – 10 bar
- Weight: 0.4 kg

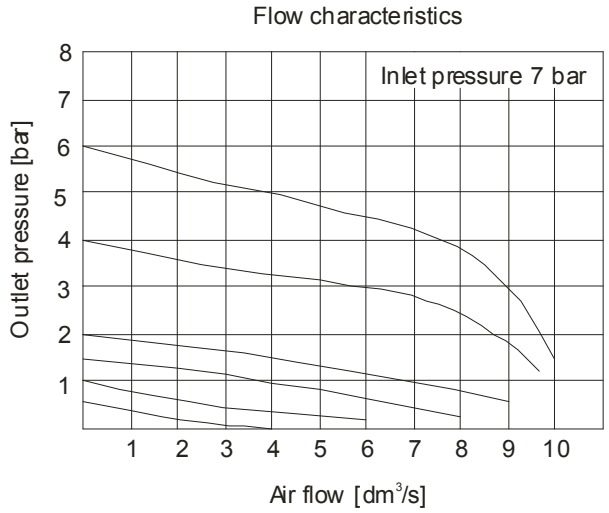
Material:

- Body: Steel
- Bin: Steel
- Handle: Acetal



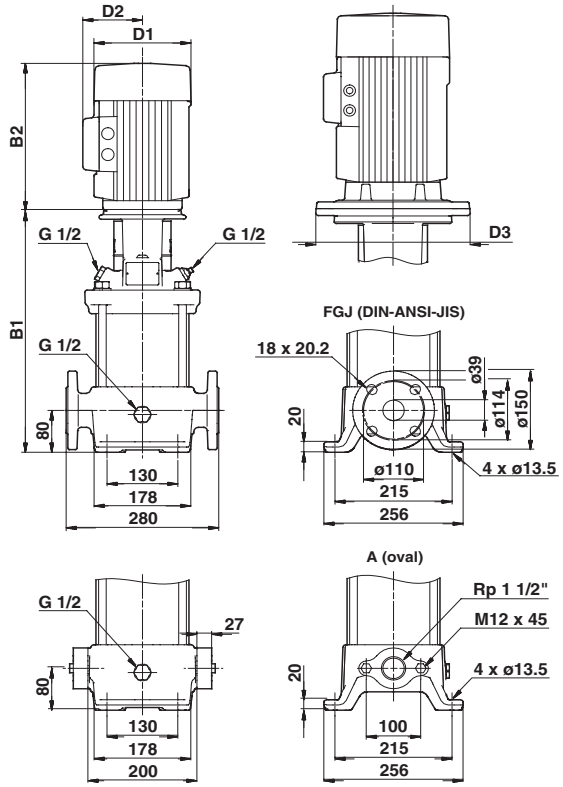


Type No.: 8000 Version: A.2	Filter regulator with automatic drain	2915101



Type No.: 8000 **Version: A.2**	**Filter regulator with automatic drain**	**2915101**

Dimensional sketch and electrical data



Pump type	Motor P_2 [kW]	CR $I_{1/1}$ [A]	CR Cos $\varphi_{1/1}$	CR η [%]	CR $\frac{I_{start}}{I_{1/1}}$	CRE $I_{1/1}$ [A]
CR(E) 10-1	0.75	3.15-2.85/1.82-1.64	0.89-0.84	82.0-84.0	5.1-6.5	5.1-4.7
CR(E) 10-2	1.5	5.70-5.00/3.30-2.90	0.89.0.78	80.5-82.0	5.9-8.4	3.3-2.7
CR(E) 10-3	2.2	8.05-6.95/4.65-4.00	0.90-0.81	83.0-84.5	6.5-9.5	4.6-3.8
CR 10-4	3.0	10.6-9.00/6.10-5.20	0.90-0.83	85.0-86.0	7.4-11.0	-
CR(E) 10-5	3.0	10.6-9.00/6.10-5.20	0.90-0.83	85.0-86.0	7.4-11.0	6.4-5.2
CR(E) 10-6	4.0	13.6-11.4/7.85-6.60	0.92-0.85	86.0-87.0	8.0-12.0	8.1-6.6
CR 10-7	5.5	18.8-15.6/10.8-9.00	0.92-0.85	86.5-88.5	8.2-12.4	-
CR 10-8	5.5	18.8-15.6/10.8-9.00	0.92-0.85	86.5-88.5	8.2-12.4	-
CR(E) 10-9	5.5	18.8-15.6/10.8-9.00	0.92-0.85	86.5-88.5	8.2-12.4	11.0-8.8
CR 10-10	7.5	25.5-22.6/14.6-13.0	0.92-0.80	87.5-89.0	9.5-11.6	-
CR(E) 10-12	7.5	25.5-22.6/14.6-13.0	0.92-0.80	87.5-89.0	9.5-11.6	15.0-12.0
CR 10-14	11.0	38.0-32.5/22.0-18.8	0.92-0.86	89.0-91.0	6.8-8.6	-
CR 10-16	11.0	38.0-32.5/22.0-18.8	0.92-0.86	89.0-91.0	6.8-8.6	-
CR 10-17	11.0	38.0-32.5/22.0-18.8	0.92-0.86	89.0-91.0	6.8-8.6	21.3

CR standard voltages: ≤ 1.1 kW: 3 x 220-255/380-440 V, 60 Hz
≥ 1.5 kW: 3 x 220-277/380-480 V, 60 Hz

Dimensions and weights

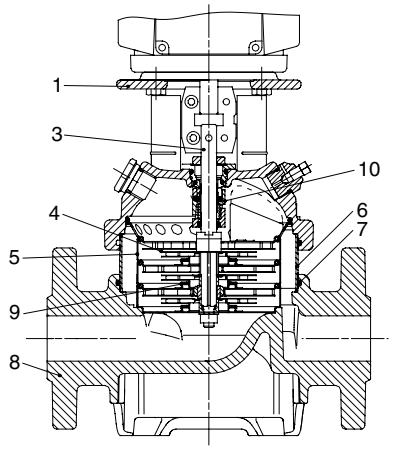
Pump type	CR Dimensions [mm] Oval flange B1	CR Oval flange B1+B2	CR DIN flange B1	CR DIN flange B1+B2	CR D1	CR D2	CR D3	CR Net weight [kg] Oval flange	CR Net weight [kg] DIN flange	CRE Dimensions [mm] Oval flange B1	CRE Oval flange B1+B2	CRE DIN flange B1	CRE DIN flange B1+B2	CRE D1	CRE D2	CRE D3	CRE Net weight [kg] Oval flange	CRE Net weight [kg] DIN flange
CR(E) 10-1	347	578	347	578	141	109	-	34.0	36.0	347	628	347	628	178	167	-	34.8	36.8
CR(E) 10-2	363	644	363	644	178	110	-	41.0	44.0	363	644	363	644	178	167	-	49.5	52.5
CR(E) 10-3	393	674	393	674	178	110	-	44.0	47.0	393	714	393	714	178	167	-	54.5	57.5
CR 10-4	428	763	428	763	198	120	-	49.0	52.0	-	-	-	-	-	-	-	-	-
CR(E) 10-5	458	793	458	793	198	120	-	50.0	53.0	458	793	458	793	198	177	-	59.0	62.0
CR(E) 10-6	488	860	488	860	220	134	-	61.0	64.0	488	860	488	860	220	188	-	72.3	74.3
CR 10-7	550	941	550	941	220	134	300	83.0	86.0	-	-	-	-	-	-	-	-	-
CR 10-8	580	971	580	971	220	134	300	84.0	87.0	-	-	-	-	-	-	-	-	-
CR(E) 10-9	610	1001	610	1001	220	134	300	85.0	88.0	610	1001	610	1001	220	188	298	97.9	100.9
CR 10-10	640	1031	640	1031	220	134	300	88.0	91.0	-	-	-	-	-	-	-	-	-
CR(E) 10-12	-	-	700	1091	220	134	300	-	94.0	-	-	700	1091	220	188	298	-	105.7
CR 10-14	-	-	837	1301	260	172	352	-	127.0	-	-	-	-	-	-	-	-	-
CR 10-16	-	-	897	1361	260	172	352	-	129.0	-	-	-	-	-	-	-	-	-
CR(E) 10-17	-	-	957	1421	260	172	352	-	131.0	-	-	957	1406	258	359	350	-	183.0

Construction

CR(E) 10



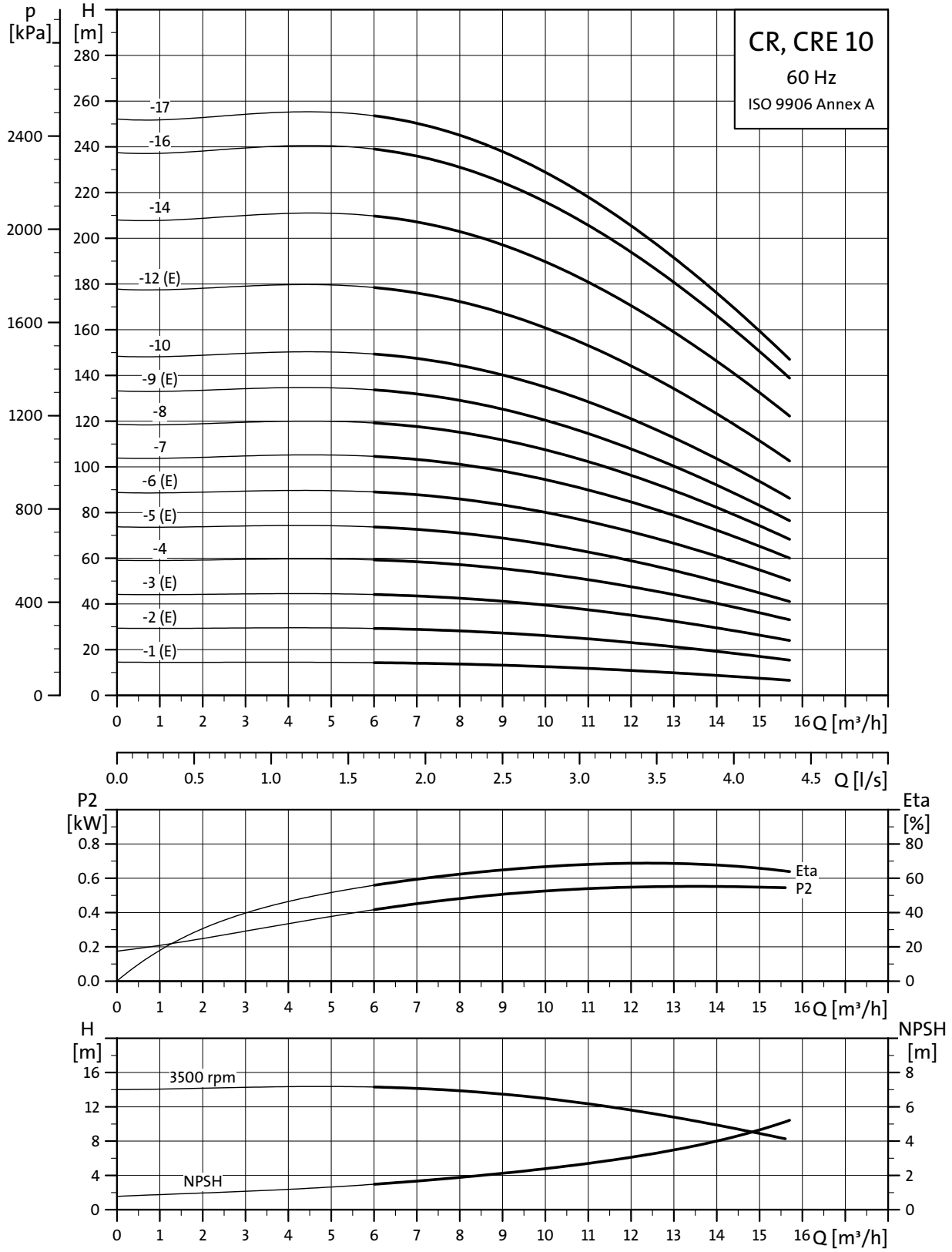
Sectional drawing



Materials: CR(E)

Pos.	Designation	Materials	EN/DIN	AISI/ASTM
1	Pump head	Cast iron EN-GJL-200	EN-JL1030	ASTM 25B
3	Shaft	Stainless steel	1.4401	AISI 316 AISI 431
4	Impeller	Stainless steel	1.4301	AISI 304
5	Chamber	Stainless steel	1.4301	AISI 304
6	Outer sleeve	Stainless steel	1.4301	AISI 304
7	O-ring for outer sleeve	EPDM or FKM		
8	Base	Cast iron EN-GJL-200	EN-JL1030	ASTM 25B
9	Neck ring	PTFE		
10	Shaft seal			
	Rubber parts	EPDM or FKM		

Performance curves



Type:

- Pressure gauge, type P1116

Size:

- ø 63

Application:

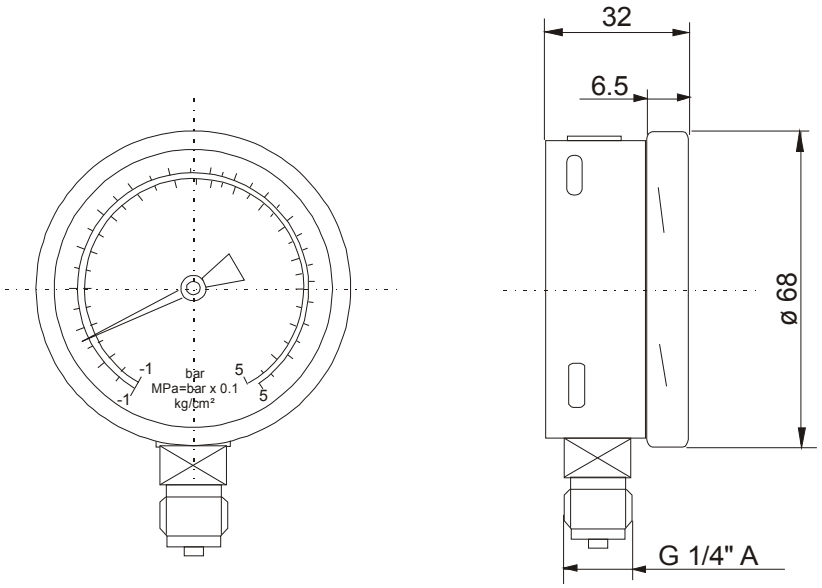
- For all gaseous and liquid media

Material:

- Case: Stainless steel
- Socket: Cu-alloy
- Liquid filling: Glycerine

Technical data:

- Connection: G 1/4”-m
- Measuring unit: bar – Mpa - kg/cm²
- Measuring range: -1 to +5 / - 0.1 to +0.5 / -1 to +5
- Pressure utilisation:
  Static pressure: 75% of $P_{max.}$
  Dynamic pressure: 66% of $P_{max.}$
- Operating temperature: -20 to +80°C
- Accuracy: EN 837 Class 1,6



Type No.: 8050 Version: A.2	**Pressure gauge, ø 63**	**6633118**

Type:

- Pressure gauge

Size:

- ø 100

Application:

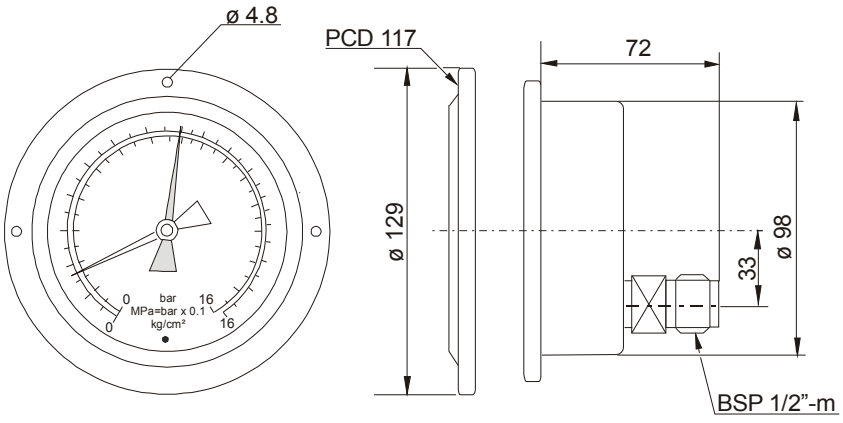
- For all gaseous and liquid media

Material:

- Case: Black enamelled steel
- Socket: Brass
- Liquid filling: Glycerine

Technical data:

- Measuring unit: bar – Mpa - kg/cm²
- Measuring range: 0 – 16 / 1.6 /16 with mechanical stop
- Connection: BSP 1/2”-m
- Operating temperature:
  Ambient: 0 to + 60°C
  Medium: 0 to + 70°C
  The mean value of the maximum ambient temperature and the medium temperature must not exceed the maximum ambient temperature.



Type No.: 8050 **Version: A.2**	**Pressure gauge, ø 100**	**6632973**

Type:

- Pressure switch
- RT 117

Size:

- 10 – 30 bar

Application:

- The pressure switch is a single-pole changeover switch where the contact position depends on the pressure in the connection port and the set value.

Material:

- Bellows: Stainless steel 18/8
- Spring: Stainless steel 17/7
- Housing: Brass
- Bellows ring: Brass

Technical data:

Electrical switchcontact load:

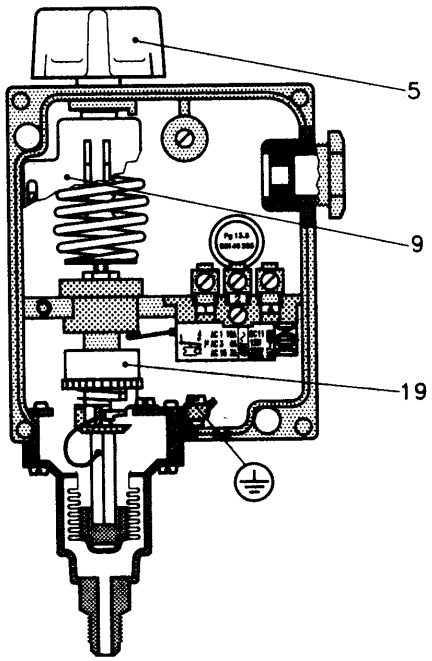
- Alternating current:
  AC-1 (ohmic): 10 A, 400 V
  AC-3 (motor): 4 A, 400 V
  AC-14/15 (coil transformer): 3A, 400V
  Blocked rotor, 28 A, 400V
- Direct current:
  DC- 13/14: 12 W, 230 V

Mechanical:

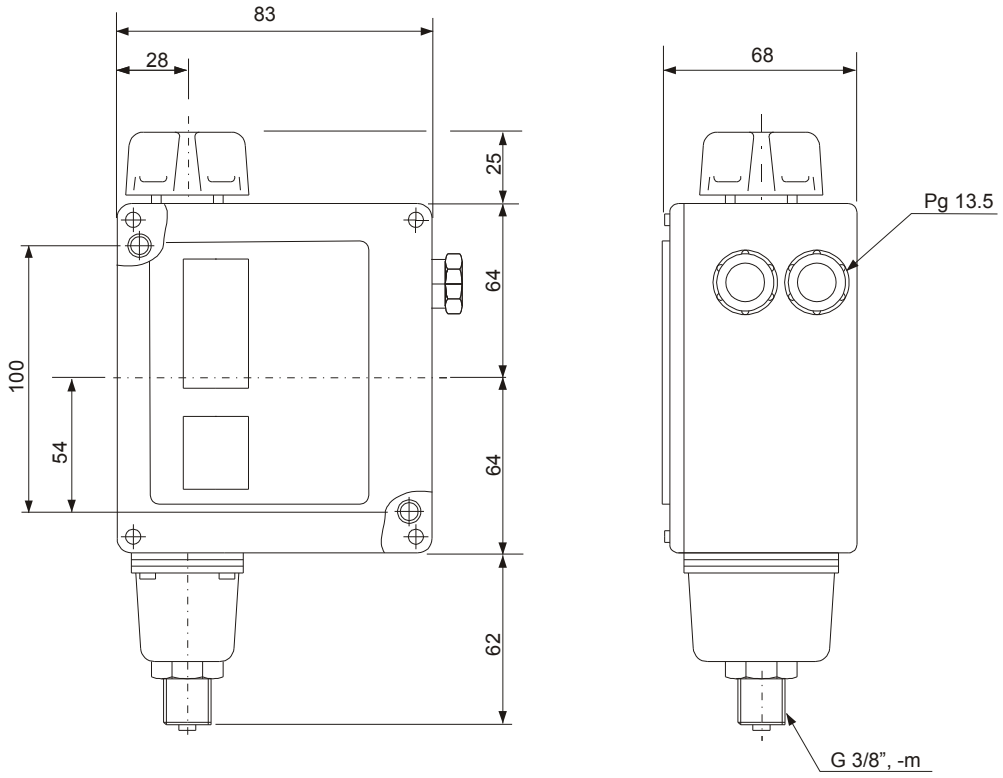
- Connection: G 3/8", -m
- Ambient temperature: - 50°C to + 70°C
- Medium temperature: max. 150°C
- Operating pressure: Max. 22 bar
- Test pressure: Max. 47 bar
- Adjustable/fixed mechanical differential: 1 to 4 bar
- Enclosure: IP 66
  The pressure control housing is made of bakelite to DIN 53470 while the cover is powder painted deep-drawn steel plate.
  To ensure the IP 66 degree of enclosure is obtained, the front cover and screwed cable entries must be correctly tightened.
- Cable entry: Two Pg 13.5 for cable from 6 to 14 mm

Installation:

- The range is set by using the knob (5) while at the same time reading the scale (9). The differential is set by rotating the differential disc (19).



Type No.: 8030 Version: A.2	**Pressure switch, 10-30 bar**	**6310303**



Type No.: 8030 **Version: A.2**	**Pressure switch, 10-30 bar**	**6310303**

Type:

- Pressure gauge valve needle straight.

Size:

- 3/8” x 3/8”

Application:

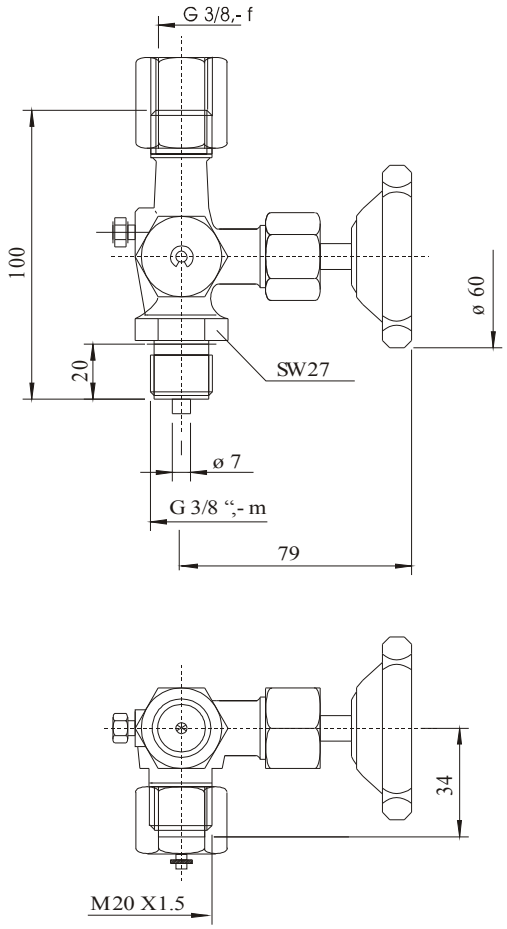
- For instrument connections

Material:

- Body: C22.8
- DIN-material No. 1.0460

Technical data:

- Nominal pressure: PN 400
- Test connection: M20 x 1.5 mm threaded male
- Weight: 0.4 kg



Type No.: 6210 **Version: A.2**	**Needle valve, straight, 3/8" x 3/8", PN 400**	**87D3050**

Type:

- Dosing pump CNPA -1601 PPE2

with chemical tank.

Application:

- For chemical dosing, modulating feed

water regulation.

- For boiler with

Max. design pressure: 12 bar

Material:

- Pump

Liquid end: Polypropylene

Valves: Polypropylene

Seals: EPDM

Balls: Ceramic

Chemical tank: Polyethylene

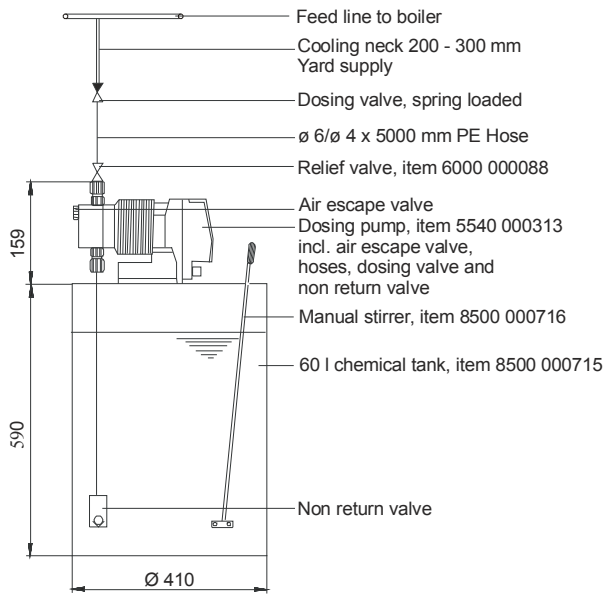
Technical data:

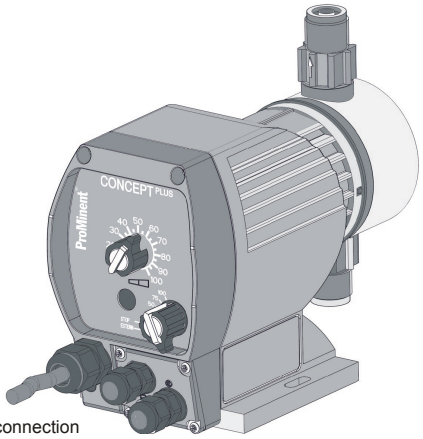
- Max. outlet pressure: 16 bar
- Max. inlet pressure: 8 bar
- Capacity at 16 bar: 1.0 l/h
- Stroke at 16 bar: 0.10 ml
- Capacity at 8 bar: 1.4 l/h
- Stroke at 8 bar: 0.13 ml
- Max. frequency: 180 stroke/min
- Suction lift: 6 m WC
- Max. ambient temperature at at max. counter pressure: 45°C
- Wattage: 10 W
- Peak current: 0.5 A
- Fuse (placed behind

the control panel): 0.16 AT

- Enclosure rating: IP 65
- Insulation class: F
- Motor: 1 phase AC
- Control supply: 230 V 50/60 Hz
- Weight: 8 kg

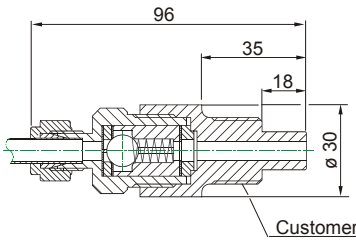
Type No.: 9296 Version: A.2	**Chemical dosing unit**	**9296006004**



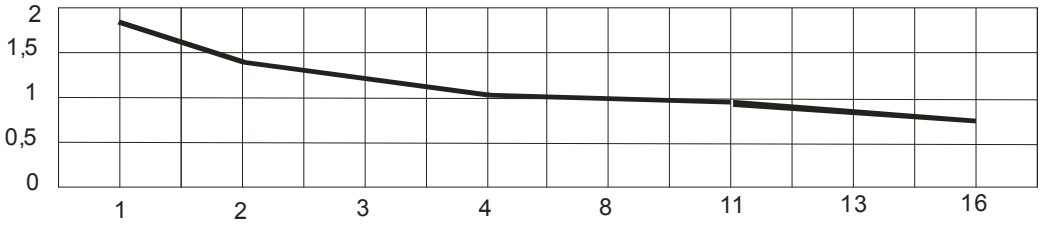


Pover connection

Dosing valve



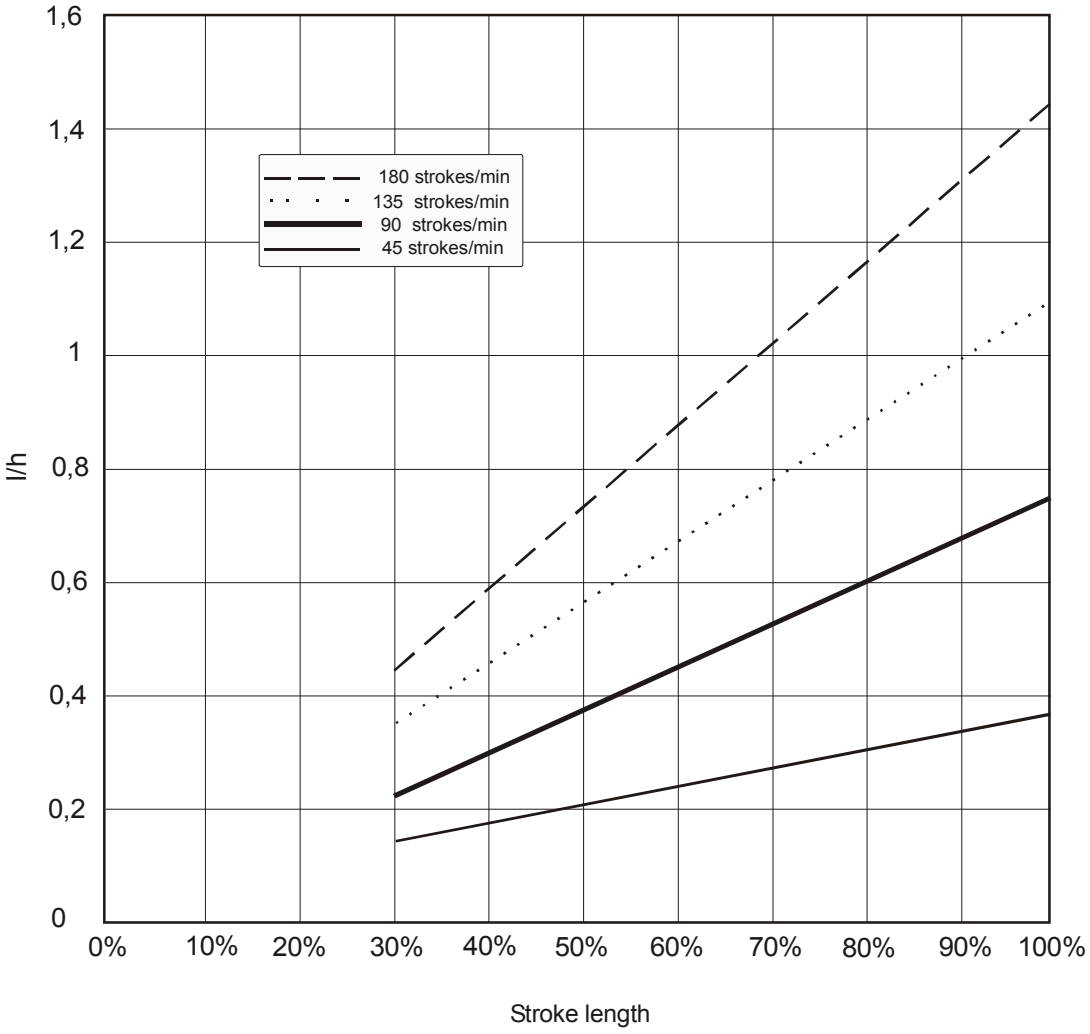
Correction factor



Back pressure

Type No.: 9296 **Version: A.2**	**Chemical dosing unit**	**9296006004**

CNPa 1601 at medium back pressure



Type No.: 9296 **Version: A.2**	**Chemical dosing unit**	**9296006004**

Type:

- Sample cooler

Size:

- SCS 20

Application:

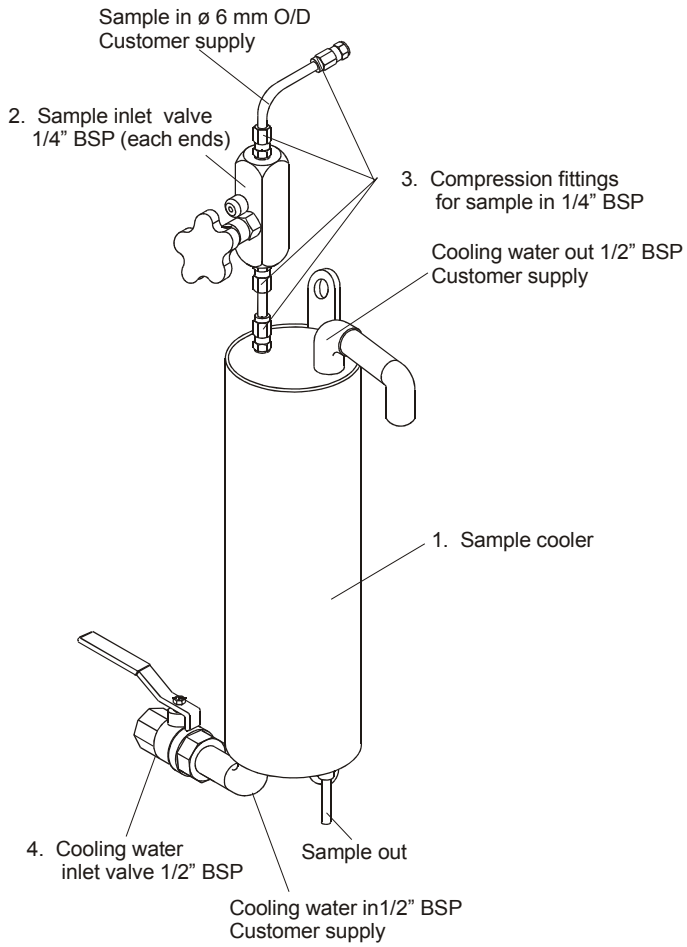
- The sample cooler is designed for taking manual samples of boiler water for analysis. The cooling water is turned on and the sample inlet valve is adjusted until a sample of boiler water is obtained at a suitable temperature. For manual sampling it is not normally necessary to measure sample or cooling water flow rates.

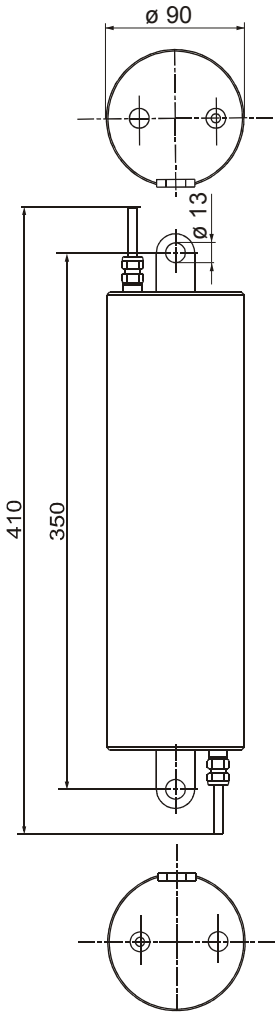
Material:

- Sample cooler: austenitic stainless steel grade 316L
- Cooling water inlet valve: stainless steel
- Sample inlet valve: stainless steel.
- Compression fitting: carbon steel

Technical data:

- Coil design pressure: 32 bar g
- Coil design temperature: 300°C
- Body design pressure: 10 bar g
- Body design temperature: 100°C





Type No.: 7050 Version: C.1	Sample cooler	8750005

Installation:

- Fit the SCS 20 so that the bottom of the unit is accessible for the collection of the cooled sample.
- Connect the cooling water inlet in ½" nominal bore pipe via an inlet valve.
- The cooling water outlet should be piped to an open drain or tundish.
- The sample inlet pipe should be in 6 mm O/D tubes.
- The sample inlet to the cooler can be taken direct from a boiler or steam line isolating valve.

Operation:

- Sample pipe work will become very hot under normal working conditions, and will cause burns if touched.
- Open the cooling water inlet valve first and ensure that a flow can be seen at the cooling water outlet.
- It is essential that cooling water is flowing before opening the sample inlet valve.
- Gradually open the samples inlet valve and regulate the flow to achieve a cooled sample at about 25°C.
- Allow the sample to run for a while before collection. This will ensure that a true sample is collected for analysis.
- When enough liquid has been collected close the sample inlet valve first and then the cooling water inlet valve.
- After closing the sample inlet valve the sample out connection may drip for a few minutes while the coil drains.

Performance:

- When it is required to predict the performance of the sample cooler system, the table below gives the sample outlet temperature to be expected for two boiler pressures an for two cooling water flow rates.

Example

- A sample flow rate of 30 l/h is required from a boiler operating at 10 barg. For a cooling water flow rate of 0.4 l/s, from the table the sample outlet temperature would be 4K (4°C) above the cooling water inlet temperature. If the cooling water is 15°C, the sample temperatures would be 19°C.

Sample flow rate		Cooling water flow rate 0.25 l/s (900 l/h)		Cooling water flow rate 0.4 l/s (1440 l/h)	
		Boiler pressure			
		10 barg	20 barg	10 barg	20 barg
l/h	l/min	Sample outlet temperature above cooling water inlet temperature K (°C)			
10	0.17	3	3	1	1
20	0.33	5	5	2	3
30	0.50	7	9	4	5
40	0.67	8	10	5	7
50	0.83	10	12	6	8
60	1.00	11	13	7	10
80	1.33	12	16	8	12
100	1.67	15	19	9	14
120	2.00	17	22	10	16

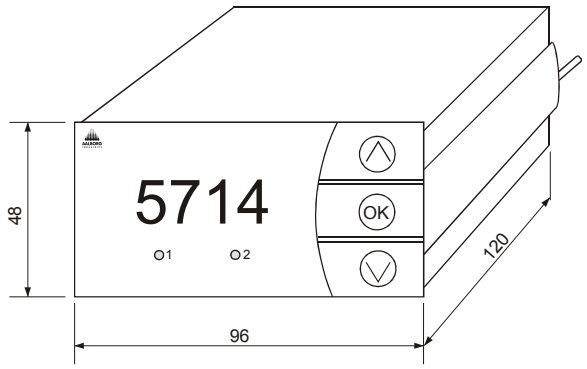
Table 1

Type No.: 7050 **Version: C.1**	**Sample cooler**	**8750005**

Type

- LED indicator/limit switch
- 5714B

Application:



- The 5714 with 2 relay outputs is designed for digital readout of current / voltage or temperature signals.

Relay outputs:

- Are selected as either a make or a break function. The relays can be used as a trip amplifier.
- Two yellow front LEDs indicate the relay status. The relays can be set up with either delayed on or off. Active relay can be selected for either an increasing or decreasing signal. The arrow keys can be used for fast change of the set point.

Technical data:

- Panel cut out: 44.5 x 91.5 mm
- Weight: 230 g

Electrical specifications:

Common specifications:

- Supply voltage:
  Max. voltage: 24…230 $V_{A\ C}$, ±10%50…60Hz
  24…250 V_{DC} ± 20%
- Internal consumption: 2.7W
  Max. consumption: 3.0 W
- Auxiliary voltages:
  2-wire supply: 25…16 V_{DC} / 0…20 mA
- EMC immunity influence: < ± 0.5% of reading
- Max. wire size: 1 x 2.5 mm²
- Relative air humidity:< 95% RH (non condensing)
- Tightness (mounted in a panel): IP65

Voltage input:

- Measurement range: -20mV...12 V_{DC}
- Program measurement range :
  0…1/0,2…1/0…10/2…10V_{DC}
- Input resistance: nominal 10 M·

Current input:

- Measurement range: -1...25 mA
- Program, measurement range:
  0…20 and 4…20mA
- Input resistance:
  Nominal20 · + PTC 25·
- Sensor error detection: loop break
  4…20mA…..Yes

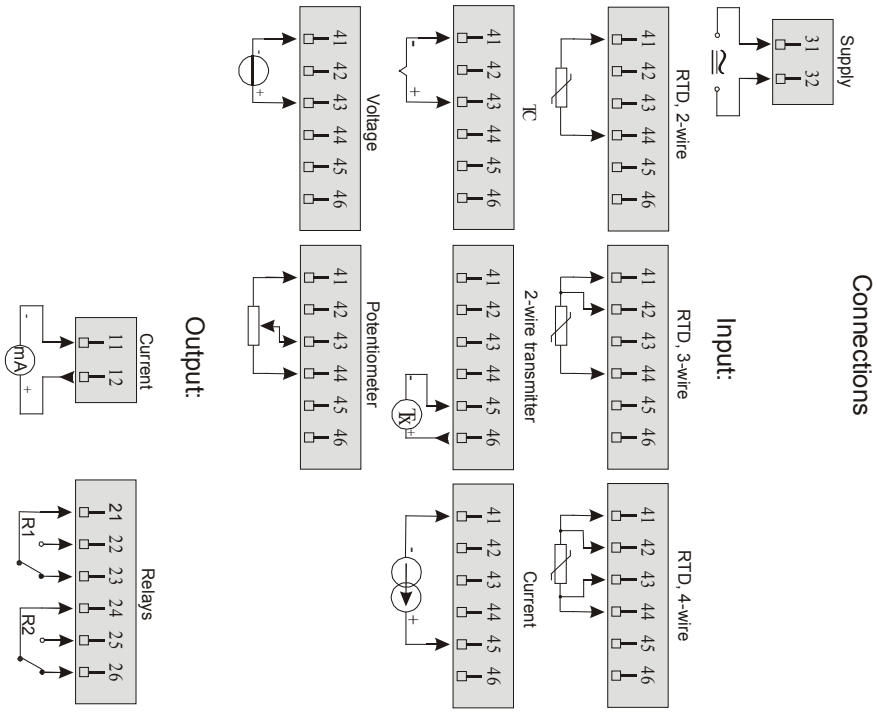
Display:

- Display readout: -199…9999 (4 digits)
- Decimal point: programmable
- Digit height: 13.8 mm
- Display updating: 2.2 times/s
- Input outside input range is indicated by: Explanatory text

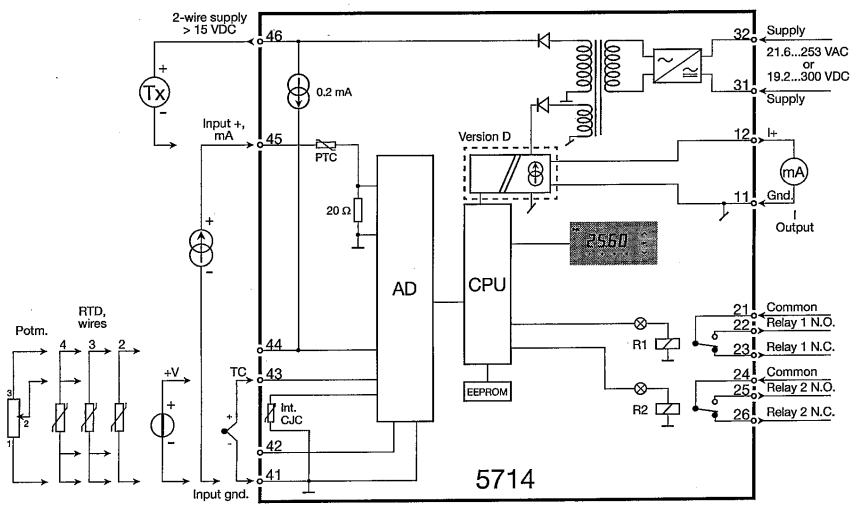
Relay outputs:

- Relay function: setpoint
- Hysteresis, in % display counts:
  0.1…25%/1…2999
- On and Off delay: 0…3600s
- Max. voltage: 250 V_{RMS}
- Max. current: 2 A / AC
- Max. AC power: 500 VA
- Max. current at 24 V_{DC}: 1A
- Sensor error action: Make / break/hold

Type No.: 8000 **Version: A.2**	**LED indicator / limit switch**	**8000000071**



Block Diagram:



Type No.: 8000 **Version: A.2**	**LED indicator / limit switch**	**8000000071**

Type:

- Ultrasonic sensor for oil detection equipment

Application:

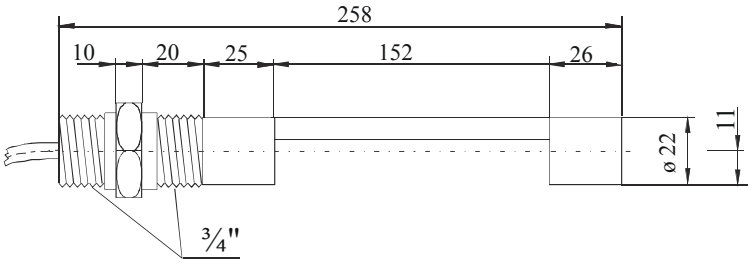
- The ultrasonic sensor is operated together with a control unit.
- The equipment provides for oil detection in feed/make-up water.

Material:

- Sensor: Stainless steel

Technical data:

- Temperature:-70ºC to 150ºC
- Design of duty:Chemical interface
- Liquid type:Clean, viscous with solids
- Cable:6 metre



Type No.: 8310 **Version: A.2**	**Ultrasonic sensor for oil detection equipment**	**8310000005**

Type:

- Control unit for oil detection equipment

Application:

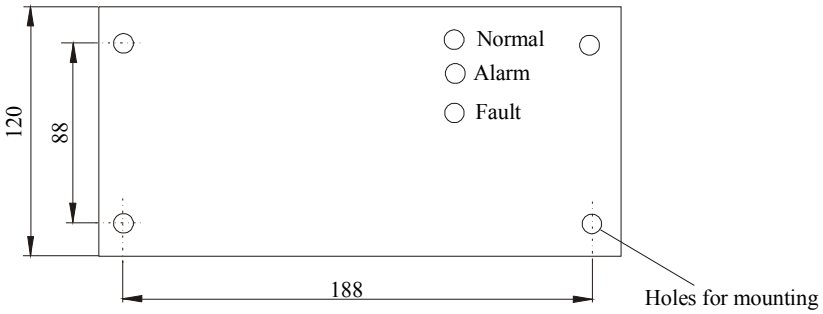
- The control unit is operated together with an ultrasonic sensor.
- The equipment provides for oil detection in feed/make-up water.

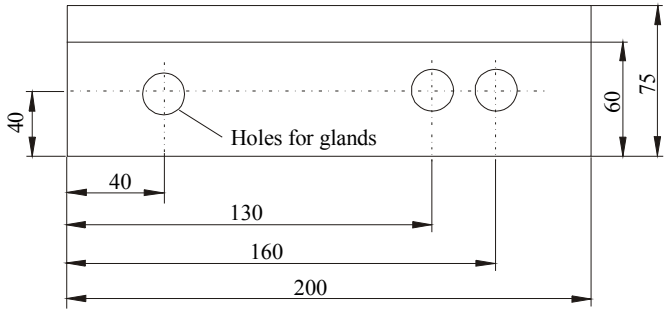
Material:

- Control device cabinet: Polycarbonate

Technical data:

- Power supply (selector switch): 110/120V or 220/240V AC
- Relay output:DPCO
- Enclosure:IP 65
- Holes for glands 3 of ø 16





Type No.: 8210 Version: A.2	**Control unit for oil detection equipment**	**8210000025**

Type:

- Conductive electrode, type SL 700 E

Application:

- The conductive electrode is used in combination with a control device to measure and supervise the salinity of feed water.

Technical data:

Instrument:

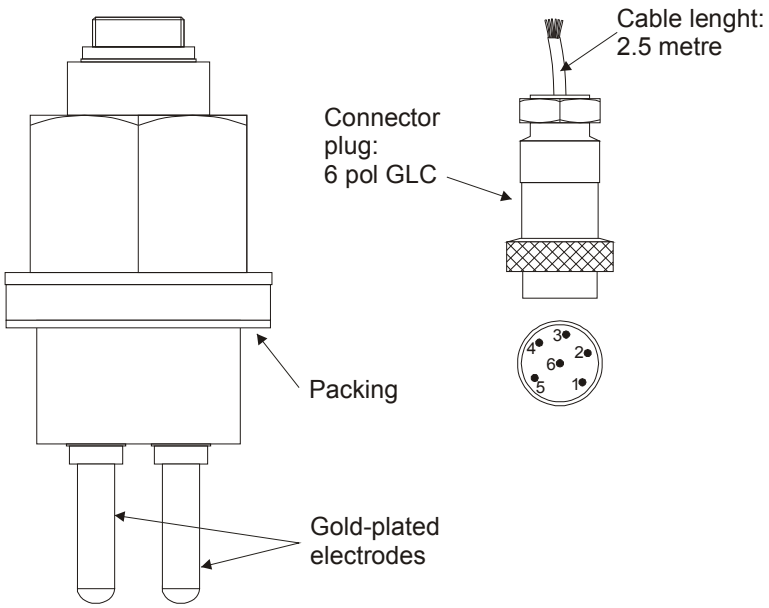
- Salinity range: 0 – 20 ppm (sea salt)
- Accuracy: +/- 10%

Electrical:

- Total cable length: max. 200 m
- Connection to control device via junction box:
  Sensor pin 1 to pin 11 (white)
  Sensor pin 2 to pin 12 (black, white)
  Sensor pin 3 to pin 13 (red)
  Sensor pin 4 to pin 14 (shield)
  Sensor pin 5 to pin 15 (black, red)

Installation:

- The conductive electrode must be installed in the supplied T-piece (item 8500 000115). The cable must be connected to the control device via a junction box (not AI supply).



Type No.: 8620 Version: A.2	**Conductive electrode, type SL 700 E**	**8620000082**

Type:

- Control device for salinometer, type SL 700

Application:

- The control device is used in combination with a conductive electrode to measure and supervise the salinity of feed water.

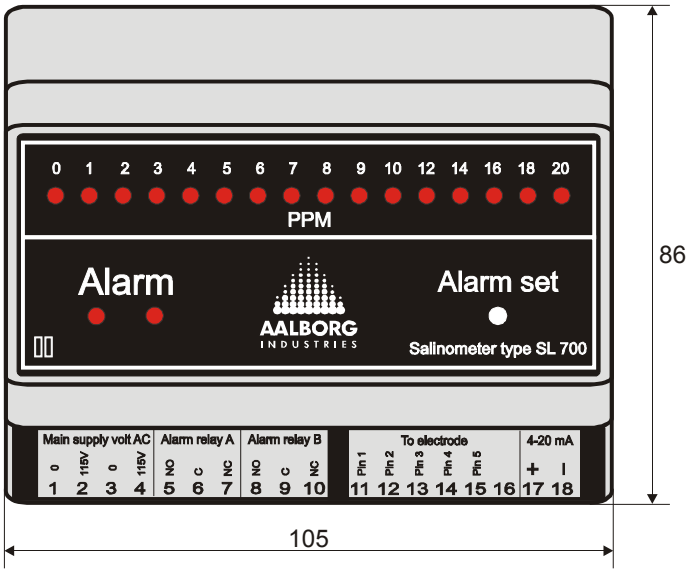
Technical data:

Instrument:

- Salinity range: 0 – 20 ppm (sea salt)
- Accuracy: +/- 10% of displayed value
- Adjustable alarm range:1 – 20 ppm
- Display: LED indication bar

Electrical:

- Mains supply: 90 – 115 V_{AC} or 190 – 230 V_{AC}, 50 – 60 Hz
- Mains current: mains supply must be secured against over current externally by using a fuse (max. 100 mA)
- Power: max. 3.5 W
- Cable connections:
  Terminal 1-4: mains supply
  Terminal 5-10: relay contacts for alarm and solenoid
  Terminal 11-16: electrode unit
  Terminal 17-18: 4-20 mA current loop (I = 0.8 x (ppm) + 4 mA)
- Relay contacts: 8 A / 24 V_{DC}



Type No.: 8210 **Version: A.2**	**Control device, salinometer, type SL 700**	**8210000032**

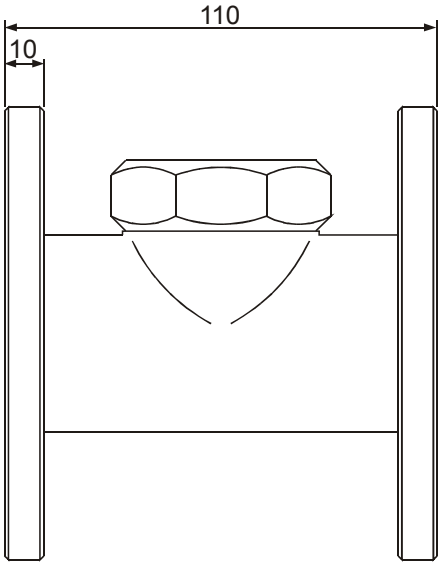
Type:
- T-piece for salinity alarm equipment

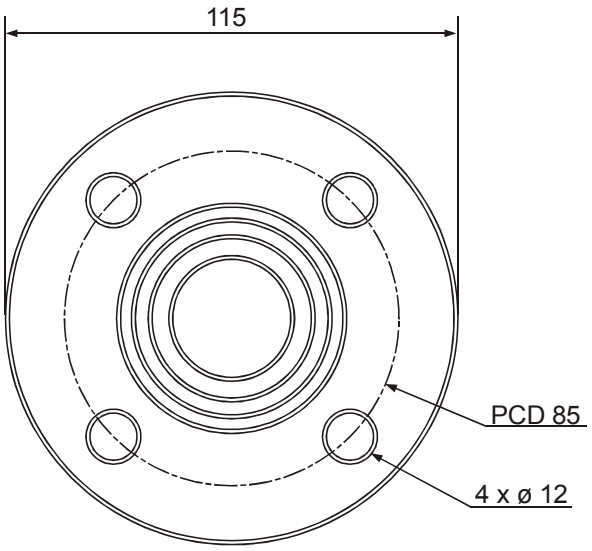
Size:
- DN 25

Application:
- Housing for salinity electrode

Material:
- Housing: RG 5
- Nut for electrode: RG5

Technical data:
- Nominal pressure: PN16
- Flanges according to DIN 2501





Type No.: 8500 Version: A.2	T-piece for salinity alarm equipment	8500000115

Type:

- Test kits Drew AGK100 supplemented with Amerzine test.

Size:

- Dimension of box for AGK 100 test kit: Height 105 mm, length 270 mm, width 185 mm
- Dimension of box for amerzine test kit: Height 45 mm, length 195 mm, width 155 mm
- Dimensions of box for hardness test kit: Height 145 mm, Length 250 mm, Width 165 mm
- Dimensions of conductivity meter: Height 230 mm, length 140 mm, width 130 mm

Application:

- Test kits for boiler water treatment.
- Test kit AGK100 should only be used with Amerzine test kit

Technical data:

- AGK100 test kit.
  Consisting of:
  1 Comparator, phosphate, 0 - 20 ppm.
  1 Snapping cup.
  1 Plastic vial.
  1 Glass tube vial.
  1 Dropper.
  30 Phosphate test tubes.
  2 Hydrate alkalinity, rgt. A.
  1 Hydrate alkalinity, rgt. B.
  1 Phenolphthalein
- Amerzine Test Kit.
  Consisting of:
  1 Cylindrical comperator, Amerzine
  1 Sample cup
  30 Ampoules.
- Hardness test kit.
  Consisting of:
  1 Snapping cup
  2 Boxes ampoules, 30 each
- Conductivity kit, loose supply.
  Consisting of:
  Power supply: AC 110V or 220V
  1 Conductivity meter
  1 Low range cell, white band, range 1-500
  1 High range cell, range 20-10.000
  1 Conductivity cylinder, 100 ml
  1 Thermometer
  1 Gallic acid
  1 Brass spoon
- Weight: 4 kg

Type No.: 8500 **Version: A.2**	**Water test equipment, AGK 100 with armerzine test**	**8800050**

Type:

- Water washing hose with nozzle

Size:

- V-nozzle: 12 mm
- Length: 15 metre (hose)
- Inner diameter: 52 mm (hose)

Application:

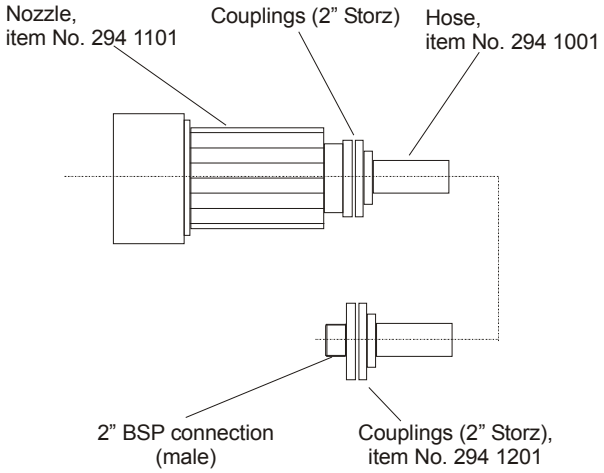
- For spraying of water

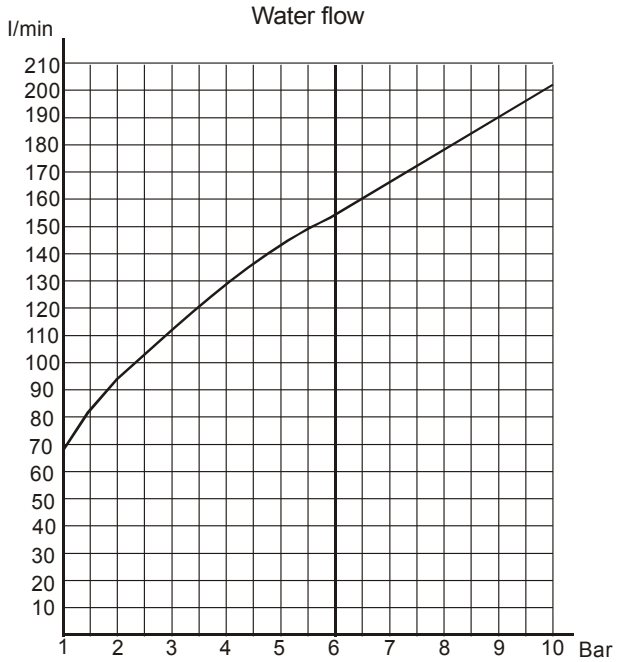
Material:

- Hose: full-synthetic material (polyester) woven in 1/1 binding, with inner rubber lining

Technical data:

- Max allowable working pressure: 20 bar
- Water temperature area: -30ºC-+60ºC
- Weight: 5.5 kg





Type No.: 8615 **Version: A.2**	**Water washing hose with nozzle**	**2941001**

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SD5590_02 Rotary cup burner, type KBE.....17-2

Rotary cup burner, type KBE

1 Burner description

The KBE burner is a rotary cup burner for modulating operation, which is designed to ensure that the flame is kept highly stable at all loads. It is capable of burning both diesel oil (DO) and heavy fuel oil (HFO). An illustration of the KBE rotary cup burner is shown in Figure 1.

The burner system consists of the rotary cup burner which is hinged to the wind box, combustion air fan, burner register systems for air, servo motor, ignition burner and supply system for fuel oil.

Illustration of the rotary cup burner

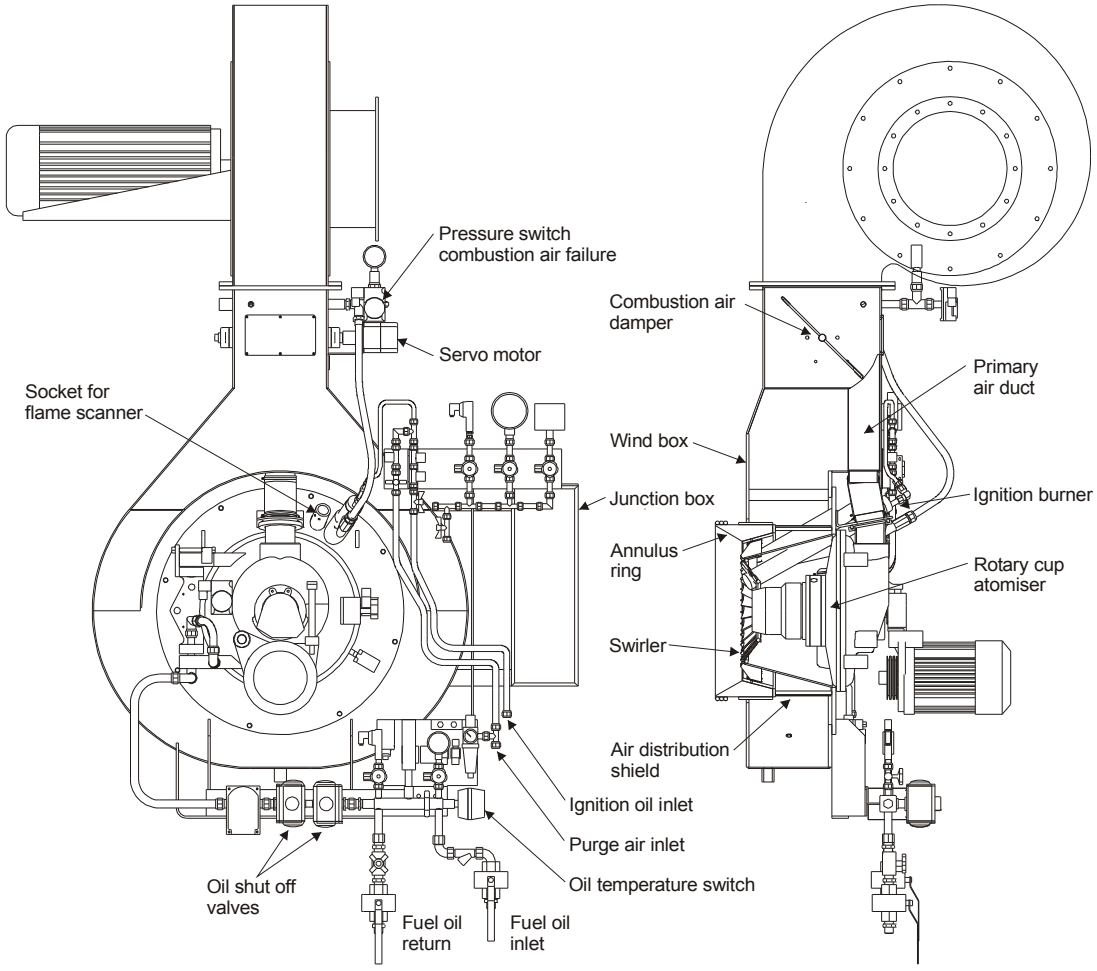


Figure 1 **sd5590_02_kbe_bux0063490en.wmf**

The working principle of the rotary cup burner is based on atomising by centrifugal force. The atomising cup is driven at high speed by an electric motor through v-belts. The oil is gently positioned at low pressure into the spinning cup in which it moves gradually forward forced by the centrifugal action of the cup until it is thrown off the cup rim as a very fine, uniform film. The high velocity primary air discharge around the cup strikes the oil film, breaks it up and converts it into a mist of fine particles which are introduced into the combustion zone and burned.

The total consumption of air needed for a complete combustion is supplied by the combustion air fan which is mounted on top of the wind box. The primary air represents approximately 10% of the total air required for the combustion. The remaining 90% is represented by the secondary air and tertiary air.

The primary air is used not only to atomise the oil film, but also to direct the resulting cone of oil into the combustion chamber. For this purpose a swirl ring is fitted in the cup shroud which will guide the primary air in the same rotating direction as the rotary cup.

The combustion air enters at the top of the wind box, passes the combustion air damper and a distribution ring.This construction ensures that the combustion air is evenly distributed and guided to the combustion air opening which is provided with air vanes. For small and medium size burners the air vanes are fixed, whereas large size burners are provided with individually adjustable air vanes. Furthermore, a part of the combustion air is led through adjustable tertiary air gaps making a balanced air flow through swirler and combustion air opening.

The burner operation and combustion process is handled by the control system. A flow control valve connected to an electrical actuator controls the fuel oil flow to the burner. The primary air flow and secondary air flow are controlled by means of a single electrical actuator. The air/fuel relation is linked together in the control system and based on the boiler steam pressure transmitter signal the control system operates the oil flow valve and combustion air damper in a continuous movement from minimum load to full load. The control system controls all start/stop signals and operating sequences. Furthermore the air/fuel ratio can be adjusted.

The ignition system consists of a separate diesel oil burner with its own oil supply system, inserted through the wind box and swirler. When the burner is started, and the ignition sequence step is reached the diesel oil flame is ignited by an electric spark between two electrodes which are connected to a high voltage ignition transformer. After the ignition period has expired, the diesel oil flow and electrodes are switched off, and the ignition burner is purged with air as long as the main flame is present.

Flame failure during start-up and normal operation is detected by a photo cell mounted on the burner unit and coupled to the control system. By loss of flame, the flame failure equipment will automatically shut down the burner. Furthermore, a number of safety devices are placed in the burner system to protect against burner swing out, high or low oil temperatures, low oil pressure, low pressure of the primary air and secondary air.

Depending on the fuel oil viscosity the burner unit can be provided with electric tracing to ensure a sufficiently low viscosity in the oil pipes to the burner.

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Rotary cup burner

1 General

The rotary cup burner is capable of burning both diesel oil (DO) and heavy fuel oil (HFO).

As the burner is a very vital component of the boiler plant, the operating staff should be thoroughly instructed with regard to the operation of the equipment and the safety regulations. This is due to the fact that burner problems are often caused by incorrect burner operation. With frequently occurring burner faults, the nearest service centre should be consulted.

To ensure a safe and reliable function of the burner it must be inspected at least once a year, in addition to the normal maintenance intervals. The inspection should be carried out by a representative of the supplier or by another competent and qualified person.

It should be clearly understood that for a plant of this complexity it is not practicable to anticipate all the possible circumstances which may arise during the operation life of the plant. Therefore, should circumstances arise in plant operation and maintenance which are not specifically covered by these instructions, the matter should be referred to Aalborg Industries for consideration and advice.

Repairs, adjustments, alterations or changes to plant operations not covered by these instructions should not be effected without reference in writing to Aalborg Industries.

Information in this manual is subject to changes without notice and does not represent a commitment on the part of Aalborg Industries. It is not allowed to copy this manual or part hereof for any purpose other than the purchaser's personal use.

Aalborg Industries shall not be held responsible for any damage or losses caused by the use of this manual.

1.1 Safety regulations

Caution: To ensure a safe burner operation, the burner has to be installed and commissioned by qualified personnel, and all guidelines in these instructions have to be followed.

All safety equipment such as flame sensor equipment and correcting elements may only be replaced by qualified personnel.

Warning: Repair of any of the safety components is NOT permitted. Failure to comply may result in serious injury or death and may cause considerable damages to the boiler plant.

If any unexpected plant behaviour, deterioration or similar event should occur giving rise to any reasonable doubt as to the continued safety of the plant, the matter should be reported at once to Aalborg Industries for their advice.

1.2 Qualified personnel

Qualified personnel according to these operating instructions are persons, who are confident in installing, regulating and commissioning the burner, and who have qualifications to carry out this work, i.e.:

- Persons who are trained to operate electric circuits and units according to the safety standards.
- Persons who are qualified in the use of dangerous fuel according to the relevant laws and regulations.

Handling fuel oil

1 Precautions to be taken with fuel oil

Fuel oil is usually the residue of crude oil after the removal by distillation of the most volatile oils and gasses. Fuel oil in its liquid state is very difficult to ignite in bulk and not capable of spontaneous combustion. However, the vapour is explosive when mixed with air, and being heavier than air, it tends to accumulate in low levels such as bilges and bottoms of tanks where it may remain undiscovered until ignited by a naked light or spark. It is always present in a partly filled oil tank or in a tank which has contained fuel oil and is given off through the vents from tanks in the process of being filled.

If allowed to continue, a leak in any part of the oil burning system may result in an accumulation of this explosive vapour.

Ignition of the vapour can be caused by an open light, electric spark, smoking, spark caused by striking metal, heat from the filament of a broken electric lamp, sparks from funnel or can be communicated from galley or fires under boilers.

Note: An oil fire cannot be extinguished by water, but may be extinguished by sand, steam or chemical fire extinguishers.

An intelligent appreciation of the properties of fuel oil as described above is a better prevention of accident than adherence to any set of rules that may be pre-described.

However, the following detailed precautions should be rigidly enforced:

- When oil is being received, no naked light or electric apparatus liable to spark should be permitted within 20 meters of the oil hose, tank or compartment, containing the tank or the vent from the tank, except when special arrangements are carried out.
- While receiving fuel oil, the storage tank must be closely watched for leaks, and care must be taken that all outlets from the tank, except the vents, are closed.
- No naked lights or electric apparatus liable to spark should be permitted at any time in a compartment containing a fuel oil tank. Electric lamps used in such compartments should have a wire protector around the bulb or be of a type that will ensure the breaking of a circuit through the lamp in the event of the lamp being broken.
- No one should be allowed to enter a fuel oil tank until it has been gas-freed, and any person then entering the tank must have a properly tended life line around his body in order to be hauled out if overcome by gas.
- Electric fuses and switches, unless the enclosed type, should not be permitted in compartments containing fuel oil pumps or piping.
- Care must be taken that the wire-gauze protectors in vent pipes from fuel oil tanks are intact at all times.
- Dampers, where fitted in the uptakes of the boilers, must be kept fully open while burning oil. Otherwise, this may result in dangerous accumulation of gas in the furnace with a resultant blowing out into the boiler or engine room.
- The valves on glass gauges in fuel oil storage or settling tanks should be kept habitually shut. When a reading of the gauge is desired, the valves may be opened, but must be shut again at once.
- In each boiler or engine room fitted for oil burning there should be fire extinguishing apparatus in accordance with the requirements/rules from the authorities and classification societies in question such as, e.g.: Fire hose, permanently coupled and of sufficient length to reach all parts of the boiler or engine room, and either:

- (a) a box containing at least 85 litres (2 cubic ft) of dry sand with a large scoop
- (b) a chemical fire extinguisher of the tank type

- When the fuel oil system has not been in use for a long period, or after joints in the piping have been re-made, the system should be tested “cold” under a pressure at least equal to the working pressure before fires are ignited. During the test a careful inspection for leaks should be carried out.
- Fuel oil should not be habitually heated above 65°C for light oils and 120°C for heavy oils and never above its flash point in any part of the system except in the burners.
- Care must be taken to prevent accumulation of oil or vapour in any place outside the system and in ships particularly in bilges under the furnace. This can be accomplished by rigid cleanliness.

Control valve, type 44-7

1 General description

The purpose of the control valve, type 44-7 is to maintain and control the upstream pressure at the adjusted set point in an oil ring-line system.Figure 2 illustrates the control valve.

The valve consists of the valve body with balanced valve plug and integrated actuator containing a diaphragm and spring assembly.The medium flows through the valve in the direction indicated by the arrow on the body. The upstream pressure to be controlled is transferred through an internal hole in the body to the operating diaphragm and is converted into a positioning force. This positioning force is used to move the valve plug depending on the force of the spring assembly. The set point adjuster can be turned to change the spring force and, consequently, the set point.The valve opens when the upstream pressure increases.

Illustration of the control valve, type 44-7

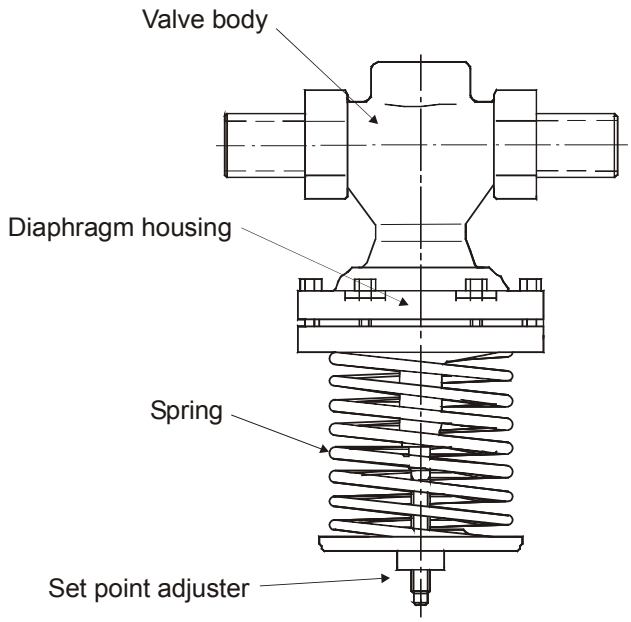


Figure 1 **om6050_06_44-7ax0056880en.wmf**

1.1 Mounting position

The control valve must be installed in horizontal pipelines with the actuator including the spring assembly suspended downwards. It must be ensured that the direction of flow corresponds to the arrow on the valve body.

1.2 Operation

The following work steps must be carried out when the control valve is put into operation:

Step A: Open the shut-off valve downstream of the control valve. Then slowly open the upstream shut-off valve.

Step B: Adjust the upstream pressure to the desired set point on the adjuster at the spring plate. Observe the upstream pressure gauge during adjustment.

Step C: Turn clockwise to increase the set point and anti-clockwise to reduce it.If the oil system is shut down for a period of time perform the following work steps:

Step D: Close the shut-off valve upstream of the control valve.

Step E: Close the shut-off valve downstream of the control valve.

1.3 Maintenance

The control valve is subject to natural wear. Depending on the operating conditions, it should be checked at regular intervals.

If the upstream pressure drops considerably after the burner has been stopped the valve fails to close tightly. This may be caused by a contaminated seat and plug, or when the valve has become un-tight due to natural wear.

If external leakage occurs at the valve body, or if the upstream pressure increases suddenly, check the operating diaphragm and replace it, if necessary.

Servomotor

1 Technical description

1.1 Mode of operation

The positioning signal of a controller or control system switches the reversible synchronous motor to right-handed rotation or left-handed rotation. The motion of rotation of the motor is converted via the gearing into an angular motion of the output shaft.The output shaft is provided with a square, onto which an adjusting lever or a corresponding coupling can be mounted.

The positioning angle of the servomotor is determined by two limit switches(travel dependent switches to indicate end positions) that are actuated by adjustable operating cams. Servomotor with potentiometer response with fail-safe potentiometers has a fixed positioning angle, depending on the potentiometer transmission.

1.2 Design

The electrical components, such as motor, switches, potentiometers and terminal strips are incorporated under the hood – separate from the gearing. All components are easily accessible after removal of hood.The electrical connection is done via screwed cable glands (cable inlets) incorporated in the housing on the terminal.

Dimensions for the servomotor

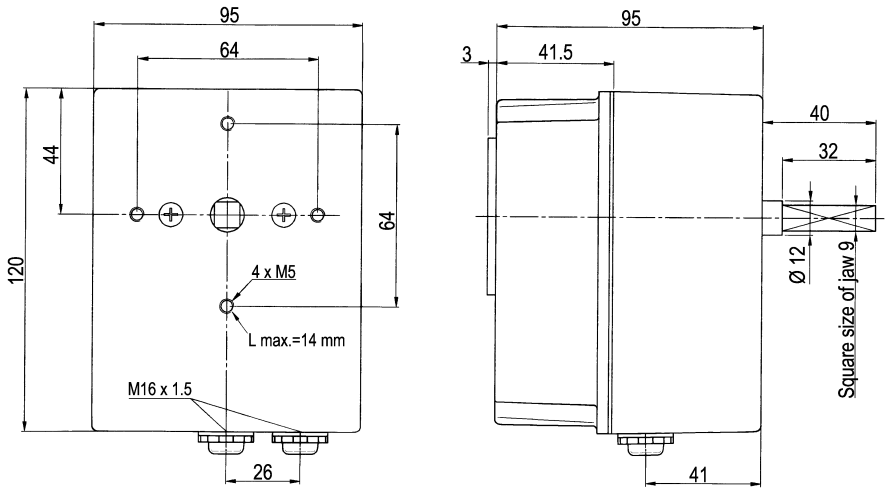


Figure 1 **om5510_07_servomx0053570en.bmp.wmf**

Technical data for the servomotor						
Type	D1					
Rated torque	6 Nm					
Positioning time	90° in 64 sec. response, 120° in 85 sec.					
Positioning angle	90° or 120° (without additional equipment approx. 180° possible)					
Permissible ambient temperature	–20°C up to +60°C					
Mounting position	any, except with the actuator hanging downwards					
Degree of protection (DIN 40050)	IP 54					
Mounting	tap holes 4 x M5, screw in depth max. 14mm					
Output shaft	Square size of jaw 9, shaft length 40mm off housing					
Mechanical position indicator	above scale plate					
Power supply	1~50/60 Hz/230 V; (1~50/60 Hz/24 V, 1~50/60 Hz/110 V)					
Electric connection	via internal terminal strip via 2 compression glands M16 x 1.5					
Operating mode (VDE 0530 part 1)	S4 – 30% c.d.f. – 1200 c/h					
End switching	2 travel dependent signal switches “WE”, max. 250 V AC, for ohm load, max. 10 A for inductive load, max. 10 A for signal lights, max. 1.5 A					
Lubricant for gearing	Klüber Polylub GLY151					
Operating voltage/frequency	1-phase AC 50/60 Hz					
Rated voltage [V/Hz]	24/50	24/60	110/50	110/60	230/50	230/60
Rated current [mA]	130	128	11.5	12.7	21.3	23.5
Power consumption [W]	3.4	3.4	1.5	1.6	4.2	4.8
Power output [W]	0.42	0.5	0.42	0.5	0.42	0.5
Rotation speed [rpm]	250	300	250	300	250	300
Signalling unit	1 (max. 2, with 2 switches) potentiometers 100 Ω, 200 Ω, 500 Ω, 1 k-Ω, 2 k-Ω, 5 k-Ω or 10 k-Ω. max. 1.5 W, wiper current max. 30 mA output positioning angle 90° or 120° response 1 potentiometer 5 k-Ω fail-safe for coupled control (not retrofittable) max. 0.5W, wiper current max.0.1 µA					

Table 1

2 Mounting

2.1 Installation conditions and mounting position

The mounting position for the servomotor must be chosen in a way that:

- it is easily accessible
- sufficient free space is available for taking the hood off, respectively for executing set-up works
- it will be protected against strong heat radiation
- the environmental temperature will not be more than +60°C

The installation position is arbitrary, except when the motor position is facing downwards.

2.2 Electric connection

Check that the electrical wiring is according to the diagram (see Figure 2). The wiring diagram can also be found inside the hood.

Note: The mains cables must always be laid separate from the control lines.

Wiring diagram

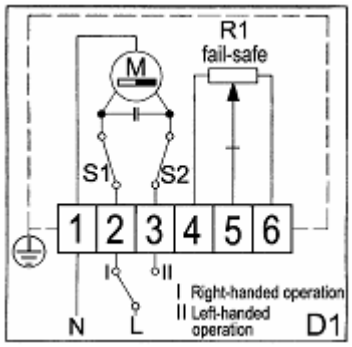


Figure 2 **om5510_07_servomx0053580en.wmf**

3 Adjustment

3.1 Adjustment of the tripping cams

Step A: Un-tighten cheese head screws in the hood and pull it off.

Step B: Travel the actuator electrically into end position.

Step C: Pull position indicator (164) (see Figure 3) off the camshaft.

Step D: Loosen knurled nut (90).

Note: Do not twist self-locking nut (89). The tripping cams are sluggish when turning.

Step E: Adjust corresponding tripping cam (82).Insert an appropriate screw driver (bladethickness 1.2 mm) into one of the slots of the corresponding tripping cam.

Step F: Turn tripping cam until the switching roller of the corresponding switch is lifted and will be switching.

Step G: Check functioning and direction of rotation.Switch S1 switches off the motor in the endposition in clockwise rotation seen on camshaft. Switch S2 switches off the motor in the endposition in anti-clockwise rotation seen on camshaft. This is the default position (factory set).

Step H: After cam adjustment tighten the knurled nut (90).

Step I: Take care for proper operation of the limit switches S1 and S2.

Important: If they do not switch off themotor in their corresponding end positions the motor will be blocked and the gearing will bedamaged.

3.2 Adjustment of the potentiometers P1

Step A: If the tripping cams for S1 and S2 are adjusted correspondingly to the rotation angle stated onthe rating plate, the potentiometers (115) adjust themselves automatically. If necessary, turnpotentiometers from backside with a screw driver to the limit stop or zero position.

Step B: It is important not to overdrive the rotation angle as shown on the rating plate, otherwise thepotentiometer shaft and no correct check-back signal willbe shown. A correct check-back signal requires a fixed transmission ratio between output gearwheeland potentiometer pinion (105). With a smaller output rotation angle than stated on therating plate there will correspondingly be a smaller rotation angle of the potentiometer.

Step C: If a larger rotation angle than shown on the rating plate is required, a different actuator with corresponding and correct transmission ratio must be chosen.

3.3 Adjustment of the position indicator

Step A: The adjustment of the limit and signal switches and also of the potentiometers terminated,push the previously withdrawn position indicator (164) again onto the threaded piece of thecam shaft all the way to limit stop.

Step B: Make a choice which one of the two adhesive scale labels is to be glued onto the positionindicator. Detach corresponding adhesive label and glue it onto the position indicator.

Step C: Direct position indicator with arrow toward red marked switch bolt:
- Position indicator with “0-120 clockwise” scale plate: actuator in end position turning-clockwise(looking onto the camshaft) →S1 is actuated.
- Position indicator with “0-120 anti-clockwise”scale plate: actuator in end position turning anti-clockwise(looking onto camshaft) →S2 is actuated.

Step D: Put on hood (21) and lock with cheese head screws.

Adjustment of the turn actuator

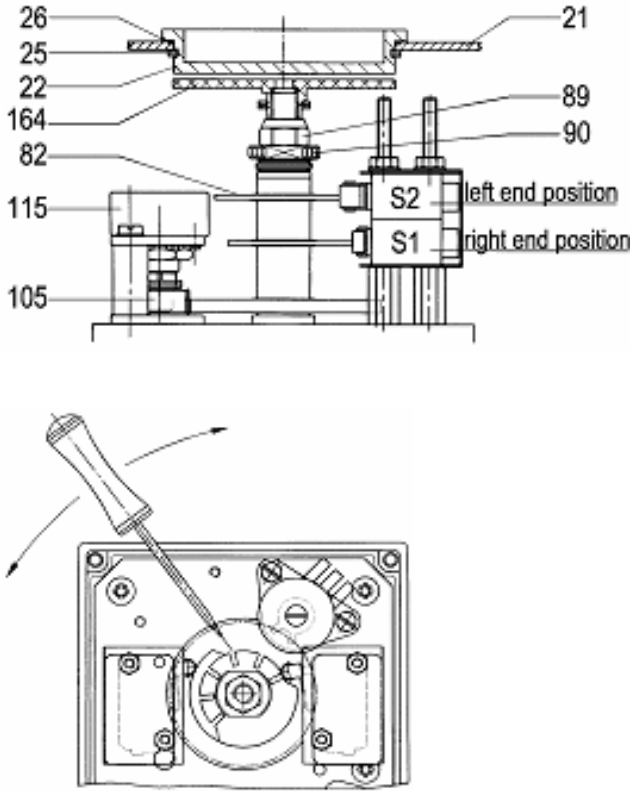


Figure 3 **om5510_07_servomx0053590en.wmf**

Position numbers for servomotor (Figure 3)			
Pos.	**Designation**	**Pos.**	**Designation**
21	Hood	82	Tripping cam
22	Inspection glass	89	Hexagon nut, self-locking
25	Snap ring	90	Knurled nut
26	O-ring	164	Position indicator
115	Potentiometer	105	Potentiometer pinion

Table 2

4 Maintenance

The gearing should be re-lubricated every three years with normal operation of the servomotor, in case of a higher strain after approximately 200,000 rotary motions (required lubricant; please seeTable 1).

Ignition burner

1 General

The rotary cup burner is ignited by a diesel oil ignition burner inserted through the wind box and the swirler. An illustration of the ignition burner is shown in Figure 1.

The ignition burner is fully automatic and is controlled by the control system.

When the rotary cup burner is started, the air damper opens for purge in maximum position. After the fixed purge time has expired, the air damper is set to ignition position and the ignition transformer is energised. The solenoid valves for diesel oil to the ignition burner open, and the ignition burner is ignited by electric high-tension sparks.

The ignition burner must ignite the main burner within the pre-set ignition period. At the end of the ignition period, the solenoid valves for diesel oil are switched off, and the solenoid valve for purge air opens and thus purges the ignition burner for diesel oil.

The solenoid valve for purge air remains activated as long as the main flame is present for cooling of the ignition burner nozzle.

Illustration of the ignition burner

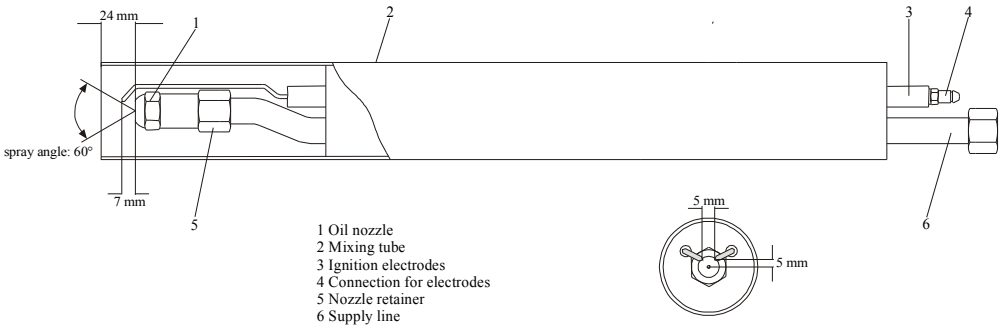


Figure 1 **om5590_22_kbignix0056330en.wmf**

Photo cell

1 Description

The RAR7 detector is used for supervision of yellow burning oil flames. If the photo cell detects a missing flame, the burner stops instantaneously. It is not possible to start the burner before the control system has been reset. With this type of detector, the radiation of the oil flame in the visible band of the light spectrum is used to generate a flame signal. The light-sensitive element is a selenium photo cell. When illuminated, it generates DC voltage which causes a current to flow to the input of the flame signal amplifier in the control unit. Hence, the selenium photo cell is an active detector. The cell is insensitive to infrared radiation. If the burner is started with an illuminated combustion chamber, e.g. due to glowing firebrick, the start sequence of the burner commences, but an alarm for flame failure will be indicated. The number of photo cells for automatic operation and emergency operation depend on the classification society.

1.1 Commissioning

The intensity of the light radiation can be checked by measuring the detector current by means of a DC ammeter (internal resistance 5000 W). Figure 1 shows the measuring circuit. The photo cell is adjusted by changing the position in proportion to the oil flame in order to obtain the maximum detector current.

Note: If the wiring of the photo cell is connected incorrectly, it is not possible to start the oil burner.

Measuring circuit

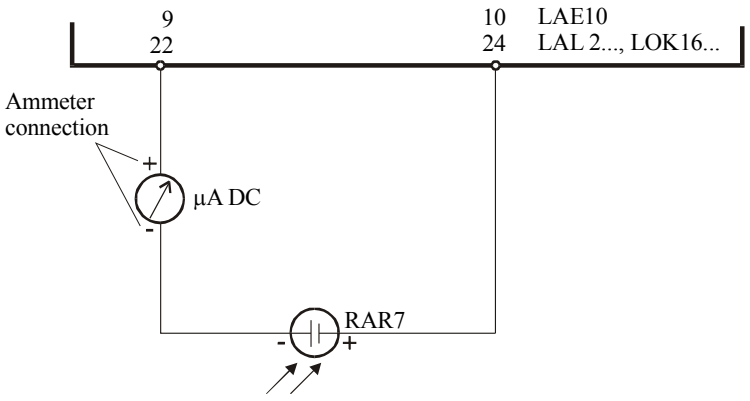


Figure 1 **om8630_01_photcix0059500en.wmf**

Viscosity - temperature chart

1 Description

The preheating temperature can be determined by means of the viscosity - temperature chart shown in Figure 1. In order to use the chart, the viscosity of the fuel oil must be known at a reference temperature.

It should be noted that the preheating temperature should be set somewhat higher than the temperature shown in the chart due to the heat loss between pre-heater and nozzle/ cup.

1.1 Example

The example is based on a pressure jet burner type MS or RMS.

Known:

Oil viscosity: 380 cSt. at 50°C

Required:

Preheating temperature in °C

Procedure to be followed:

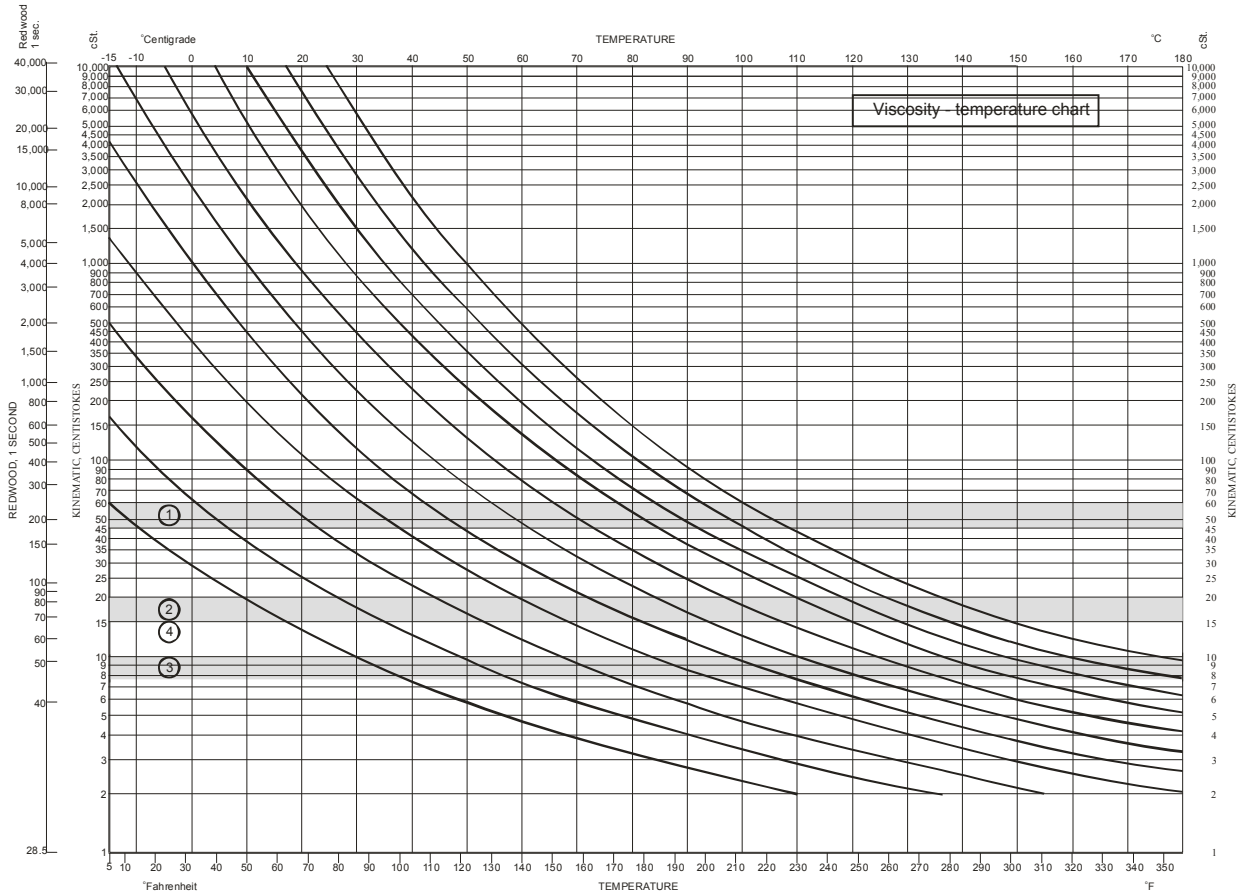
Step A: Follow the reference temperature line at 50°C vertically down to the intersection with the 380 cSt. viscosity line.

Step B: From this point move parallel down with the nearest fuel grade line.

Step C: When the line meets the recommended nozzle viscosity line, go vertically up to the temperature axis.

Step D: At this point read the desired preheating temperature of 150°C.

Viscosity - temperature chart



1 Recommended cup viscosity for rotary cup burners

2 Recommended nozzle viscosity for steam atomising burners

3 Recommended nozzle viscosity for pressure atomising burners type MS, RMS and KBP

4 Recommended nozzle viscosity for pressure atomising burners type KBO

Figure 1 **om9280_01_visc1x0060120en.wmf**

Oil system

1 Description

This section describes the oil system in general terms together with some of the requirements needed to have a safe and reliable burner operation.The burner is designed for burning both diesel oil (DO) and heavy fuel oil (HFO). An illustration of the oil system to the rotary cup burner is shown in Figure 1.

Illustration of the oil system to a rotary cup burner

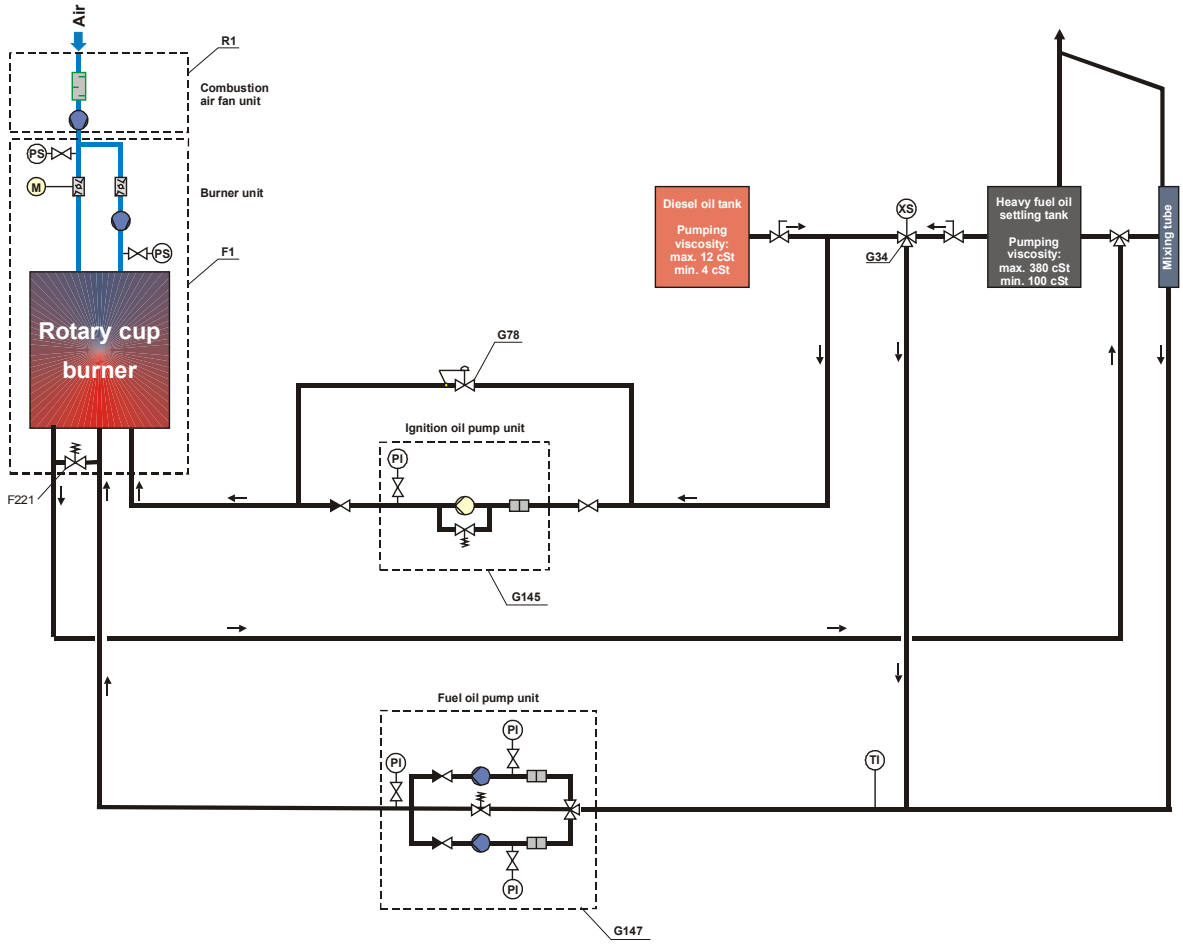


Figure 1 **om5590_47_f_x0056410en.wmf**

Description of position numbers in			
Position No.	**Description**	**Position No.**	**Description**
F1	Burner unit	G78	Pressure relief valve, DO
R1	Fan unit	G145	Ignition oil pump unit
F221	Control valve, FO pressure	G147	Fuel oil pump unit
G34	Three-way valve		

Table 1

The oil system consists of oil tanks for DO and HFO, mixing tube andoil pumps. The supply oil pumps are common for both DO and HFO. The fuel type is selected by manually operating three-way selector valve (G34). The burner fuel system consists of a rotary cup burner, an ignition burner, an oil flow control valve and shut-off valves.

The heavy fuel oil tank may be provided with a heating coil for heating up the fuel oil in the tank to at least 50°C at which temperature it will be possible to pump the oil. The oil temperature in the tank should not exceed approximately 60°C in order to keep the oil temperature controlled by the heater units.Whenever a boiler plant is intended to operate on heavy fuel oil, all pipes carrying fuel oil must be insulated and traced in order to keep a sufficiently low viscosity of the oil. The tracing can be done either by means of steam heating or by means of electric heating cables.

The supply oil pump unit is either a twin type package or a single type with driving motor. The unit is connected to valves and filters facilitating easy shift between pumps for a twin installation.The pumping capacity for the pump is calculated in such a way that there will be sufficient oil flow to the burner in full load condition.The ignition burner always operates on DO whether the rotary cup burner operates on DO or HFO. This secures a reliable ignition.

1.1 DO and HFO operation

Fuel oil pump (G147) isfeed from the tank selected by (G34), either DO or HFO. The fuel oil pump is supplying the burner with the delivery pressure set on (F221) depend-enton fuel type.

Changing from DO to HFO is done by shifting the lever on (G34) allowing the heater to heat the fuel in the burner unit. The fuel oil pressure is depending on fuel type, which will ensure the control valve to open fully on both HFO and DO. The fuel amount is controlled by two curves in the control system.

Burner supply systems

1 General description

This section describes the burner supply systems in general terms together with some of the requirements needed to have a safe and reliable burner operation.

The burner and oil system are designed for both diesel oil and heavy fuel oil operation. An illustration of the burner supply systems for the rotary cup burner, type KBE is shown in Figure 1.

The burner supply systems consist of the fuel oil system, combustion air system, ignition system, and compressed air system.

Illustration of the KBE burner system

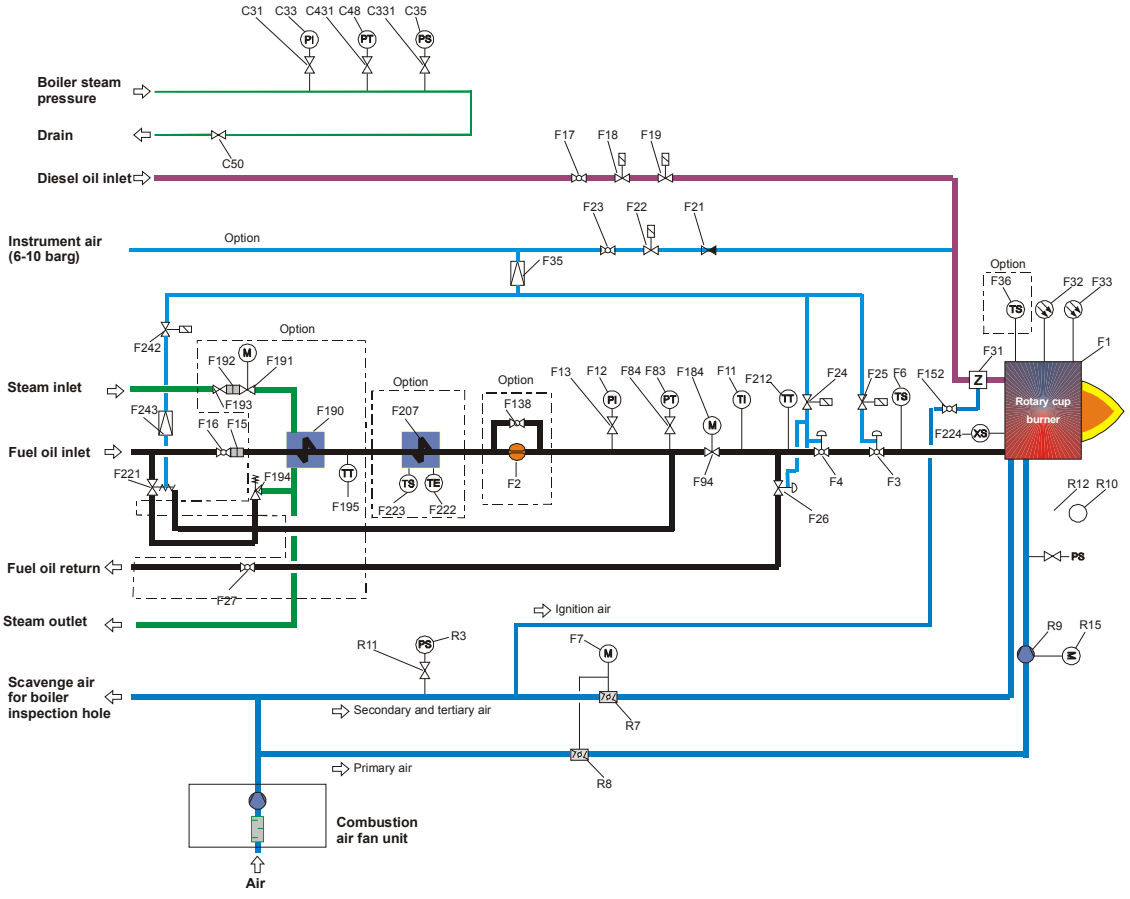


Figure 1 **om5590_48_b_oilsx0056420en.wmf**

Description of position numbers in Figure 1					
Pos. No.	**Description**	**Pos.** No.	**Description**	**Pos.** No.	**Description**
C31	Instrument stop valve	F19	Solenoid valve	F191	Steam flow control valve
C33	Pressure gauge, steam	F21	Check valve	F192	Strainer for steam valve
C35	Pressure switch, max.	F22	Solenoid valve	F193	Stop valve
C48	Pressure transmitter	F23	Stop valve	F194	Excess pressure valve
C50	Drain valve	F24	Solenoid valve	F195	Temperature transmitter
C331	Instrument stop valve	F25	Solenoid valve	F207	Electrical heater
C431	Instrument stop valve	F26	Stop valve with actuator NO	F212	Temperature transmitter
F1	Rotary cup burner	F27	Stop valve, outlet	F221	Control valve fuel oil pressure
F2	Oil flow meter	F31	Ignition burner	F222	Temperature sensor
F3	Pneumatic shut-off valve	F32	Flame scanner	F223	Temperature switch
F4	Pneumatic shut-off valve	F33	Flame scanner	F224	Limit switch –burner in position
F6	Temperature switch, tracing	F35	Air regulator with filter unit	R3	Pressure switch
F7	Servomotor, air damper	F36	Temperature switch, fire in wind box	R7	Air damper, combustion air
F11	Temperature indicator	F83	Pressure transmitter, fuel oil	R8	Air damper, primary air
F12	Pressure gauge, oil	F84	Instrument stop valve	R9	Primary air fan, included in the burner unit
F13	Instrument stop valve	F94	Oil control valve	R10	Pressure switch
F15	Strainer	F138	Stop valve	R11	Instrument stop valve
F16	Stop valve, inlet	F152	Air throttle valve	R12	Instrument stop valve
F17	Stop valve	F184	Servomotor, oil flow	R15	Fan/ burner motor
F18	Solenoid valve	F190	Steam heater for fuel oil		

Table 1

1.1 Fuel oil system

Fuel oil pressure is controlled by the pressure control valve (F221). The fuel flows through the stop valve (F16) and strainer (F15) before entering the heater, which can be either an electricor a steam heater. In case of anelectric heater (F207) the electric input is controlled by a temperature sensor (F222) and solid state relays, the heater is furthermore equipped with temperature switches (F223), one for each heater element. In case of a steam heater (F190) the steam flow is controlled by the temperature transmitter (F195) and a control valve (F191). The heater is active only when HFO is selected on the three-way valve (G34) and a fuel oil pump is running. After the heater the oil is passing through a flow meter (F2), which can be by-passed in case of obstructions. The signal from flow meter is only counting in the summarizer when the burner is running. From the flow meter the oil is passing the pressure transmitter (F83) giving start signal for stand by oil pump (if delivered) in case of low pressure.

When the burner is in operation the pneumatic shut-off valves (F3 and F4) are opened and the oil flow is controlled by the oil flow valve (F94). The fuel oil is then atomised by the high speed rotary cup and injected into the combustion zone and burned. During non firing periods valve (F26) is open, keeping the burner piping hot by circulating HFO, furthermore burner piping system is equipped with electric heat tracing.

The burner load is controlled by the control system, which receives a continuous signal from the steam pressure transmitter (C48). This signal is compared to different set points, feed back signals, and parameters in the control system. The output from the control system is used to control the oil control valve (F94) via the servomotor (F184) and the air damper (R7 and R8) via servomotor (F7).

When the burner is in ignition position, minimum position, maximum position, etc. the air/oil flow is fixed by settings in the control system. Furthermore, the control system is designed to prevent poor combustion (black smoke), which may arise during start-up, stop, and load alterations.

Flame failure during start-up and normal operation is detected by the flame scanner(F32 and F33) mounted on the burner unit and coupled to the control system. By loss of flame, the flame failure equipment will automatically shut down the burner by closing the pneumatic shut-off valves (F3 and F4). Furthermore, a number of safety devices are placed in the burner system to protect against burner swing out (F224), high or low oil temperatures (F212) and low oil pressure (F83).

1.2 Combustion air system

The combustion air fan draws air from the engine room and discharges it into the burner wind box. Depending on burner size the combustion air fan can be mounted directly onto the wind box or separately arranged and connected via an air duct. At the top of the wind box the combustion air damper (R7) and primary air damper (R8) are located.

The primary air damper which is attached to the combustion air damper controls the air flow used to atomise the oil film and to direct the cone of oil into the combustion chamber.

The combustion air passes a distribution ring before it reaches the combustion air opening which is provided with air vanes. Furthermore, a part of the combustion air is led through adjustable tertiary air gaps making a balanced air flow through swirler and combustion air opening.

The burner load is controlled by the boiler steam pressure transmitter controlling the two servo motors, one for oil valve one for air dampers, via the curve bands in the computer. The pressure switches (R3 and R10) secure the burner against too low air pressures.

1.3 Ignition system

The ignition system consists of a separate diesel oil burner (F31) with its own oil supply system, inserted through the wind box and swirler. It operates on the principle of mechanical pressure jet atomisation.

When the burner is started, and the ignition sequence step is reached the solenoid valves (F18 and F19) open and the diesel oil flame is ignited by an electric spark between two electrodes connected to a high voltage ignition transformer. The combustion air to the

ignition burner is supplied from the combustion air system through the air throttle valve (F152).

At the end of the ignition period, the solenoid valves (F18 and F19) to the ignition burner are closed, and the ignition burner is purged by compressed air through the solenoid valve (F22) and the non-return valve (F21) as long as the main flame is present.

1.4 Compressed air system

The compressed air system consists of two systems which operate with different pressures. The air system for the ignition oil burner comprises the stop valve (F23), solenoid valve (F22) and the non return valve (F21). The air system for control of the pneumatic shut-off valves (F3, F4 and F26) consists of the air filter/reduction unit (F35) and solenoid valves (F24 and F25).

Commissioning

1 General

The following commissioning instructions are valid for rotary cup burners type KBE with a standard delivery of individual parts for the burner unit and supply systems from AALBORG INDUSTRIES.

Prior to commissioning, the instructions for the individual parts of the burner unit and supply systems should be studied. The special instructions for the boiler and control system should also be consulted. The instructions should only be considered as a guideline. This is due to the fact that each plant should be commissioned individually to obtain the best burner performance for the specific plant.

Attention: If the burner unit and supply systems include parts, which are not standard delivery from AALBORG INDUSTRIES, the specific instructions for these parts should be ignored in the following sections. The actual instructions for the specific parts should be thoroughly studied and followed during commissioning.

During commissioning of the burner unit and supply systems, it might be necessary to adjust some regulation parameters, timer settings, etc. in the control system to optimise the function of the plant. These adjustments are not described in the following sections, but should be carried out as the optimisation requirements emerge. Please see the instructions for the control system.

1.1 Pre-service checks

Before commissioning of the burner, the following work steps must be carried out:

Step A: Check that the boiler is ready for operation according to the special instructions for the boiler.

Step B: Increase or decrease the water level in the boiler to approximately 50 mm below normal water level.

Step C: Check the electric wiring.

Step D: Switch on the power for the boiler plant and reset the control system. Ensure that the burner is in stopped mode.

Step E: Check that the control system is operational according to the special instructions for the control system.

Step F: Pre-adjust the set points for boiler operation on the pressure switches and/or pressure transmitter.

The position numbers mentioned in the following sections refer to the illustrations in Figure 1 and Figure 2. The position numbers consist of an identification letter and a

position number code. Position numbers with the identification letters “G and R” refer to Figure 1, and position numbers with the identification letter “F” refer to Figure 2.

Illustration of the oil system

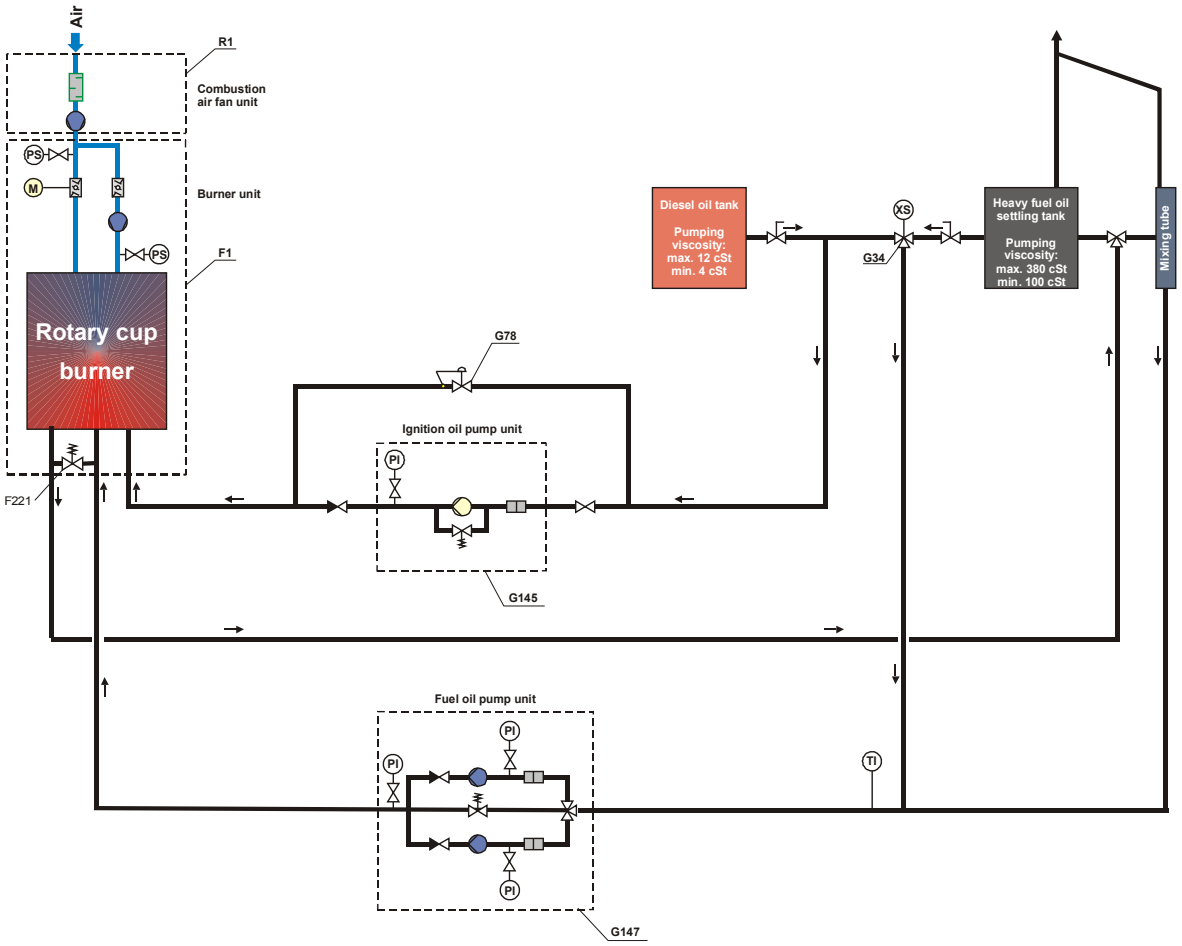


Figure 1 **om5590_100_f_oilx0056250en.wmf**

Illustration of the burner unit and supply systems

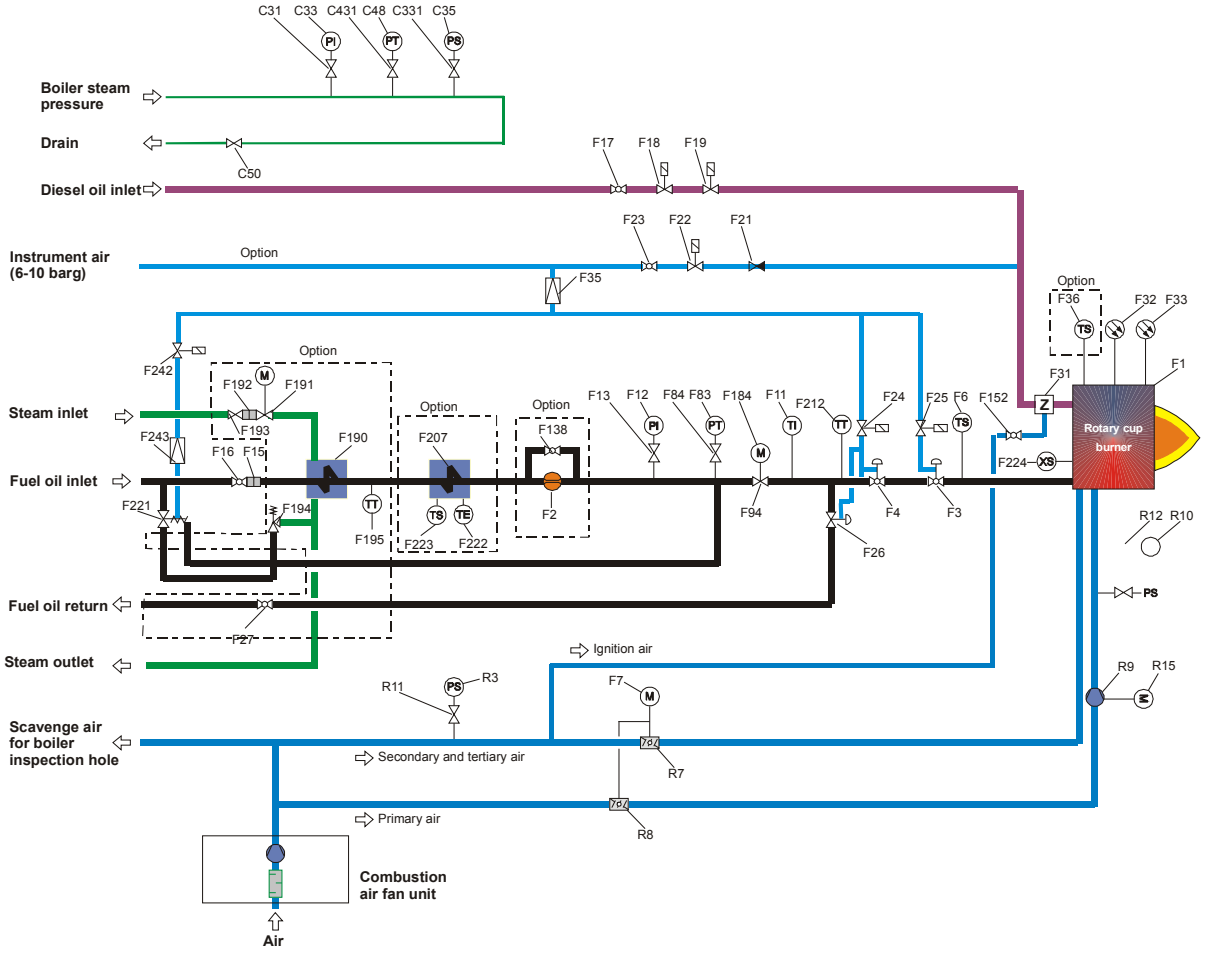


Figure 2 **om5590_100_b_oilx0056240en.wmf**

2 Commissioning

2.1 Commissioning adjustments of the burner unit

On delivery from Aalborg Industries, the burner unit has been pre-adjusted to fit the task. Even though the burner unit has been pre-adjusted, it is advisable to carry out additional checks during commissioning. These checks are described in the following.

2.1.1 Dismantling

Step A: Ensure that the power is switched off before any work is carried out on the burner unit.

Step B: Close the stop valves (F16 and F27).

Step C: Remove the flame scanners.

Step D: Dismount the flexible hose for combustion air to the ignition burner.

Step E: Dismount the pipe for ignition oil and purge air to the ignition burner.

Step F: Remove the two spark plug caps from the ignition burner.

Step G: Unscrew the screw that holds the burner flange and swing out the burner.

2.1.2 Adjustment of the ignition burner

Step A: Check the position of the oil nozzle for the ignition burner. The oil nozzle tip should be inserted 24 mm from the end of the ignition burner mixing tube. Adjust if necessary.

Step B: Check the position of the ignition electrodes. The ignition electrodes should be 7 mm in front and 5 mm above the nozzle tip. The distance between the electrodes should be 5 mm. Adjust if necessary.

Note: An exact setting of the ignition electrodes cannot be given, but has to be established when the ignition burner is in operation.

2.1.3 Check the internal parts of the rotary cup burner

Step A: Rotate the rotary cup by hand to ensure an unobstructed rotation.

Step B: Check that the protrusion between the rotary cup and primary air nozzle is 0.5 - 2.0 mm, see Figure 3.

Step C: Adjust if necessary by loosening the bolts, which fix the primary air nozzle to the burner body. Adjust the primary air nozzle to the desired position, and tighten the bolts again.

Note: An exact distance cannot be given, but has to be determined when the burner is in operation. A large protrusion results in a wide diffusion of the flame, and a small protrusion results in the opposite. The protrusion should be between 0.5-2.0 mm.

Step D: The small adjustable air vanes in the combustion air opening of the burner are factory set to point straight into the furnace. Depending on the furnace shape, the angle may be altered to make the combustion air rotate. However, adjustments should not be made at this point.

Step E: The tertiary gap is factory set to fully open and normally needs no further adjustment.

Illustration of the primary air nozzle

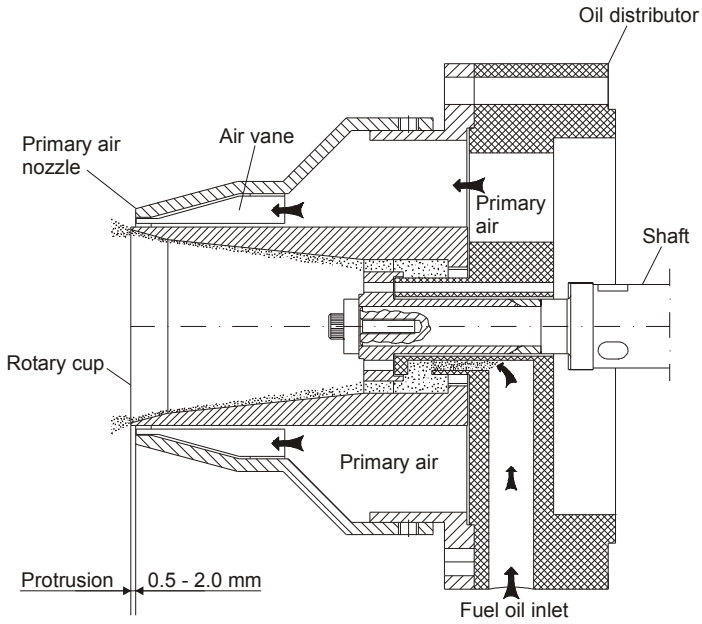


Figure 3 **om5590_100_kbeprx0056270en.wmf**

2.1.4 Assembling

Step A: Close the burner and secure with the screw.

Step B: Mount the flexible hose for combustion air to the ignition burner.

Step C: Mount the pipe for ignition oil and purge air to the ignition burner.

Step D: Mount the two spark plug caps on the ignition burner.

Step E: Insert the flame scanners.

Step F: Switch on power and reset the control system.

2.2 Commissioning of the oil system

When the oil system is commissioned, it should initially be flushed by means of an external pumping system. This must be done to ensure that the oil system is not clogged-up and to prevent foreign objects from entering the pump unit which might cause damage.

Warning: When the oil system is commissioned on diesel oil, the tracing of the piping system must be off.

2.2.1 Commissioning

Step A: Check that oil is present in the diesel oil tank. Open the stop valves, which connect the diesel oil tank to the oil system.

Step B: Select diesel oil on the manually operated three-way valve (G34). Check that the control system indicates diesel oil operation.

Step C: On the three way valve in the return line, choose oil to return to the mixing tube.

Step D: Turn the manually operated three-way valve (or the valves at each pump, dependent on pump type) at the oil pumps (G147) for oil flow through both pumps if a double pump unit is delivered.

Step E: Open the stop valves for the pressure gauges on the oil pump(s).

Note: The stop valves for the pressure gauges on the pump unit should only be opened for pressure control purposes. The stop valves should be closed during normal operation.

Step F: Close the stop valves (G18 and F9) for the pressure switches (G17 and F10).

Step G: Make sure the preheater (F207 if electrical heated or F190 if steam heated) is off.

Step H: Adjust the control valve (F221) to approximately middle position.

Step I: Close the stop valves (F16 and F27) and open the stop valve (F26) completely.

Step J: Rotate the oil pumps by hand to ensure a free and an uninterrupted rotation.

Step K: Adjust the circuit breakers for both pumps to suit full load current of the motors. The current appears from the motor identification plate and/or the electric diagrams.

Step L: The oil pumps must be filled with diesel oil prior to operation. The vent valve installed on the outlet side of the pump unit must be opened until the air has escaped from the suction side of the pump. As soon as diesel oil emerges, the vent valve may be closed.

2.2.2 Flushing the oil system

Step A: Set the burner into manual operation mode in the control system.

Step B: Start one of the oil pumps and check that it is running with the correct direction of rotation. Open the vent valve again until only diesel oil emerges.

Step C: Stop the pump and start the other oil pump (if a twin pump is delivered). Perform the same check and venting procedures.

Note: The pressure relief valve installed in each pump is factory set and checked and should not be adjusted during commissioning.

Step D: Flush the oil system for some time with one oil pump in operation. The total flushing time should be determined with regard to the size of the oil system and the amount of impurities (particles, grease, etc.). Check the complete oil system for leaks.

Note: The set points for the pre-heater safety valves are factory set and checked and should not be adjusted during commissioning.

Step E: After 2/3 of the pre-determined flushing period, open the stop valves (F16 and F27).

Step F: Open the stop valve (F13) for the pressure gauge (F12).

Step G: At the end of the flushing period close the stop valve (F26) completely and open it 1/4 - 1/2 turn. A flow of approximately 100 l/h must be maintained to secure the burner against cold oil at low loads when operating on heavy fuel oil.

Step H: Adjust the oil pressure in the ring line on the control valve (F221) to minimum 1.0 barg and maximum 4.0 barg. The normal pressure should be set to 2.0 barg measured at the pressure gauge (F12).

Step I: Open the stop valves (F84) for the pressure transmitter (F83).

Step J: When flushing is completed, stop the operational oil pump and clean the oil filters in the fuel oil supply pump unit. Vent the oil pumps after the filters have been cleaned.

2.2.3 Check the low alarm and start of stand-by oil pump function

Step A: Adjust the set point for low alarm and start of the stand-by oil pump in the control system.

Step B: Start one of the oil pumps and set the other pump into stand-by mode, if two are delivered.

Step C: Decrease the oil pressure on the pressure control valve (F221) gradually until the set point is reached. The operating oil pump should stop, and the pump in stand-by mode should start. The control system should indicate an alarm. Readjust if necessary.

Step D: Switch operation mode of the pumps and carry out the same procedure.

2.2.4 Check the low oil pressure shut down and trip function

Step A: Adjust the set point for low oil pressure shut down and trip in the control system.

Step B: Decrease the pressure somewhat more until the set point is reached. The operating stand-by pump should stop, and a shut down should be indicated in the control system. Readjust if necessary.

Step C: Readjust the oil pressure to 2.0 barg again on the pressure control valve (F221) and reset the alarms and shut downs.

2.2.5 Check the trip function for overload

Step A: Check the trip function for overload by pressing the test button for the pump in operation on the circuit breaker.

Step B: The pump stops, and a shut down for pump failure should be indicated in the control system.

Step C: When the stand-by pump is started, perform the same test with this pump.

Step D: Reset the circuit breakers and all shut downs after testing.

2.3 Commissioning of the burner unit oil system

Step A: Check that the burner is in stopped mode.

Step B: Apply air to the pneumatic shut-off valves (F3 and F4). Adjust the air pressure to 5-10 barg on the air filter/reduction unit (F35).

Step C: Calibrate the oil servomotor range in the control system. The low and high range should be set to 0º and 90º opening of the oil flow valve respectively.Set the position of the servomotor (F184) to 0º, which can be seen on the outer scale of the oil flow valve (F94). The raw data line in the control system displays a numerical value. This value must be entered in low range menu line.

Step D: Set the position of the oil servomotor to 90º. The new numerical value, which is displayed in the raw data line, must be entered as the high range.

Step E: Set the time to operate the servomotor from 0º to 90º in the control system (normally 66 sec. at 50 Hz and 56 sec. at 60 Hz).

Note: Please consider the following proposed settings as guidelines only as the final settings should be performed after measuring the flue gas (CO_2/O_2 content). The control system settings depend on burner size, furnace pressure, etc.

Step F: Pre-adjust the stand-by position (burner stopped) to 15% in the control system.

Step G: Pre-adjust the ignition position to 15% in the control system.

Step H: Pre-adjust the minimum firing position to 15% in the control system.

Step I: Pre-adjust the full load position to 100% in the control system.

Note: Generally the oil flow valve is designed for 100% oil flow at 90° opening position of the valve. However, in case of burners equipped with a larger valve the full load position should be reduced by settings in the control system.

2.4 Commissioning of the ignition oil system

When the ignition oil pump is commissioned, the burner should be operated in emergency mode. This is because the ignition oil pump only operates in the ignition sequence during burner start, and a number of start/stop operations are necessary to check and adjust the system.

2.4.1 Commissioning

Step A: Open the stop valves located just before and after the ignition oil pump.

Step B: Open the instrument stop valve for the pump pressure gauge.

Note: The stop valve for the pressure gauge should only be opened for pressure control purposes. The stop valve should be closed during normal operation.

Step C: Close the stop valve (F17) on the burner unit.

Step D: Rotate the ignition oil pump by hand to ensure a free and an uninterrupted rotation.

Step E: Adjust the circuit breaker for the ignition oil pump to suit full load current of the motor. The current appears from the motor identification plate and/or the electric diagrams.

Step F: When the ignition oil pump is commissioned, the pump and the pipe system must be filled with diesel oil and ventilated. The vent valve installed in the pump must be opened until the air has escaped. As soon as diesel oil emerges, the vent valve may be closed.

Step G: Operate the ignition burner as described in the chapter “Manual operation” Press the ignition button on the emergency panel and keep it pressed.

Caution: The ignition oil pump should only be operated for a limited period of time during the following commissioning procedure. Due to a continuous re-circulation, the diesel oil is eventually heated. This could damage the pump due to the low viscosity of the heated diesel oil.

Step H: Check that it is running with the correct direction of rotation. Open the vent valve again until only diesel oil emerges.

Step I: Adjust the opening pressure on the pump to 8-10 barg.

Note: The pressure at the ignition oil burner should be approximately 8 barg. This means that the pressure loss resulting from height difference and friction should be taken into consideration.

Note: The pressure relief valve (G78) is factory set and checked and should not be adjusted during commissioning.

2.4.2 Check the trip function for overload

Step A: With the pump in operation check the trip function for overload by pressing the test button on the circuit breaker.

Note: A shut down for ignition oil pump failure will not be indicated. If this failure arises during normal start-up sequence, the burner will trip due to flame failure.

Step B: Reset the circuit breaker after testing and open the stop valve (F17).

Step C: Set the control system into automatic operation mode.

2.5 Commissioning of the burner motor

Step A: Rotate the burner motor by hand to ensure a free and an uninterrupted rotation.

Step B: Adjust the circuit breaker for the burner motor to suit full load current of the motor. The current appears from the motor identification plate and/or the electric diagrams.

Step C: Operate the burner as described in the chapter “Manual operation” Start the burner motor.

Step D: Check that the burner motor is running with the correct direction of rotation.

Note: The rotary cup must rotate in the same direction as the primary air is guided by the swirl ring fitted in the cup shroud.

Step E: Check that the burner motor does not produce any abnormal vibrations or mechanical noises.

Step F: With the burner motor in operation press the test button on the circuit breaker.

Step G: The motor stops, and a shut down for burner motor failure should be indicated in the control system.

Step H: Reset the circuit breaker.

2.6 Commissioning of the combustion air system

When the combustion air system is commissioned, it should be checked that the combustion air fan and, if equipped, the air duct system have been installed and supported correctly.

2.6.1 Commissioning the air servomotor

Step A: Calibrate the air servomotor range in the control system. The low and high range should be set to 0º and 90º opening of the air damper respectively.Set the position of the servomotor (F7) to 0º, which can be seen on the outer scale of the air damper (R7) or by visual check through the inspection door on the wind box. The raw data line in control system displays a numerical value. This value must be entered in low range menu line.

Step B: Set the position of the air servomotor to 90º. The new numerical value, which is displayed in the raw data line, must be entered as the high range.

Step C: Set the time to operate the servomotor from 0º to 90º in the control system (normally 66 sec. at 50 Hz and 56 sec. at 60 Hz).

Note: Please consider the following proposed settings as guidelines only as the final settings should be performed after measuring the flue gas (CO_2/O_2 content). The control system settings depend on burner size, furnace pressure, etc.

Step D: Pre-adjust the stand-by position (stopped) to 0% in the control system.

Step E: Pre-adjust the ignition position to 15% in the control system.

Step F: Pre-adjust the minimum firing position to 15% in the control system.

Step G: Pre-adjust the full load position to 70% in the control system.

2.6.2 Commissioning the primary air damper

Step A: Open the inspection door at the air dampers on the wind box for access to the primary air damper.

Step B: Pre-adjust the primary air damper to a small gap in ignition position and to fully open in full load position of the servomotor, see Figure 4.

Step C: Close the inspection door again.

Illustration of the primary air damper

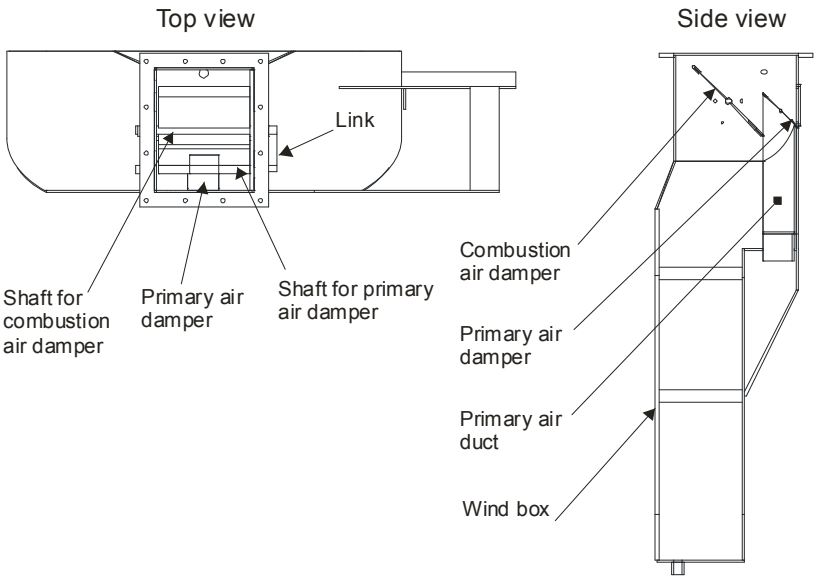


Figure 4 **om5590_100_kbe_px0056260en.wmf**

2.6.3 Commissioning checks and operation

Step A: Rotate the combustion air fan by hand to ensure a free and an uninterrupted rotation.

Step B: Check the electrical wiring at the terminals of the combustion air fan. The wiring must be performed according to the wiring shown in the electrical diagrams.

Step C: Adjust the circuit breaker for the combustion air fan to suit full load current of the motor. The current appears from the motor identification plate and/or the electric diagrams.

Step D: Operate the combustion air fan as described in the chapter “Manual operation”

Step E: Close the air damper and start the combustion air fan. Check that it is running with the correct direction of rotation.

Step F: Check that the combustion air fan and system do not produce any abnormal vibrations or mechanical noises.

Step G: Check the combustion air system for leaks.

Step H: Open the air damper fully and check the current consumption of the combustion air fan. The current must not exceed the full load current stated on the motor identification plate and/or the electric diagrams.

Step I: Check the temperature of the fan bearings. The bearing temperature must be at a constant level after approximately 30 minutes of operation. If the temperature continues to increase, stop the combustion air fan and check the bearings.

2.6.4 Check the trip function for overload

Step A: With the combustion air fan in operation press the test button on the circuit breaker.

Step B: The fan stops, and a shut down for combustion air fan failure should be indicated in the control system.

Step C: Reset the circuit breaker, close the air damper and set the control system into automatic operation mode.

3 Start-up

To continue the commissioning procedures, the oil system must be in normal operation. Furthermore, the ignition oil system and combustion air system must be operational. Prior to the actual start-up of the burner, some additional checks should be carried out with regard to the ignition oil burner and the burner start-up sequence. When these checks are completed, the burner should be commissioned on diesel oil and finally on heavy fuel oil.

Attention: Before and during start-up, the furnace must be checked with regular intervals for oil spillage. If an oil spillage is present in the furnace, the cause must be determined and the failure must be rectified. The furnace should be purged until it is free of oil.

3.1 Additional commissioning checks

3.1.1 Check the ignition burner

Step A: Operate the burner unit as described in the chapter “Manual operation”

Step B: Close the air damper and start the combustion air fan.

Step C: Open the air damper approximately 15-20%.

Step D: Open the small air throttlevalve (F152) attached to the ignition burner.

Step E: Close the stop valve (F17) to the ignition burner.

Step F: Press the push button for ignition and keep it pressed.

Step G: Check the ignition spark between the electrodes. Use the inspection holes to visually check the ignition spark. The ignition electrodes should be adjusted if necessary.

Step H: Release the ignition button and open the stop valves (F17 and F23).

Step I: Press the ignition button again and keep it pressed. Check that the solenoid valves (F18 and F19) are opened.

Step J: Check the ignition flame. Use the inspection holes to visually check the ignition flame. Adjust the ignition electrodes, air throttle valve or opening pressure on the ignition oil pump, if necessary.

Step K: Release the ignition button and check that the solenoid valves (F18 and F19) close.

Step L: Check that the solenoid valve (F22) opens and that the ignition burner is purged with air.

Step M: Check the ignition burner several times to ensure a reliable ignition.

3.1.2 Adjust the set points for the air pressure switches

Step A: With the combustion air fan in operation and the air damper 15-20% open, adjust the air pressure switches (R3 and R10). The switch points should be set just below the actual existing pressure conditions.

Step B: Close the air damper and stop the combustion air fan.

3.1.3 Check the burner start-up sequence

In automatic mode, the start/stop sequences of the burner are handled by the control system. A condition for the initiation of the start-up sequence is that no safety interlock shut downs are present. If a safety interlock shut down is present, the cause must be corrected.

The following check of the start-up sequence should be carefully monitored on site to demonstrate the correct function of the start-up sequence locally. The start sequence is also indicated in the control system.

Step A: Set the burner into manual operation mode from the control system.

Step B: Start one of the fuel oil pumps and set the other into stand-by mode (if delivered).

Step C: Close the stop valve (F16).

Step D: Check that the air damper (R7) is in closed position and that the oil flow valve (F94) is in stand-by position.

Step E: Start the burner from the control system.

Step F: Observe that the combustion air fan starts and that the air damper is moved into purge position.

Step G: Observe that the furnace is purged for a period of time (minimum 30 seconds) before the servo motor closes the air damper to ignition position.

Step H: Check that the oil flow valve is in ignition position.

Step I: Check that the ignition burner is ignited. Use the inspection holes to visually check the ignition flame.

Step J: Check that the pneumatic shut-off valves (F3 and F4) change position.

Step K: Because the stop valve (F16) is closed, the burner start-up fails due to flame failure. Check that the pneumatic shut-off valves (F3 and F4) change position immediately after the flame failure shut down appears.

Step L: Observe that diesel oil to the ignition burner is shut-off and that it is purged with air.

Step M: Open the stop valve (F16) and reset all shut downs.

3.2 Commissioning on diesel oil

When the burner is commissioned, the boiler pressure and temperature must not be intensified too rapidly as this might cause stresses in the boiler. The burner should be kept in minimum firing position during the first commissioning period. The burner should also only be operated at relatively short intervals during the initial start-up. For specific information on the allowed temperature rise for the boiler see chapter “Lighting-up Curve”.

3.2.1 Operation of the burner

Step A: Open the by-pass valve (F138) for burner units equipped with oil flow meter. This must be done to protect the flow meter against impurities during the first operation.

Step B: Start the burner in manual operation mode from the control system.

Step C: Check that the burner ignites when the pneumatic shut-off valves (F3 and F4) open and that it remains ignited when the ignition burner is shut-off.

Note: A number of starts may be necessary before the burner ignites. If ignition of the burner fails despite of several attempts, adjust the ignition load setting, air/fuel ratio or correction factor for air/fuel ratio from the control system. It might also be necessary to re-adjust the primary air damper setting.

Step D: Check that the burner is in minimum firing position after start-up.

Step E: Check that the flame does not pulsate. Adjust the correction factor, air/fuel ratio, and/or minimum load if necessary

Step F: Check the shape and colour of the flame. Measure the CO_2 and/or the O_2 content and adjust the correction factor or air/fuel ratio if necessary.

Step G: Check the colour of the flue gas. Measure the soot spot No. It should not exceed a soot spot No. of 1-3 (Bachrach). Adjust the correction factor or air/fuel ratio if necessary.

Note: The final adjustment of the combustion parameters, e.g. air/fuel ratio, minimum load, primary air damper setting, etc. should be carried out when the burner operates on heavy fuel oil as this is the main fuel. It is therefore advisable to adjust the correction factor instead of the air/fuel ratio when the burner is commissioned on diesel oil.

3.2.2 Check the stop sequence

Step A: The stop sequence should also be carefully monitored on site. Operate the burner for a few minutes and stop it from the control system.

Step B: Check that the pneumatic shut-off valves (F3 and F4) are closed.

Step C: Check that the burner motor stops.

Step D: Check that the combustion air fan stops.

Note: Depending on burner size some combustion air fans are set for a minimum operation time of 20 minutes in automatic mode to avoid more than three starts per hour.

Step E: Check that the oil flow is in stand-by position and that the air damper is closed.

Step F: Check that the furnace is free of oil spillage.

Step G: Close the by-pass valve (F138) for burner units equipped with oil flow meter.

3.2.3 Check the safety interlock shut down for flame failure equipment

Step A: When the burner is in operation, check the flame failure equipment by removing the flame scanners from the holder and cover the sensor. The burner stops, and a shut down for flame failure is indicated in the control system. Reset all shut downs.

Step B: Check and simulate a glowing furnace by using a flash light pointed directly at the flame scanner.

Step C: Set the burner into start mode. The control system should indicate a shut down for photo cell failure.

Step D: Mount the flame scanner into the holder and reset all shut downs.

3.2.4 Check the safety interlock shut down for burner swing out

Step A: When the burner is in operation, unscrew the screw that holds the burner flange and carefully swing out the burner a few mm. The burner stops, and a shut down for burner swing out is indicated in the control system.

Step B: Close the burner and secure with the screw. Reset all shut downs.

3.2.5 Setting and testing of the minimum air pressure switch for combustion air

Step A: When the burner is in operation, check the minimum air pressure switch by increasing the switch point for the switch. Unscrew the protective cover of the switch and increase the switch point at the setting wheel. The burner stops, and a shut down is indicated in the control system.

Step B: Decrease the switch point again. Reset the shut down after testing and start the burner again.

Step C: Measure the pressure at the connection point of the switch when the burner operates at minimum load. Use this value for determination of the switch point. It should be approximately 80% of this value.

Step D: Adjust the setting wheel of the minimum pressure switch to the calculated value and mount the protective cover.

3.2.6 Setting and testing of the minimum air pressure switch for primary air

Step A: When the burner is in operation, check the minimum air pressure switch (R10) by increasing the switch point for the switch. Unscrew the protective cover of the switch and increase the switch point at the setting wheel. The burner stops, and a shut down is indicated in the control system.

Step B: Decrease the switch point again. Reset the shut down after testing and start the burner again.

Step C: Measure the pressure at the connection point of the switch when the burner operates at minimum load. Use this value for determination of the switch point. It should be approximately 80% of this value.

Step D: Adjust the setting wheel of the minimum pressure switch to the calculated value and mount the protective cover.

3.2.7 Check the safety interlock shut down for low oil pressure

Step A: When the burner is in operation, check the low oil pressure shut down and trip function as described in the paragraph “Commissioning of the oil system”. The burner stops, and a shut down for low oil pressure is indicated in the control system. Reset the shut downs after testing.

3.2.8 Check the trip function for burner motor overload

Step A: When the burner is in operation, check the trip function for burner motor overload by pressing the test button for the burner motor on the circuit breaker.

Step B: The burner motor stops and a shut down for burner motor failure is indicated in the control system.

Step C: Reset the circuit breakers and all shut downs after testing.

3.2.9 Check the safety interlock shut down for too low water level

Step A: When the burner is in operation, perform a live test of both of the water level safety devises. One of the alarms must be deactivated while testing the other and opposite.

Step B: Decrease the water level in the boiler by means of the blow-down valves until the water level has fallen below the too low level mark. After the response delay has expired the burner stops and a shut down is indicated in the control system.

Step C: Increase the water level in the boiler and reset the shut down. Perform the same test for the other safety device.

Step D: Activate all safety devices again.

3.2.10 Check the safety interlock shut down for high steam pressure

Step A: When the burner is in operation, raise the boiler pressure until the set point for high alarm is reached. The control system must indicate a high alarm.

Step B: With the burner in operation, check the shut down and trip function for high steam pressure. Raise the steam pressure until the burner stops. A shut down is indicated in the control system.

Step C: If the boiler safety system is equipped with more than one high steam pressure shut down it is necessary to perform the same check with both high steam pressure shut downs. One of the shut downs must be deactivated while testing the other and opposite.

Step D: With all steam pressure safety interlocks activated, reset all alarms and shut downs.

3.2.11 Check the active safety interlock shut downs in emergency operation

Step A: Operate the burner as described in the chapter “Manual operation”.

Step B: When the burner is in operation, check the active safety interlock shut downs for flame failure, too low water level, and low combustion air as described previously.

3.3 Commissioning on heavy fuel oil

When the burner has been commissioned on diesel oil and service steam is available for heating, the final commissioning on heavy fuel oil can be carried out.

3.3.1 Change of fuel

Step A: Stop the burner.

Step B: Check that oil is present in the heavy fuel oil service tank. Open the stop valve, which connects the service tank to the oil system. To avoid cavitation of the pumps, the viscosity of the oil in the heavy fuel oil tank should not exceed 380 cSt. If necessary, the oil tank should be heated.

Step C: Open the stop valve (F193) before the preheater if a steam heater is delivered (F190).

Step D: Select heavy fuel oil on the manually operated three-way valves (G34). Check that the control system indicates heavy fuel oil operation.

Step E: Adjust the oil temperature in the control system. The viscosity of the oil at the rotary cup should be between 45-60 cSt. The pre-heating temperature can be determined by means of the chart in the chapter "Viscosity-temperature chart".

Step F: Check that the tracing systems for the oil system and the burner unit are operational.

Step G: Check the set points for low shut down and high shut down on the temperature switch in the control system. Adjust if necessary.

3.3.2 Operation on heavy fuel oil

When the burner is commissioned on heavy fuel oil, final adjustments of the combustion process should be carried out to achieve high quality performance data. The aim is to operate the burner with lowest possible O_2 content and highest possible CO_2 content without the risk of an uncompleted combustion (black smoke). At the same time the reliability of the burner must be ensured.

A number of initiative actions can be performed to improve and optimise the combustion process such as adjusting the air/fuel ratio, primary air damper opening, air vanes in the combustion air opening, tertiary gap and cup protrusion. Adjustment of the air/fuel ratio is made from the control system whereas the others are mechanical adjustments.

The air/fuel ratio should be checked and adjusted through the complete burner range to ensure a correct combustion. The air/fuel ratio can be checked by measurements of the soot spot No. and the O_2 content and/or the CO_2 content in the flue gas. The visual appearance of the flame should also be checked. If the amount of combustion air to the burner for a given oil flow is too low, the combustion will be uncompleted, and it produces black smoke. Although the O_2 content is low, and the CO_2 content is high, the air flow should be increased. If, on the other hand, the O_2 content is high and the CO_2 content is low, it indicates that the air flow for the combustion process must be decreased.

The primary air flow is an important factor for the combustion process. Too much primary air causes an unstable flame and can possibly even blow it out. The flame also has a tendency to pulsate at low firing rate. Too little primary air causes bad atomising of the oil, and the flame will have a tendency to touch the swirler. Furthermore, if the oil temperature is too high, the flame becomes unstable. Too low oil temperature causes bad atomising. The primary air flow can be adjusted as described in the section “Commissioning the primary air damper”

The shape of the flame can be adjusted by changing the position of the adjustable air vanes in the combustion air opening. The air vanes are factory set to point straight into the furnace. Depending on the furnace shape, the angle may be altered to make the combustion air rotate. The flame should be adjusted to a shape in which minimum contact to the furnace walls is achieved. The adjustment should be checked when the burner is in full load condition. If the angle of the air vanes is too wide, the shape of the flame may become too wide, and it may hit the walls of the combustion chamber. If the angle of the air vanes is too low, the flame may hit the backside wall of the combustion chamber. In both cases the flame has a tendency to deposit soot on the furnace walls.

The tertiary gap is factory set to fully open and normally needs no further adjustment. The purpose of the tertiary air is to stabilise the flame, cool the swirler and burner parts. At low firing rate the tertiary air pressure should be approximately 15 mm WC. If the air gab is too small a vacuum may be generated on the inlet side of the swirler. This

causes the flame to be sucked against the swirler ring. The flame heats up the swirler and may cause damage to it. Soot will be deposited on the swirler and ignition burner.

Finally the shape of the flame can also be altered by changing the protrusion between the rotary cup and the primary air nozzle. A large protrusion results in a wide diffusion of the flame, and a small protrusion results in the opposite. The protrusion should be between 0.5-2.0 mm.

The following commissioning steps imply that the lighting-up procedure of the boiler is completed and that a sufficient load demand is present to carry out adjustments at 100% load.

Step A: Set the correction factor of the air/fuel ratio in neutral position (correction factor = 100) in the control system. The correction factor is used to adjust the air/fuel ratio if the calorific value of the oil is changed, e.g. when the bunker type is changed.

Step B: Start the burner in manual operation mode and check that it ignites when the pneumatic shut-off valves open and remains ignited when the ignition burner is shut-off. Adjust the ignition load, air/fuel ratio and/or carry out burner adjustments if necessary.

Step C: Start the burner several times to ensure a reliable ignition of the burner.

Step D: Adjust the oil flow to minimum load.

Step E: Check that the flame is stable and does not pulsate when the burner operates at minimum load. Carry out measurements of the soot spot No. and O_2 content and/or CO_2 content. Adjust the minimum load, air/fuel ratio and/or primary air flow if necessary.

Step F: The shape and colour of the flame must also be checked, adjust if necessary.

Step G: Carry out the same measurements through the complete burner range in steps of 10%. Adjust the air/fuel ratio if necessary. At full load the shape of the flame should be checked, and the air vanes in the combustion air opening and/or cup protrusion should be adjusted if necessary.

Step H: The measurements obtained for the combustion process through the complete range together with a number of comparable combustion data should be noted and inserted in the chapter "Measurements and settings".

Note: When any adjustments are carried out on either primary air, combustion air, tertiary air, or protrusion, it is important not only to check the flue gas contents but also to visually check the combustion with regard to length, shape and colour of the flame frequently. Attention should be drawn to the combustion at the rotary cup and swirler.

Note: The main fuel for the rotary cup burner is heavy fuel oil. After the final adjustment on heavy fuel oil at the correct viscosity, the air/fuel ratio suits the burner over the whole range of the oil flow. Further burner adjustment should be carried out solely by adjusting the correction factor and oil viscosity.

3.3.3 Check the safety interlock shut down for high and low oil temperature

Step A: When the burner is in operation, increase the oil temperature gradually until the set point for high shut down is reached. The burner stops, and a shut down is indicated in the control system.

Step B: Decrease the temperature and reset all shut downs. Start the burner again.

Step C: Decrease the temperature gradually until the set point for low shut down is reached. The burner stops, and a shut down is indicated in the control system.

Step D: Set the temperature control valve back to the previous set point and reset all shut downs.

3.3.4 Additional function checks

Step A: Check/adjust additional safety interlock shut downs if provided. A number of shut downs might be included in the safety interlock circuit depending on the specified function and/or the classification society.

Operating instructions

1 General

The following operation instructions are valid for rotary cup burners of type KBE with a standard delivery of individual parts for the burner unit and supply systems from AALBORG INDUSTRIES.

Attention: If the burner unit and supply systems include parts, which are not standard delivery from AALBORG INDUSTRIES, the specific instructions for these parts should be ignored in the following sections. The actual instructions for the specific parts should be thoroughly studied and followed during operation of the burner.

The operation instructions in the following sections describe the normal burner operations with regard to preparation for start-up on the selected fuel type, normal start/stop, change of fuel, etc. It is implied that the boiler, burner, control system, and additional equipment for the boiler plant have been commissioned and are fully operational.

1.1 Descriptions

1.1.1 Descriptions

In the following sections various operating procedures are described such as:

- Diesel oil mode
- Heavy fuel oil mode
- Normal start/stop
- Change from diesel oil operation to heavy fuel oil operation
- Change from heavy fuel oil operation to diesel oil operation
- Change of heavy fuel oil bunker type
- Prolonged stop

1.1.2 Position numbers

The position numbers mentioned in the following sections refer to the illustrations in Figure 1 and Figure 2. The position numbers consist of an identification letter and a position number code. Position numbers with the identification letters “G and R” refer to Figure 1, and position numbers with the identification letter “F” refer to Figure 2.

Illustration of the oil system

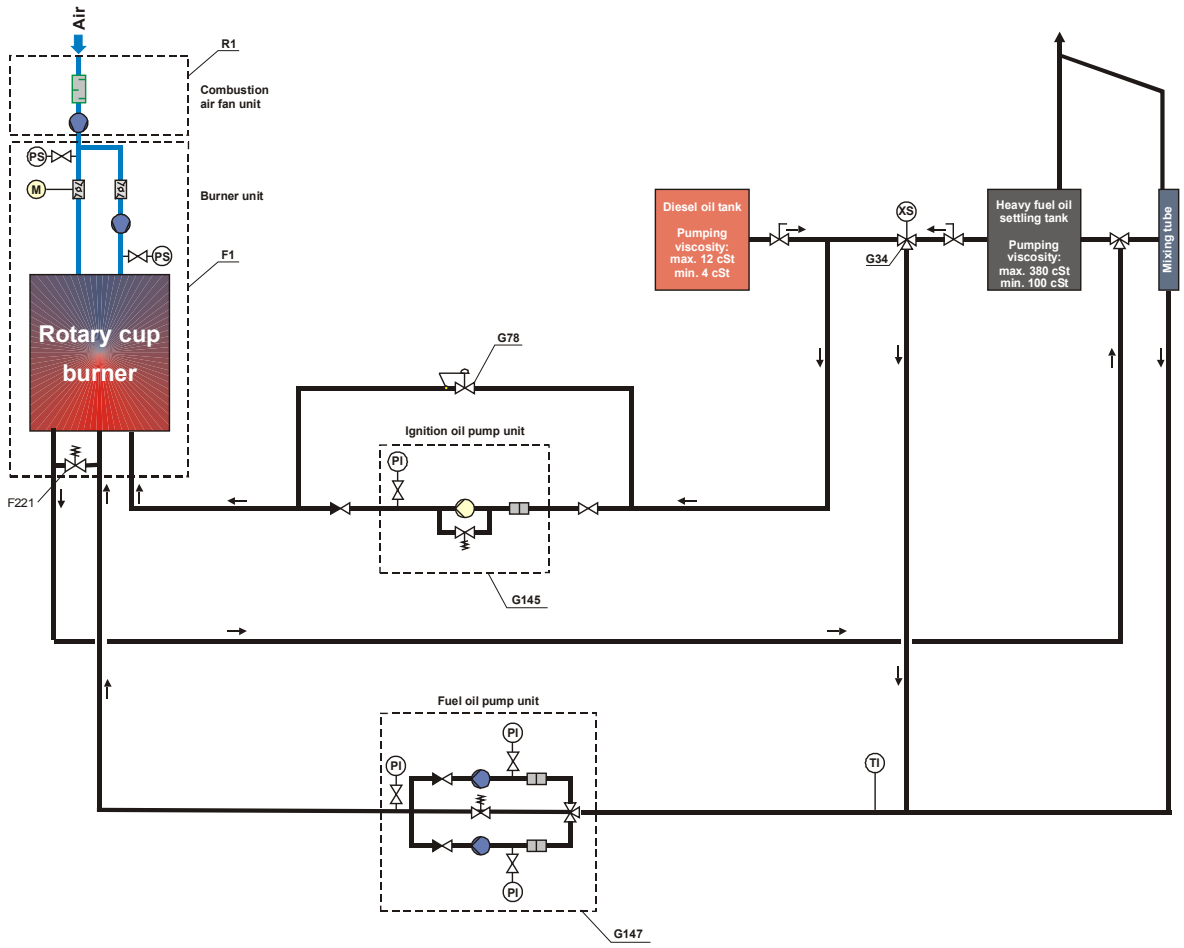


Figure 1 **om5590_61_f_oilsx0056500en.wmf**

Illustration of the burner unit and supply systems

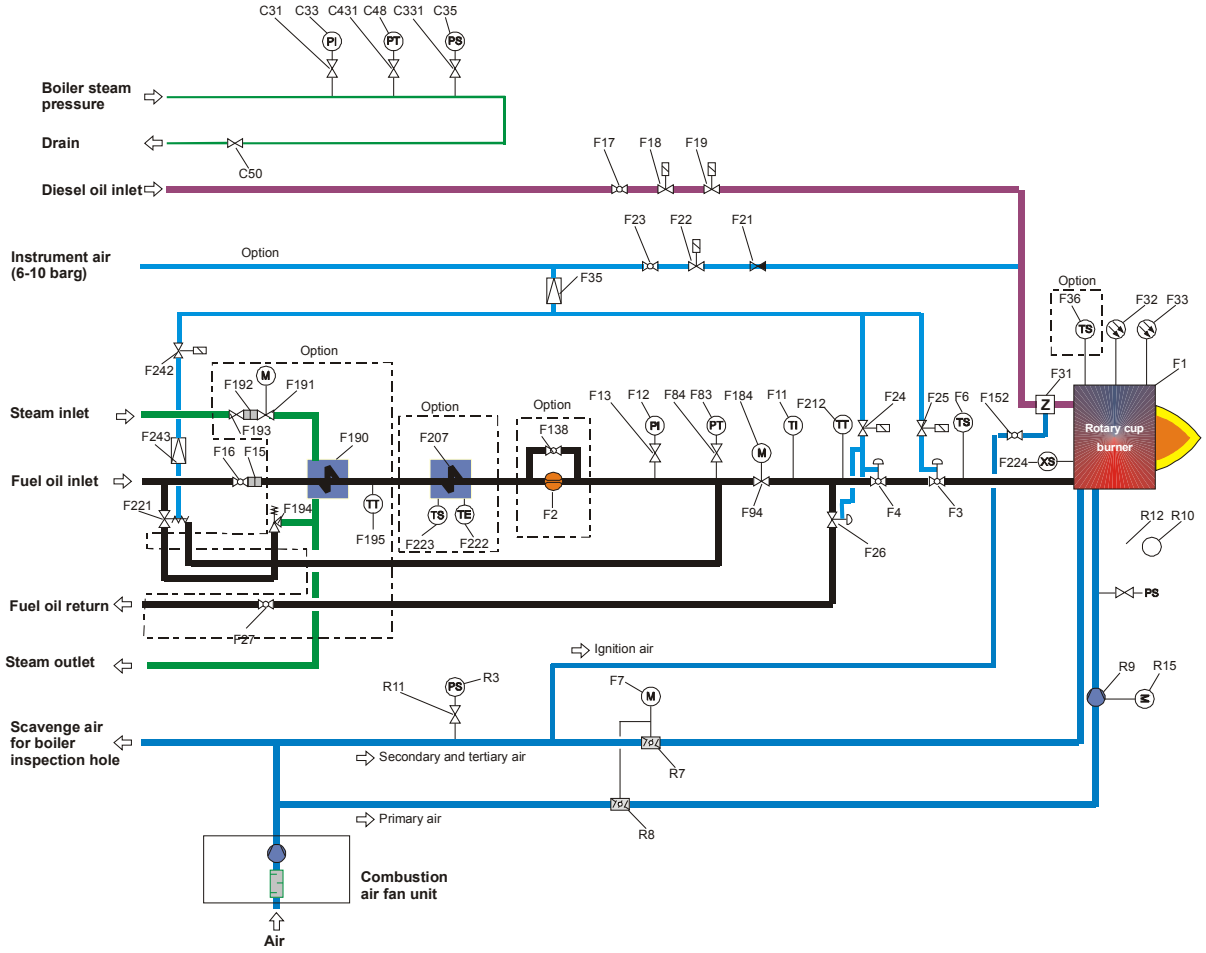


Figure 2 **om5590_61_b_oilsx0056490en.wmf**

2 Operating Instructions

Note: Before any operation, secure that steam valve on boiler to instruments for each steam pressure instruments, is open.

2.1 Diesel oil mode

This section describes the actions that must be carried out before the burner unit and oil system are operational on diesel oil.

Step A: Check that oil is present in the diesel oil tank. Open the stop valves, which connect the diesel oil tank to the oil system.

Step B: Select diesel oil on the manually operated three-way valve (G34). The control system will indicate diesel oil operation.

Step C: Make sure the three way valve in return line leads oil to the mixing tube and not to the oil tank.

Step D: Turn the manually operated three-way valve (or the valves at each pump, dependent on pump type) at the oil pumps (G147) for oil flow through both pumps.

Step E: Open the stop valves for the pressure gauges on the oil pumps.

Note: The stop valves for the pressure gauges on the pump unit should only be opened for pressure control purposes. During normal operation, the stop valves should be closed.

Step F: Open the stop valves (F84 and F13) for the pressure transmitter (F83) and pressure gauge (F12).

Step G: Open the stop valves (F16 and F27).

Step H: Open the stop valves located just before and after the ignition oil pump.

Step I: Open the instrument stop valve for the pump pressure gauge.

Note: The stop valve for the pressure gauge should only be opened for pressure control purposes. The stop valve should be closed during normal operation.

Step J: Open the stop valves (F17 and F23).

Step K: Set one of the oil pumps into operation mode and the other oil pump into stand-by mode. If the burner is in automatic operation mode, the oil pumps will not be operational before start-up of the burner is initiated.

Step L: The burner is now ready for operation.

2.2 Heavy fuel oil mode

This section describes the actions, which must be carried out before the burner unit and oil system are operational on heavy fuel oil.

Step A: Check that oil is present in the heavy fuel oil service tank. Open the stop valve, which connects the service tank to the oil system. To avoid cavitation of the pumps, the viscosity of the oil in the heavy fuel oil tank should not exceed 380 cSt. If necessary, the oil tank should be heated.

Step B: Select heavy fuel oil on the manually operated three-way valve (G34). Check that the control system indicates heavy fuel oil operation.

Step C: Open the stop valve from the burner return line to the mixing tube and close the stop valves to the oil tanks.

Step D: Turn the manually operated three-way valve (or the valves at each pump, dependent on pump type) at the oil pumps (G147) for oil flow through both pumps.

Step E: Open the stop valves for the pressure gauges on the oil pumps.

Note: The stop valves for the pressure gauges on the pump unit should only be opened for pressure control purposes. During normal operation, the stop valves should be closed.

Step F: Open the stop valves (F84 and F13) for the pressure transmitter (F83) and pressure gauge (F12).

Step G: Open the stop valves (F16 and F27).

Step H: Start one of the oil pumps.

Step I: Check that the tracing systems for the oil system and the burner unit are operational.

Step J: Check that the oil pressure in the ring line is at the correct level, set the other pump (if delivered) into stand by mode.

Step K: Adjust the oil temperature on the temperature control. The viscosity of the oil at the rotary cup should be between 45-60 cSt. The pre-heating temperature can be determined by means of the chart in the chapter "Viscosity-temperature chart".

Step L: Open the stop valves located just before and after the ignition oil pump.

Step M: Open the instrument stop valve for the pump pressure gauge.

Note: The stop valve for the pressure gauge should only be opened for pressure control purposes. The stop valve should be closed during normal operation.

Step N: Open the stop valves (F17 and F23).

Step O: The burner is now ready for operation.

2.3 Normal start/stop

The control system automatically starts, stops, and regulates the burner in normal operation depending on the steam demand. When the steam pressure is below the set point for operation, the burner commences the start-up sequence.

In modulation free mode, the control system attempts to maintain the steam pressure at the desired set point by regulation of the burner load. The burner can be regulated through the complete load range from minimum firing load to full load.

However, should the steam demand decrease below the minimum firing load of the burner, the steam pressure will increase to the set point for burner stop. The burner stops and remains stopped until the set point for burner operation is reached again.

2.4 Change from diesel oil operation to heavy fuel oil operation

When the fuel supply is changed from diesel oil operation to heavy fuel oil operation, the following work steps should be carried out:

Step A: Check that oil is present in the heavy fuel oil service tank. Open the stop valve, which connects the service tank to the oil system. To avoid cavitation of the pumps, the viscosity of the oil in the heavy fuel oil tank should not exceed 380 cSt. If necessary, the oil tank should be heated.

Step B: Select heavy fuel oil on the manually operated three-way valves (G34). The control system will indicate heavy fuel oil operation.

Step C: Check that the tracing systems for the oil system and the burner unit are operational.

Step D: Check the heavy fuel oil temperature. The viscosity of the oil at the rotary cup should be between 45-60 cSt. The pre-heating temperature can be determined by means of the chart in the chapter "Viscosity-temperature chart".

Note: When the fuel type is changed from diesel oil to heavy fuel oil, a shut down for low oil temperature may arise. If the burner is in operation, it will stop due to this shut down.

2.5 Change from heavy fuel oil operation to diesel oil operation

When the fuel supply is changed from heavy fuel oil operation to diesel oil operation, the following work steps should be carried out:

Step A: Check that oil is present in the diesel oil tank. Open the stop valves, which connect the diesel oil tank to the oil system.

Step B: Select diesel oil on the manually operated three-way valve (G34). The control system will indicate diesel oil operation.

Step C: Check that fuel oil heater (F207 if electrical or F190 if steam) is not working.

Step D: Check that the tracing of the piping system is off when the burner is in diesel oil operation.

Caution: Heating of diesel oil in the piping system must be avoided.

2.6 Change of heavy fuel oil bunker type

If the heavy fuel oil bunker type is changed and the calorific value of the oil changes, the air/fuel ratio should be adjusted to obtain the correct combustion data. This is done by changing the correction factor of the air/fuel ratio in the control system. If the correction factor is set to a value above 100, the air flow for the combustion process decreases. If the correction factor is set to a value below 100, the air flow for the combustion process increases. This means that if the calorific value of the oil increases, the value of the correction factor should be decreased to obtain the same combustion data and visa versa.

2.7 Prolonged stop

When the boiler plant is stopped for a long period of time, the oil system including the pre-heater should be flushed with diesel oil before the plant is shut down. Furthermore, the tracing must be switched off.

Emergency operation

1 General

In the rare event of a total break down of the control system, the burner unit with belonging systems maybe operated in emergencyoperation (also called manualoperation). Due to the fact that the majority of the safety interlocks trips and alarms are overruled in emergency operation mode, the safety precautions for the plant must be very carefully observed.

Please note that in emergency operation mode the safety interlocks are reduced to:

- Too low water level
- Flame failure
- Low combustion air pressure

Warning: When the burner operates in emergency mode, it is very important that the boiler plant is carefully and continuously supervised by the ships engineering personnel. Pay special attention to the steam pressure and water level.

Note: The automatic water level regulation, the automatic oil temperature, and the automatic steam pressure regulationare not operational in emergency mode. This means that the water level and the steam pressure in the boiler, and the oil temperature must be controlled manually.

In emergency mode, the burner unit and supply systems are operated from the control panel(s), where various operating switches, push buttons and/or potentiometers are provided for operating purposes.

Before emergency operation of the burner is initiated, attempts to restart the control system must be performed. If restart of the control system is impossible, the work steps of the following sections must be followed.

1.1 Emergencyoperation of the burner

Note: Before any operation, make sure the steam valves on the boiler for each steam pressure instruments are opened.

Step A: Turn the key switch placed on the outside (or inside) of the local control panel to "MANUAL"position.

Step B: Push "FUEL OIL PUMP 1 START/STOP" or ".FUEL OIL PUMP 2 START/STOP" to start an oil pump.

Step C: Check the oil pressure in the ring line. The pressure should be about 2.0 barg indicated on the burner pressure gauge, adjust if necessary.

Step D: Check the oil temperature if the burner is operating on heavy fuel oil. The viscosity of the oil at the rotary cup should be between 45-60 cSt. The pre-heating temperature can be determined by means of the chart in the chapter "Viscosity-temperature chart". Adjust the oil temperature on the temperature control valve, if necessary.

1.2 Emergencyoperation of the burner unit

The push buttons "IGNITION", "OIL VALVES", and "STOP" and the indicator lamp "FLAME" may be located on the front of the local control panel or on the burner front. All other buttons and indicating lamps are located on the front (or inside) of the local control panel.

Step A: Close the combustion air damper by pushing "AIR SERVO LOAD DOWN". The air damper should be in closed position before start-up to reduce the current consumption.

Step B: Start the combustion air fan andburner motor on the operating switch"BURNER MOTOR".

Step C: Push "AIR SERVO LOAD UP" to open the air damper to maximum position. Purge the furnace with combustion air. The combustion air flow should be kept at maximum flow for at least 60 seconds.

Warning: Insufficient purging may cause danger of furnace explosions. If the operator suspects that there is a risk of an oil spillage in the furnace, it must be completely dried out before start of the burner is attempted.

Step D: Set the air flow to ignition load position, approximately 15-20% load, by reducing the position of the air damper on the "AIR SERVO LOAD DOWN" push button. The final position setting of the air damperfor ignition load and all other loads must be determined by visual checks of the flame and the flue gas when the burner is in operation.

Step E: Set the oil flow to ignition load position, approximately 15-20% load, by pushing "OIL SERVO LOAD UP" or "OIL SERVO LOAD DOWN

Step F: Press the button "IGNITION" and keep it pressed.

Step G: When the ignition flame is established, press the push button "OIL VALVES" to open the oil valves.

Step H: Release the ignition and oil valves push buttons after maximum 5 seconds or when the indication lamp "FLAME" illuminates whichever comes first.If the flame is not established within maximum 5 seconds, immediately return to step D.

Step I: The burner is now in operation, and adjustments of the burner load must be carried out as described in the following section.

Note: If the flame is extinguished during operation, immediately return to step E. If the flame cannot be established in the following attempt, please see the section for faults and rectifying faults.

1.3 Operating instructions in emergency mode

The request for regulations of the burner load should be deducible from the actual demand for process steam. The optimal operation form for the burner is to minimise the number of load alterations as this will facilitate the burner operation in emergency mode. Regulations of the burner load must be performed by manual adjustments of the combustion parameters, oil flow and air flow.

When the burner load is changed, it is important to differentiate between increases or decreases of the load. This is due to the fact that an incorrect air/fuel ratio towards a rich oil mixture causes an incomplete combustion that will produce black smoke. If the burner load shall beincreased, the air flow mustbe increasedbefore the oil flow, and opposite the oil flow mustbe decreasedbefore the air flow if the burner load is decreased.

Step A: Adjust the air flow and oil flow to the desired load by means of the push buttons "OIL SERVO LOAD UP" and "OIL SERVO LOAD DOWN" and "AIR SERVO LOAD UP" and "AIR SERVO LOAD DOWN". The final settings must be determined by visual checks of the flame and the flue gas.

Step B: In boiler plants with on/off regulation of the water level, one of the feed water pumps should be started and stopped according to the water level in the boiler.

Step C: In boiler plants with modulating control of the water level, one of the feed water pumps should be started. The water level can then be manually controlledlocally on the valve.

Step D: Switch on the chemical dosing pump on the switch "CHEMICAL DOSING PUMP 1".

1.4 Stop the burner in emergency mode

Step A: Adjust the air flow and oil flow to minimum load position load by means of the push buttons "OIL SERVO LOAD DOWN" and "AIR SERVO LOAD DOWN".

Step B: Press the push button "STOP" to stop the burner. The oil valves close immediately.

Step C: Stop the burner motor and combustion air fan if so required.

Note: If the burner operates on diesel oil, the oil system should be stopped if burner operations are of infrequent occurrences. A continuous re-circulation of the diesel oil might damage the oil pumps due to heating of the oil.

Maintenance

1 Recommended maintenance intervals

To ensure a safe and reliable function of the burner, inspection must take place with frequent intervals as described below. The inspection should be carried out by competent and properly trained personnel familiar with the operating and maintenance procedures relevant for this type of plant.

1.1 Safety regulations for maintenance work

Always ensure that the electrical power is off and that nobody can start the boiler unit before commencing maintenance work.

All pipes, drums, etc. must be depressurised before any maintenance work is carried out on these.

1.2 Continuous maintenance

The below check lists should be followed frequently and according to the listed intervals. Dependent on the operation conditions, however, some items may need more attention.

1.2.1 General maintenance

- The burner, control panels and other equipment should be kept clean and dry. Check that no foreign matter accumulates in or around them.
- Replace lamps, contactors, and other components when they cease to function or show signs of deterioration. A part, replaced before it actually fails, could save a costly delay.
- Check that all connections are tightened and that the wiring is in a good condition.
- Check pipe work for leaks, particularly on flanges, joints, and connections. Repair any leaks which may cause safety risks.
- Check that the glands of manual valves are tight enough to prevent too easy operation of the valve. Operate the valves periodically, if possible, to ensure free movement.
- Check the pneumatic shut-off valves, placed just before the rotary cup, for leaks.
- Check that the fan inlet is kept clean of unintended obstructions.
- Check the shape of the flame to ensure a proper combustion.
- Check the combustion values by flue gas analysis.
- Oil filters should be inspected and cleaned if necessary.

1.2.2 Periodical maintenance

Weekly

- Clean the rotary cup. Depending on the oil quality, a more frequent cleaning may be necessary.

Monthly

- Clean the flame scanner and check the function.
- The electrodes should be cleaned and the insulation material checked for any damage. Be careful not to change position of the electrodes or damage the ceramic insulation pieces.
- The ignition burner nozzle should be checked and cleaned. If the spray pattern hits the other parts of the ignition burner despite it is cleaned, the nozzle should be changed.
- Check the function of the combustion and primary air pressure switches.
- Check the function of the oil temperature switches.
- Check the function of all other safety interlocks which are connected to the burner control system.
- Check the tension of the v-belts.
- Check the refractory material in the annulus ring and repair it if necessary.
- Check the refractory lining in the combustion chamber and repair it if necessary.

Yearly

- Remove deposits from the air ducts, burner register and the swirler. Large quantities of dust-laden air will pass through the register, and inevitably this tends to build up deposits. These deposits should be brushed off.
- Clean and grease the bearings in the drive motors and burner shaft.
- The electrical and mechanical connections of the local panels and power panels must be checked and tightened.
- The oil tanks must be inspected and cleaned at least every four to five years.

Faults and rectifying faults

1 Trouble shooting

The trouble shooting list is based on a proper set up of the burner plant during commissioning and/or service and that no further adjustments of the air/fuel ratio, air vanes, etc. have taken place. The trouble shooting list can be seen in Table 1.

Please note that the trouble shooting list is general for the rotary cup burners and has not been made for any particular plant, but is based on several years of experience. Therefore, the cause for a specific problem may not be mentioned and vice versa. However, customers are always welcome to contact our Service Department for advice or service assistance.

Check availability of power and fuel supplies before commencing detailed checks. Ensure that burner plant wiring diagrams relevant to the particular installation are available. When the cause of a lockout should be located, it can be of assistance to know the start/stop cycle or at which point of operation the lockout occurred, e.g. modulating.

Fault finding chart

Observation	Cause	Elimination of fault
1. Ignition		
No ignition/ignition flame failure	Ignition burner oil pump faulty Oil pressure too low Oil nozzle blocked Oil nozzle worn out Ignition electrodes dirty Ignition electrodes out of adjustment Isolator body cracked Ignition transformer faulty Ignition cables charred Burner control faulty Solenoid valve faulty Combustion air pressure too high	Repair/replace oil pump or motor Restore oil pressure Clean/replace nozzle Replace nozzle Clean electrodes Adjust electrodes Replace electrodes (isolator only) Replace ignition transformer Exchange cables Replace control unit Replace Check/adjust air damper opening
2. Flame Failure		
Flame failure of main flame during ignition	Ignition flame not established Oil valves not opened properly Oil pressure too low Oil temperature too low/high Oil flow too low	See above Check air pressure/replace oil valve Adjust pressure Adjust temperature Adjust oil flow/clean rotary cup/remove any blockage

Fault finding chart		
3. Flame		
Unstable main flame	Oil amount too low Oil temperature too low Rotary cup dirty Rotary cup damaged	Raise oil amount Raise oil temperature Clean the rotary burner cup Replace the rotary burner cup
4. Combustion		
Black smoke/incomplete combustion Coloured smoke is often related to a poor quality of fuel oil and cannot be eliminated by adjustment	Oil amount too low/high Viscosity not correct (oil temperature) Insufficient primary air/secondary air Increased furnace/uptake back pressure	Raise/reduce oil amount Adjust oil temperature Check/adjust settings Clean the gas passage and if necessary remove blockage
Observation	**Cause**	**Elimination of fault**
5. Rotary Cup		
Carbon deposits in the burner cup	Too high oil temperature Insufficient after running/cleaning time for the burner cup Leaking oil shut-off valves Poor oil quality	Reduce oil temperature Increase timer setting Clean/repair/exchange faulty valves Clean the rotary cup more frequently
6. Air Nozzle and Swirler		
Oil/carbon deposit on primary air nozzle, swirler	Primary/tertiary air pressure insufficient Increased furnace/uptake back pressure	Check/adjust setting Clean gas passage and if necessary remove blockage
7. Flame Failure during Service		
Flame failure during service	Flame blown away/out due to too small amount of oil caused by blockage in the oil system Flame blown out due to too low oil temperature Flame blown out due to too low oil pressure Dirty/defective or worn out photo cell Burner control faulty	Restore oil amount and remove blockage Raise oil temperature Raise oil pressure Clean/exchange photo cell Exchange control unit
8. Flame Pattern		
Change of flame pattern	Changes in the air/fuel ratio (generally related to changes in the oil pressure or in the oil temperature/viscosity) Changes of the furnace/uptake back pressure	Check/adjust oil pressure and oil temperature. Check air supply Restore normal furnace/uptake back pressure, i.e. by cleaning gas passage
9. Vibration		
Vibrations on the burner	Deposits in the burner cup Burner shaft bearings defective/worn out	Clean the burner cup and check/adjust oil temperature Replace bearings
10. Motor		
Burner motor does not start	Overload relay tripped Contactor faulty Burner motor defective	Check motor and fuses and reset overload relay Replace contactor Replace burner motor

Fault finding chart		
11. Shut-off Valves		
Oil shut-off valves do not open	Insufficient air pressure Pneumatic parts faulty Solenoid valves faulty Burner control faulty	Check air supply Replace pneumatic unit Exchange solenoid/complete valve Replace control unit
Oil shut-off valves do not close tightly	Particles in the valve	Clean valves and if necessary exchange valves
12. Shut-Down		
Burner shut-down	Shut-down due to safety circuits or faulty components	Please refer to the electric layout/diagram for specific information

Table 1

Measurements and settings

1 General description

Each plant has its individual service conditions depending on the actual design and layout of the burner and boiler plant. Exact values for the burner cannot be given, but have to be determined at the commissioning or by later adjustments.

The following pages show the standard measurements and settings for a plant which includes a KBE burner. This enables the user to obtain some of the most important measurements and settings related to the burner for later reference.

It is recommended that the user completes the scheme shortly after commissioning when normal service conditions have been established.

2 Burner measurements and settings

Table 1 and Table 2 show a standard measuring/setting scheme. Figure 1 illustrates a diagram in which it is possible to mark the air/fuel ratio curve. The values should be taken from No. 1 and No. 3 in the tables.

Measuring/setting scheme for a rotary cup burner (KBE)

General plant data

Plant name: Date/time: Boiler type/No.: Burner type/No.:	Minimum load: Ignition load: Maximum load:

Burner adjustment data

Burner cup, direction of rotation: Direction of primary air vanes: Direction of secondary air vanes:	Distance between cup and cup shroud [mm]: Tertiary gabs open [mm]: Throttle valve open [turn]:

Common measurement data

Oil type/viscosity/density: Oil temperature in tank [°C]: Air temperature inlet combustion air fan [°C]:	Oil temperature before and after pre-heater [°C]: Oil temperature at burner inlet [°C]: Oil pressure at burner inlet [barg]:

Measurement data

1	Load/oil flow	%	**0%**	**10%**	**20%**	**30%**	**40%**	**50%**
2	Regulation output for fuel oil flow	%						
3	Air flow setting	%						
4	Regulation output for air flow	%						
5	Static pressure after combustion air fan	mm WC						
6	Static pressure in wind box	mm WC						
7	Static pressure in furnace	mm WC						
8	Static pressure in uptake	mm WC						
9	Flue gas temperature in uptake	°C						
10	O_2 in uptake	%						
11	CO_2 in uptake	%						

Measuring/setting scheme for a rotary cup burner (KBE)								
12	Soot No. (Bachrach)	No.						
13	Boiler pressure	barg						

Table 1

Measuring/setting scheme for a rotary cup burner (KBE) continued							
1	Load/oil flow	%	**60%**	**70%**	**80%**	**90%**	**100%**
2	Regulation output for fuel oil flow	%					
3	Air flow setting	%					
4	Regulation output for air flow	%					
5	Static pressure after combustion air fan	mm WC					
6	Static pressure in wind box	mm WC					
7	Static pressure in furnace	mm WC					
8	Static pressure in uptake	mm WC					
9	Flue gas temperature in uptake	°C					
10	O_2 in uptake	%					
11	CO_2 in uptake	%					
12	Soot No. (Bachrach)	No.					
13	Boiler pressure	barg					

Table 2

Curve for air/fuel ratio

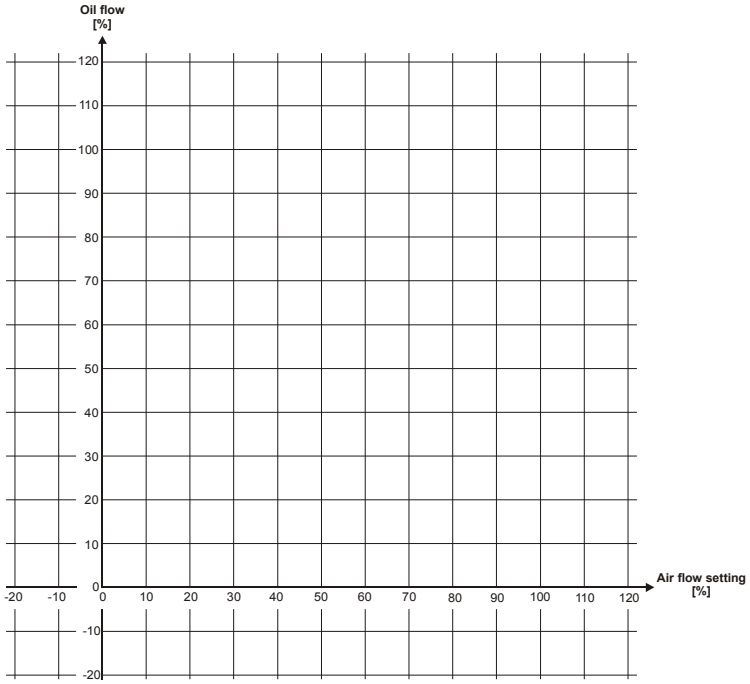


Figure 1 **om5590_96_air_fux0056510en.wmf**

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Combustion air fan

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Technical data for combustion air fan

1 General data

- Project No.:.....051868-01-1, 051868-02-1, 051868-03-1, 051868-04-1,
- 051868-05-1, 051868-06-1, 051868-07-1, 051868-08-1
- Hull No.:.....H2390, H2391, H2392, H2393,
- H2403, H2404, H2405, H2406
- Classification society:.....GL&CCS H2390-91
- .....CCS H2392-93+H2403-06
- Pressure gauge calibration:.....MPa
- Thermometer calibration:.....°C
- Language for signs:.....UK
- Colour of combustion air fan unit:.....Ral 5002 (blue)

2 Data for combustion air fan

- Fan type:.....MT 445(500)-250/D
- Actual position designation:.....RD 180
- Static pressure at 45°C:.....392 mmWC
- Air flow at 45°C:.....4738 m³/h
- Silencer type:.....None
- Noise level for fan :.....Max.105 db(A)

3 Data for fan motor

- Motor maker:.....Høyer
- Motor type:.....Y2E2 160 M1-2
- Power supply:.....3 x 440 V, 60 Hz
- Rated output for motor:.....13 kW
- Revolutions:.....3588r.p.m.
- Ambient air temperature:.....45°C
- Starting method:.....Direct On Line
- Starting current:.....164A
- Operating current (full load):.....20A
- Power consumption at 20°C:.....10.1kW

- Power consumption at 45°C:.....9.3kW
- Numbers of cable entries:.....2 pcs.
- Cable gland size:.....M40
- Heating element (standstill):.....None
- Thermostat protection:.....None
- Insulation class:.....F
- Degree of protection:.....IP55

4 Data for pressure loss layout

- Air duct system (from fan to wind box), max.:.....0mmWC
- Boiler (from furnace to outlet at full load):.....125mmWC
- Flue gas system, max.:.....5mmWC

Combustion air fan

1 Description

The purpose of the combustion air fan is to supply primary, secondary and tertiary air to the burner. It is a directly driven fan mounted on top of the wind boxfor the small burners (KBE150 – KBE750) and placed separately for the large burners (KBE850 – KBE1300). The combustion air fan consists of the scroll casing, inlet cone, impeller, bracket and motor. The impeller is mounted on the motor shaft, and the motor is mounted on the bracket.A silencer can be mounted on the fan suction side. Figure 1 shows an illustration of the combustion air fan (shown without silencer).

Illustration of the combustion air fan

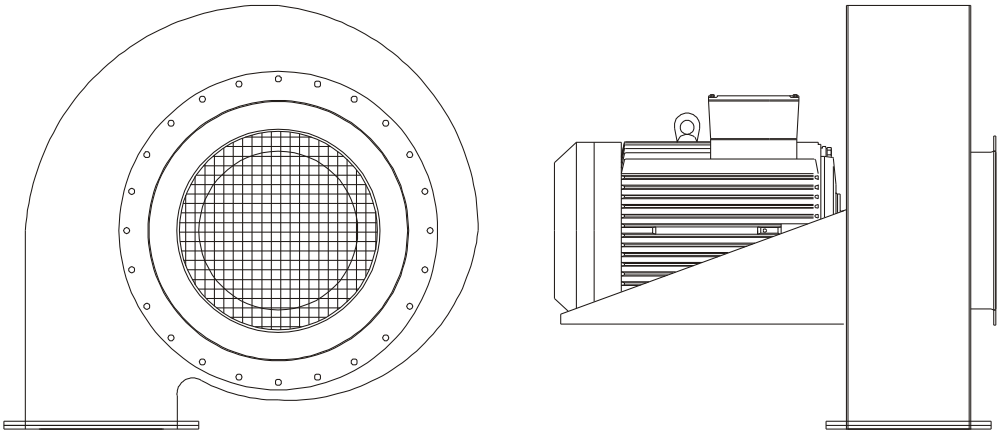


Figure 1 **om5590_10_comfanx0056300en.wmf**

2 Storage

If the combustion air fan unit is stored for a period of time prior to installation, a number of initiatives must be observed and considered. They are described in the following sections.

2.1 Combustion air fan (normal conditions)

2.1.1 Combustion air fan (normal conditions)

When the combustion air fan unit is delivered, it is provided with the correct quantity and type of grease. The optimum storage temperature is 15°C.

The impeller axle must be rotated at regular intervals during storage. This prevents the motor bearings from being damaged. The maximum rotation interval is four to five weeks.

2.1.2 Combustion air fan (extreme conditions)

Storage at temperatures above +35°C and below -5°C have a negative effect on the state of the bearing grease. By storage in these conditions the maximum rotation interval is two to three weeks.

After start-up of the combustion air fan the motor bearings (if provided with lubricating nipples) should be greased with a small quantity of grease (4 to 5 grease gun shots).

2.1.3 Prolonged standstill

Rotate the impeller axle at the intervals described above.

3 Installation

When the boiler plant is delivered, the burner and combustion air fan are supplied loose.

As soon as the wind box including burner has been mounted onto the boiler the combustion air fan can be installed. The mounting position appears from the burner arrangement drawing.

3.1 Connection of the motor

3.1.1 Connection of the motor

Figure 2 shows the possible wiring connections at the terminal rows of the motor. The electrical wiring diagram indicates the actual connection of the motor for the specified plant.

Electrical connection diagram

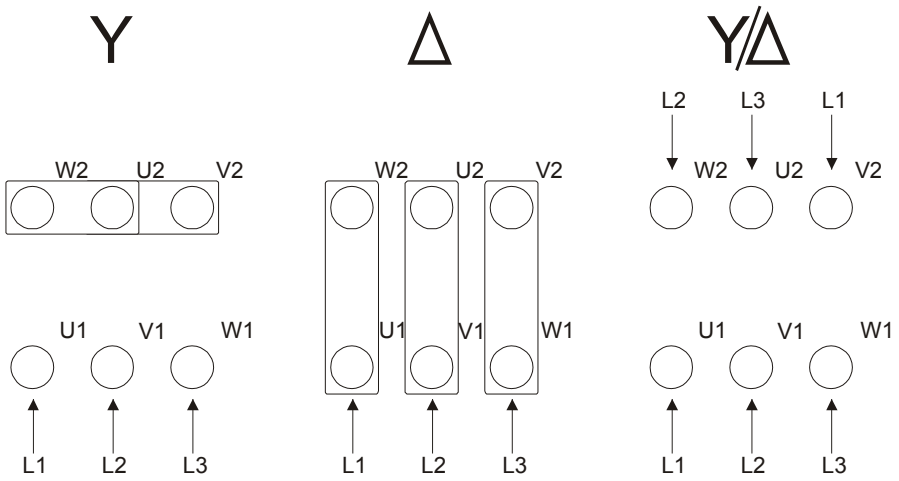


Figure 2 **om5590_10_bar_07x0056290en.wmf**

4 Prior to start-up

Prior to the first start-up of the combustion air fan, the following procedures must be performed:

- Check that the combustion air fan has been installed and supported correctly.
- Check that the inlet net has been mounted.
- Check that the electrical wiring at the terminals of the combustion air fan is performed according to the wiring shown in the electrical diagrams.
- Adjust the circuit breaker for the combustion air fan to suit full load current of the motor. The current appears from the motor identification plate and/or the electric diagrams.
- Rotate the combustion air fan by hand to ensure a free and an uninterrupted rotation.
- Ensure that all safety circuits are activated and functional.
- Ensure that all loose items have been removed in the proximity of the suction side of the combustion air fan.

5 Initial start-up

When the combustion air fan is started for the first time, the following procedures must be performed:

- Start the combustion air fan and check that it is running with the correct direction of rotation (see the direction arrow).
- Check that the combustion air fan does not produce any abnormal mechanical noise.
- Check the combustion air fan for any abnormal vibrations.
- Check the temperature of the fan bearings. The bearing temperature must be at a constant level after approximately 30 minutes of operation. If the temperature continues to increase, stop the combustion air fan and check the bearings.
- Check the current consumption of the combustion air fan, if possible. The current must not exceed the full load current stated on the motor identification plate and/ or the electric diagrams.
- Stop the combustion air fan.

6 Normal operation

To ensure a safe and reliable function of the combustion air fan, inspection must take place with frequent intervals as described below.

Step A: Check the motor temperature (maximum 80°C).
Step B: Check for vibrations by touching the combustion air fan.

Note: If a fault is observed, it must be corrected at once.

7 Vibration control

If the fan is operating in a dusty and/or fatty air environment, coats may occur on the impeller. This might cause abnormal vibrations, which eventually will cause break-down of the combustion air fan. The cause must be examined immediately.

At the factory the fan has been weighed statically and dynamically in accordance with the VDI 2056 - G, Standard. Figure 3 shows vibration curves for the fan according to VDI 2056-G Standard.

Vibration curves for fan

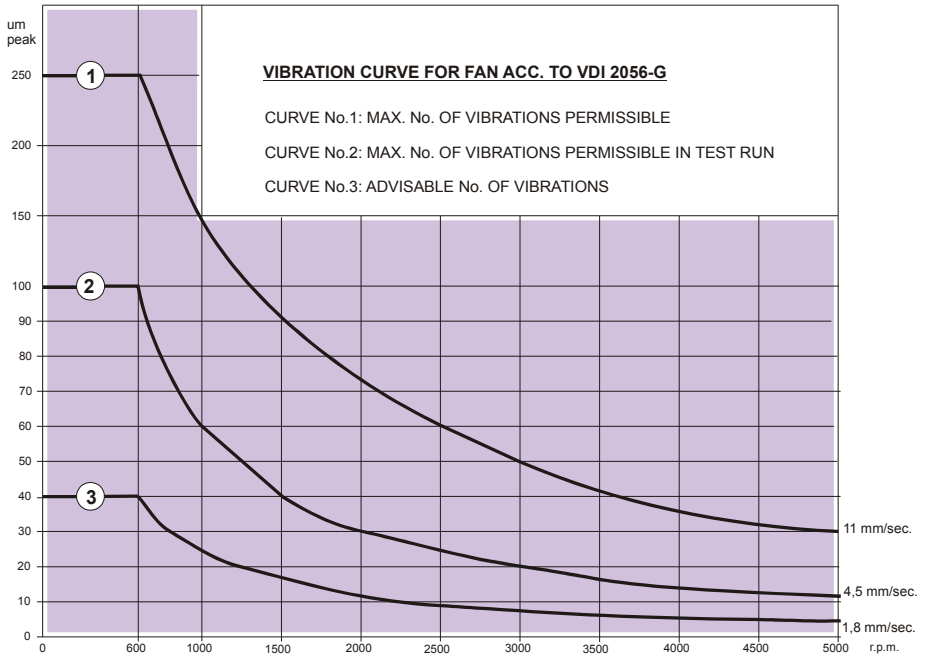


Figure 3 **om5590_10_bar_03x0056280en.wmf**

8 Maintenance

Warning: Ensure that the combustion air fan is not unintentionally started during repair work.

8.1 Cleaning of impeller

Step A: Access to the impeller is obtained by dismounting the clean-out door.

Step B: The cleaning procedure can be performed with a high-pressure cleaner combined with scraping of the rebellious coat. In connection with this ensure that any water in the spiral casing is drained off.

Step C: Before starting the combustion air fan again, it is important to check that the impeller is clean and that the dismounted parts have been re-assembled.

Note: If the impeller has not been carefully cleaned, the residual coat might cause a lack of balance. If the vibration level exceeds the maximum level of 11 mm/s, it might result in a breakdown of the combustion air fan. Take precautions by inspecting the impeller before starting up.

8.2 Maintenance of the electric motor

Normally, electric motors need no other maintenance than cleaning and greasing of bearings as well as general cleaning. If motors and/or bearings are to be dismantled, please contact an expert (electromechanical workshop).

8.2.1 Motors without lubricator

Bearings are built-in to protect from dust and dampness. The bearings should normally be greased after approximately 10,000 hours running time and cannot be greased during operation.

After 10,000 running hours or a running time of maximum three years, the bearings must be disassembled and cleaned. The bearings should be filled 2/3 with ball bearing grease type BP-LS-EP2 or any similar type of grease. Filling the bearings more than 2/3 can result in too much heat being generated in the bearings.

8.2.2 Motors with lubricator

The motor is provided with pressure nipples and bearing cover with grease valves. The bearings must be greased at the intervals shown in Table 1 with ball bearing grease type BP-LS-EP2 or any similar type of grease.

Step A: The motor must be greased when running to avoid over flow in the bearings.

Step B: Add grease until clean grease comes out of the grease valve and remove surplus grease.

Step C: Besides greasing the bearings at the prescribed intervals, they must be dismounted and cleaned every 3rd year as described in the previous section.

Lubrication intervals in months								
Speed r.p.m. 50 Hz	**Running hours per day**	**Motor frame size**						
		160	**180**	**200**	**225**	**250**	**280**	**300**
970	8	75	69	63	51	27	24	12
	24	25	23	21	17	9	8	4
1450	8	48	45	39	30	15	15	6
	24	16	15	13	10	5	5	2
2900	8	21	18	15	9	6	3	3
	24	7	6	5	3	2	1	1
If the operating frequency is 60 Hz with subsequent 20% higher r.p.m., the greasing intervals are reduced to 2/3 of the above stated intervals (e.g., lubrication interval at 50 Hz = 3 months, lubrication interval at 60 Hz = 2 months.								

Table 1

Table of contents

Fuel oil pump unit (MISSION OS)

Technical data for fuel oil pumps.....20-2
Instruction.....20-4

Technical data for fuel oil pumps

1 General data

- Project No.:.....051868-01-1, 051868-02-1, 051868-03-1, 051868-04-1,
- 051868-05-1, 051868-06-1, 051868-07-1, 051868-08-1
- Hull No.:.....H2390, H2391, H2392, H2393,
- Hull No.:.....H2403, H2404, H2405, H2406
- Classification society:.....GL&CCS H2390-91
- Classification society:.....CCS H2392-93 + H2403-06
- Pressure gauge calibration:.....MPa
- Thermometer calibration:.....°C
- Language for signs:.....UK
- Colour of fuel oil pump unit.....Munsell 7.5 BG 7/2

2 Data for fuel oil pumps

- Pump:.....Vertical screw pump
- Pump type:.....DS1/750.32
- Delivery head:.....0.5 MPa
- Relief valve set point (factory set):.....0.8 MPa
- Oil temperature, maximum:.....150 °C
- Pump capacity at 3 cSt:.....966 l/h
- Pump capacity at 380 cSt:.....1116 l/h
- NPSH at 3cSt.:.....2mWC
- NPSH at 380 cSt.:.....4mWC
- Weight of fuel oil pump unit:.....43kg

3 Data for pump motor

- Motor maker:.....AC
- Motor type:.....AY 71 B-2
- Power supply:.....3 x 440V, 60Hz
- Rated output for motor:.....0.66kW
- Revolutions:.....3340r.p.m.
- Ambient air temperature:.....45°C

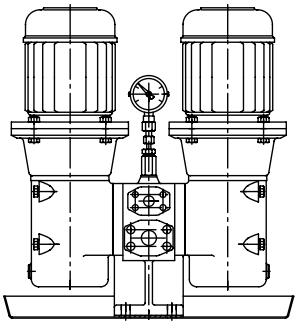
- Starting method:.....Direct On Line
- Starting current:.....7.7A
- Operating current (full load):.....1.54A
- Power consumption at 3 cSt:.....0.31kW
- Power consumption at 380 cSt:.....0.46kW
- Numbers of cable entries with reliefer:.....M20 x 1.5
- Heating element (standstill):.....None
- Thermistor protection:.....None
- Insulation class:.....F
- Degree of protection:.....IP55

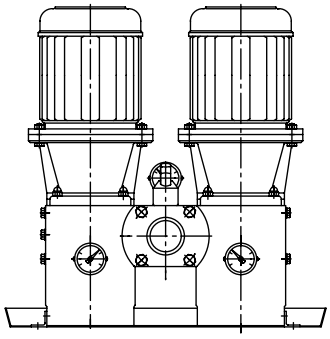
MANUAL DE INSTRUCCIONES
OPERATING INSTRUCTIONS

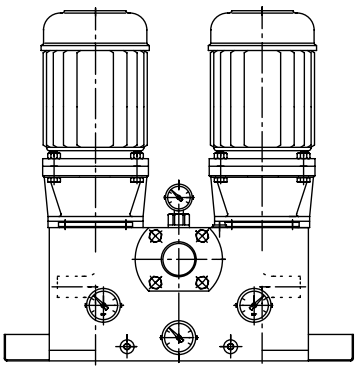
OID 01 E
Edición 07/04
Edition 07/04

Bombas de husillo roscado
Screw Spindle Pumps

Estación doble DL / DS / DCL / DCS
Para gasóleo de calefacción ligero y pesado
Double Stations DL / DS / DCL / DCS
For light and heavy fuel oil







1. INFORMACIÓN GENERAL

- El manual de instrucciones deberá leerse detenidamente y deberá cumplirse obligatoriamente por el personal implicado.
- El propietario asumirá la responsabilidad del cumplimento de las instrucciones.
- Todas las bombas se someten a una prueba de funcionamiento y a un control de rendimiento. Nuestro taller suministra únicamente bombas sin errores de funcionamiento.
- Los valores máximos relativos a las condiciones de aplicación se muestran en la placa indicadora de potencia. Las diferencias respecto de estos valores requerirán nuestra aprobación. Póngase en contacto con nuestro taller para aclarar cualquier tipo de pregunta al respecto.
- El fluido de bombeo deberá presentar suficientes cualidades de lubricación. Los componentes mecánicos abrasivos y químicos agresivos que se encuentren en el medio reducen la vida útil de la bomba. No asumiremos ningún tipo de garantía por los daños ocasionados como consecuencia de un incumplimiento del manual de instrucciones. Procure detectar a tiempo el desgaste y lleve a cabo el mantenimiento correspondiente.
- Aquellas instalaciones en las que las posibles averías puedan causar daños personales o materiales, se deberán equipar con dispositivos de alarma y / o grupos de reserva y comprobar su capacidad de funcionamiento en intervalos regulares.
- El propietario será responsable del cumplimiento de las normas generales de prevención de accidentes, así como de las normas de seguridad y de trabajo.

Indicaciones importantes:

- En caso de preguntas para solicitar información adicional o de pedidos de piezas de repuesto, siempre se deberá indicar el modelo y el nº de la bomba.
- En caso de que una avería no se pueda reparar por cuenta propia, se deberá enviar la bomba de vuelta, si es posible de un modo económico y con la bomba montada (permite una mejor aclaración de las averías). Asegúrese que los accesorios como uniones de rosca, acoplamientos y similares sean desmontados, ya que no se podrá asumir ningún tipo de garantía por el envío de vuelta.

2. ENTREGA

Compruebe la integridad del volumen de suministro y comuníquenos de inmediato las posibles reclamaciones (empresa de transportes / taller).

3. GARANTÍA

La extensión de la garantía será de acuerdo con nuestras condiciones de entrega. Los trabajos de reparación durante el período de validez de la garantía sólo se podrán llevar a cabo por el propietario o por una persona designada por nosotros y únicamente con nuestra autorización e instrucción expresa.

1. GENERAL INFORMATION

- The staff concerned with the unit should read the operating instructions and follow it.
- The user is responsible for taking any precautions outlined in this manual.
- The capacity of all pumps has been tested during a test run. We supply only pumps which guarantee a trouble free operation.
- Maximum operation values are given on the performance plate. Any differences require our confirmation. Contact us for any special information.
- The medium must be lubricant. Mechanically abrasive and chemically aggressive parts in the medium reduce the life span of the pump. No guarantee can be given if the instructions in the manual have not been observed. The user must maintain the unit periodically and replace the wearing parts.
- Installations which could lead to personal injury and/or material failure should be equipped with an alarm system and/or reserve aggregate. This system should be checked periodically.
- The user is responsible for following the general preventation of accidents and the local safety and/or operating directions.

Important Remark:

- For questions regarding the pump and for spare parts orders please always mention type and pump number.
- If any problems occur which need our help, return the complete pump (for a correct damage report) and choose the transportation with the lowest price. It is important that all the assembling parts like screws, coupling a.s.o. are being dismantled as no guarantee is given for the return shipment.

2. DELIVERY

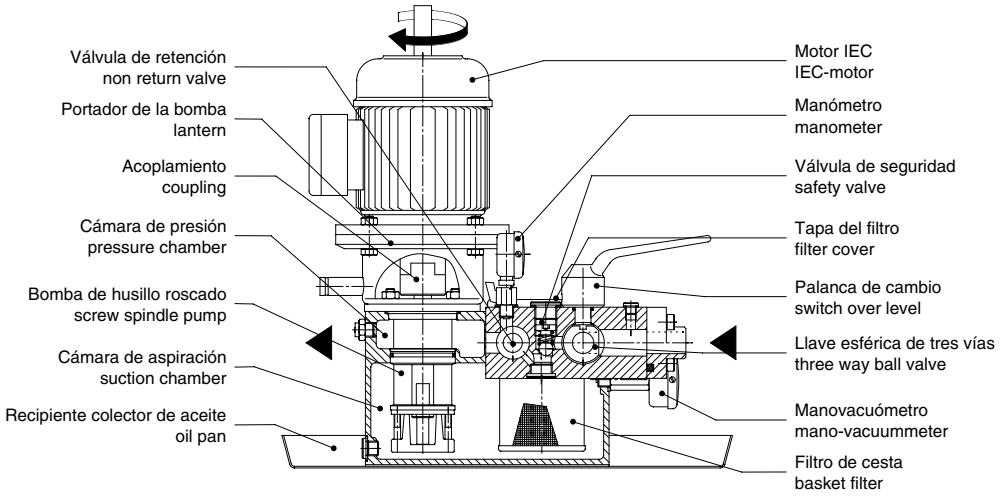
Inspect the received goods for any shortages. Report any mistakes immediately (to the forwarding agent or the factory).

3. WARRANTY

Warranty according to our terms of delivery. Repairs during the guarantee period must be carried out only by the user or any other person authorized by us and in accordance with our agreement and instructions.

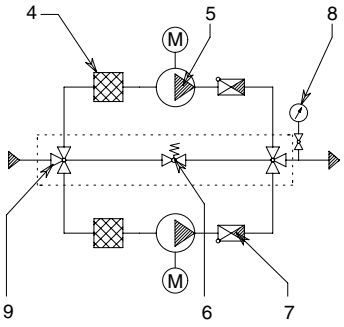
4. DESCRIPCIÓN DEL MODELO

4.1 Estructura y construcción, indicación de la dirección de paso y del sentido de giro de la bomba ➢ **Imagen 1**

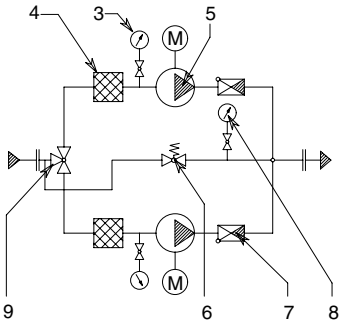


4.2 Esquema de conexiones hidráulicas ➢ Imagen 2

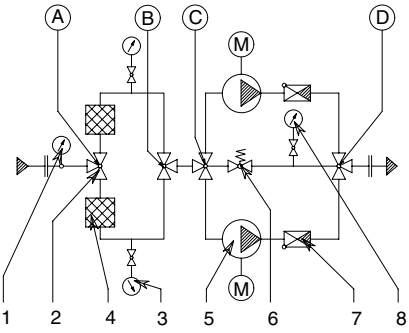
Serie/series DL2



Serie/series DL3,
DL4, DS1, DS3, DS4



Serie/series DL7,
DS7, DCL7, DCS7



1)	Termómetro	thermometer
2)	Macho de grifo de tres vias A/B + C/D	three-way-cock A/B + C/D connected
3)	Manovacuómetro bloqueable	lockable mano- and vacummeters
4)	Filtro de cesta (tamiz protector DL2)	basket filter (DL2 - strainer)
5)	Grupo de la bomba	pump aggregate
6)	Válvula de seguridad	safety valve
7)	Válvula de retención	non return valve
8)	Manómetro bloqueable	lockable manometer
9)	Llave esférica de tres vías	three way ball valve

4.3 Márgenes de aplicación / datos de rendimiento ➢ Imagen 3

Los valores indicados se refieren a fluidos de bombeo que proporcionen una buena lubricación.

4. DESCRIPTION

4.1 Design Construction, flow directions and the direction of rotation of the pump ➢ **scheme 1**

4.2 Hydraulic Schematic ➢ scheme 2

4.3 Range of Applicaton/Range of Capacity ➢ scheme 3

The mentioned values refer to good lubricating medium.

	Grupos de bloque	Aceite ligero / light fuel oil						Aceito pesado / heavy fuel oil					**Block Aggregates**
		DL 2	DL 2	DL 3	DL 4	DL 7	DCL 7	DS 1	DS 3	DS 4	DS 7	DCS 7	
		150 240	hasta/up 1300										
a	Presión bares	6	6	6	6	6	40	6	6	6	6	40	pressure stage, bar
b	Temperatura °C mín.	10	10	10	10	10	10	50	50	50	50	50	temperature °C min.
	Temperatura °C máx.	50	50	50	50	50	50	130	130	130	130	150*	temperature °C max.
c	Temperatura mín. para los materiales de trabajo de la estación doble	max. -10°C						max. -10°C					min.-temperature for material of double stations
d	Viscosidad mm2/s mín.	4	4	4	4	4	4	10	10	10	10	10	viskosity mm2/s min.
	Viscosidad mm2/s máx.	37	37	37	37	37	37	700	700	700	700	700	viskosity mm2/s max.
e	Revoluciones / viscosidad:												RPM/Viscosity
	2900 1/mín. - máx. mm2/s	80	80	80	80	80	80	152	152	152	152	152	2900 1/min - max. mm2/s
	1450 1/mín. mm2/s							700	700	700	700	700	1450 1/min - mm2/s
	Nivel de aspiración	véase en curvas características NPSH						see NPSH - characteristic lines					suction head
f	Presión de entrada:												inlet pressure:
	- con anillo obturador radial	0.5 bar											- with radial shaft seal
	- con junta de anillo deslizante	5 bar											- with mechanical seal

* ... a partir de 130°C hasta 150°C es necesario un soporte exterior y una junta de anillo deslizante SiC.

* ... from 130°C to 150°C a outside bearing and a mechanical seal (SiC) is necessary

Otros valores serán facilitados a petición.

Other values upon request

4.4 Valores NPSH necesarios m CA ➢ Imagen 5

Los valores NPSH no tienen en cuenta si el fluido de bombeo ya se encuentra desgasificado a depresión baja (p. ej., con gasóleo de calefacción EL y gasóleo máx. 4 m de columna de agua).

4.4 NPSH Required m WC ➢ scheme 5

The NPSH values do not take into account whether the medium degases at lower pressure (e. g. light fuel sxoil or diesel oil max. 4 m WC).

Bomba de montaje / insert pump	Viscosidad mm²/s								Viscosity mm²/s							
	6 *				37				152				380			
	Revoluciones 1/min								RPM 1/min							
	1450	1750	2900	3500	1450	1750	2900	3500	1450	1750	2900	3500	1450	1750	2900	3500
	NPSH necesarios (columna de agua en m)								NPSH required (m WC)							
FE 5 / NE 5	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3,1
NE 7,5	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3,3	3,5
NE 10	3	3	3	3	3	3	3	3	3	3	3	3,3	3	3,1	3,6	4
NE 13	3	3	3	3,3	3	3	3	3,3	3	3	3,6	4,1	3,2	3,4	4,4	5,1
NE 15	3	3	3	3	3	3	3	3	3	3	3	3,2	3	3	3,6	3,9
NE 20	3	3	3	3,1	3	3	3	3,1	3	3	3,4	3,8	3,1	3,3	4,1	4,7
NE 26	3	3	3,2	3,7	3	3	3,2	3,7	3	3	3,9	4,5	3,3	3,6	4,9	5,8
NE 32	3	3	3	3	3	3	3	3	3	3	3,3	3,7	3	3,2	4	4,5
NE 42	3	3	3,2	3,7	3	3	3,2	3,7	3	3	3,9	4,5	3,3	3,6	4,9	5,8
NE 54	3	3	3,5	4,2	3	3	4	4,9	3,1	3,4	5	6,2	3,8	4,2	6,4	---
CLD 55	3	3	3	3,3	3	3	3	3,3	3	3	3,6	4,1	3,2	3,4	4,9	5,6
CLD 74	3	3	3,5	4,1	3	3	3,5	4,1	3	3,1	4,3	---	3,5	3,8	5,9	---
CLD 85	3	3	3,8	4,5	3	3	3,8	4,5	3	3,3	4,7	---	3,6	4	6,5	---
CLD 118	3	3	---	---	3	3	---	---	3,2	3,5	---	---	3,9	4,3	---	---

* Para gasóleo de calefacción EL recomendados un nivel de aspiración máx. de 4 m de columna de agua medido en la brida de aspiración de la estación.

* For fuel oil we recommend a max. suction head of 4 m WC, measured at suction flange of the station.

Coordinación: Bombas de montaje - estaciones

FE 5	DL2/ 150	
	DL2/240	
NE 5	DS1/ 150	
	DS1/ 240	
NE 7,5	DL2/ 400	DS1/ 400
	DL2/ 750	DS1/ 750
NE 10	DL2/ 320	DS1/ 320
	DL2/ 500	DS1/ 500
	DL2/1000	DS1/1000
NE 13	DL2/1300	DS1/1300
NE 15	DL3/1800	DS3/ 900
	DL7/ 900	DS3/1800
	DL7/1800	DS7/ 900

NE 20	DL3/2300	DS3/1100
	DL7/1100	DS3/2300
	DL7/2300	DS7/1100
NE 26	DL3/2900	DS3/1500
	DL3/1500	DS3/2900
	DL3/2900	DS7/1500
		DS7/2900
NE 32	DL4/3200	DS4/1600
	DL7/3200	DS4/3200
		DS7/1600
		DS7/3200
NE 42	DL4/4000	DS4/2000
	DL7/4000	DS4/4000
		DS7/2000
		DS7/4000
NE 54	DL4/6000	DS4/6000

Allocation: insert pumps - stations

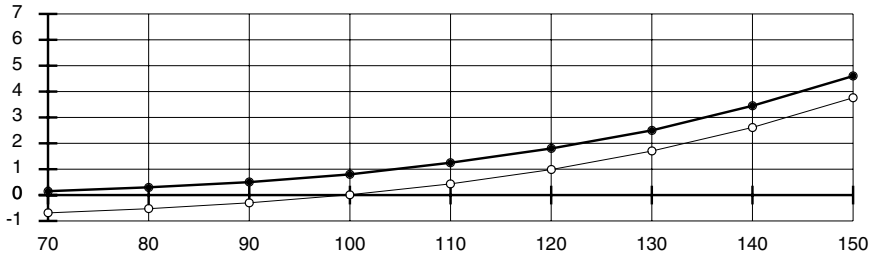
CLD 55	DL7/6000	DS7/2800	DCS7/3000
	DCL7/6500	DS7/6000	6500
CLD 74	DL7/8500	DS7/3500	DCS7/4100
	DCL7/7500	DS7/8500	7500
CLD 85	DL7/9000	DS7/3800	DCS7/4500
	DCL7/9000	DS7/9000	9000
CLD118		DS7/7000	

4.5 Presión de entrada / comportamiento de aspiración ➢ Imagen 7

El agua contenida en el gasóleo de calefacción "pesado" se evapora a temperaturas demasiado elevadas y con una presión de entrada demasiado baja. El diagrama muestra la presión mínima de entrada en la tubuladura de aspiración de la bomba. Estos valores se deberán mantener para garantizar un funcionamiento correcto (temperatura máx. 150 °C).

4.5 Inlet Pressure/Suction Behaviour ➢ scheme 7

The water contained in the heavy fuel oil is evaporating because of high temperatures and less inlet pressure. The diagramm shows the minimum inlet pressure on the suction side of the pump. These values must be observed to guarantee perfect operating conditions (temperature max. 150° C).



Presión de evaporación del agua / vapour pressure water

Presión de entrada recomendada / recommended inlet pressure

4.6 Válvula de seguridad

4.6.1 La válvula de seguridad sirve para proteger la bomba de la sobrepresión y no se podrá utilizar como válvula de control o reguladora.

4.6.2 La presión de abertura se encuentra ajustada de fábrica aprox. 10 % por encima de la presión de servicio (sin embargo, no por debajo de 3 bares).

4.6.3 Control de la presión de cortocircuito ajustada
Cierre lentamente la válvula de cierre en el lado de presión. El manómetro muestra la presión de cortocircuito. Atención: La circulación demasiado prolongada del fluido dentro de la bomba puede provocar un calentamiento y, como consecuencia, daños mecánicos.

4.6.4 Ajuste de la válvula ➢ Imagen 8
Girando hacia la derecha (en sentido horario) se aumenta la presión de abertura y girando hacia la izquierda se reduce la presión de abertura. Atención: en DL7/DS7/DCL7/DCS7 se debe aflojar el tornillo de fijación antes de realizar el ajuste de la válvula.

4.6 Safety Valve

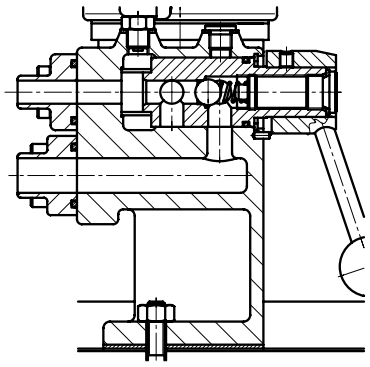
4.6.1 The built-in safety valve protects the pump from becoming overpressured and should not be used as a control valve.

4.6.2 The opening pressure is adjusted 10 % above the operating pressure (but not less than 3 bar).

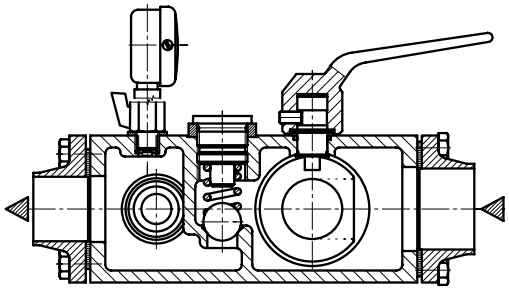
4.6.3 Checking the Adjusted Opening Pressure.
Close the stop valve at the pressure side of the pump. The manometer shows the opening pressure.
Attention: When the medium is circulating too long in this way, the pump will warm up and as a result this can cause mechanical damage.

4.6.4 Adjusting the Valve ➢ scheme 8
Turning the adjusting screw clockwise increases the opening pressure, turning it anticlockwise decreases it. Attention: Before adjusting the valve please remove the cover screw for DL7/DS7/DCL7/DCS7.

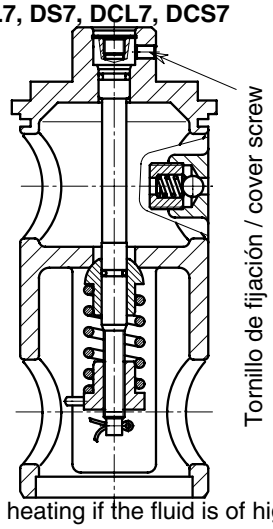
DL2



DL3, DL4, DS1, DS3, DS4



DL7, DS7, DCL7, DCS7



4.7 Calefacción

4.7.1 Para fluidos con una viscosidad elevada es necesario una calefacción para la bomba. Evite los arranques en frío (tenga en cuenta los tiempos de calentamiento). Como consecuencia se puede producir peligro de cavitación y daños en la junta del eje. Durante el proceso de calentamiento se deberán abrir todas las válvulas debido a la dilatación térmica.

4.7.2 Calefacción eléctrica ➢ Imagen 9
Las calefacciones eléctricas se encuentran dimensionadas a través de una potencia calorífica limitada, de forma que no sea posible un sobrecalentamiento.

a)	Tensión	220 Voltios
b)	Frecuencia	50 Hz / 60 Hz
c)	Sección del conductor	2 x 1 mm^2

Otros valores serán facilitados a petición.

4.7.3 Calefacción de medio ➢ Imagen 10
Tenga en cuenta las temperaturas de calentamiento en la cámara bombas y en la cámara de estanqueidad.

a)	con anillos obturadores radiales	máx. 80°C
b)	con juntas de anillo deslizante	máx. 100°C

Calefacción a vapor

a)	Temperatura	máx. 180°C	
b)	Presión	máx. 18 bares	DS1
		máx. 6 bares	DS3, DS4

En la calefacción a vapor se deberá procurar que no se supere la temperatura de calentamiento de un máx. de 100 °C.

4.7 Heating

4.7.1 It is necessary to install a heating if the fluid is of high viscosity. To avoid cavitation and damage of seals, don`t start up the pump with cold fluid. (Pay attention to heating up period). When heating up, all valves must be opened because of expansion due to heat.

4.7.2 Electrical Heating ➢ scheme 9.
Electrical heatings are dimensioned for a limited heating capacity and can therefore not overheat.

a)	voltage	220 Volt
b)	frequency	50 Hz / 60 Hz
c)	wire cross section	2 x 1 mm^2

Other values upon request

DS 1	DS 3, DS 4	DS 7, DCS / L 7
Potencia calorífica / heating capacity	Potencia calorífica / heating capacity	Potencia calorífica / heating capacity
180 Vatios / Watt	250 Vatios / Watt	400 Vatios / Watt

4.7.3 Medium Heating ➢ scheme 10
Pay attention to heating up temperature in pump/- and seal casing.

a)	for radial shaft seals	max. 80°C
b)	for mechanical seals	max. 100°C

Steam Heating

a)	temperature	max. 180°C	
b)	pressure	max. 18 bar	DS1
		max. 6 bar	DS3, DS4

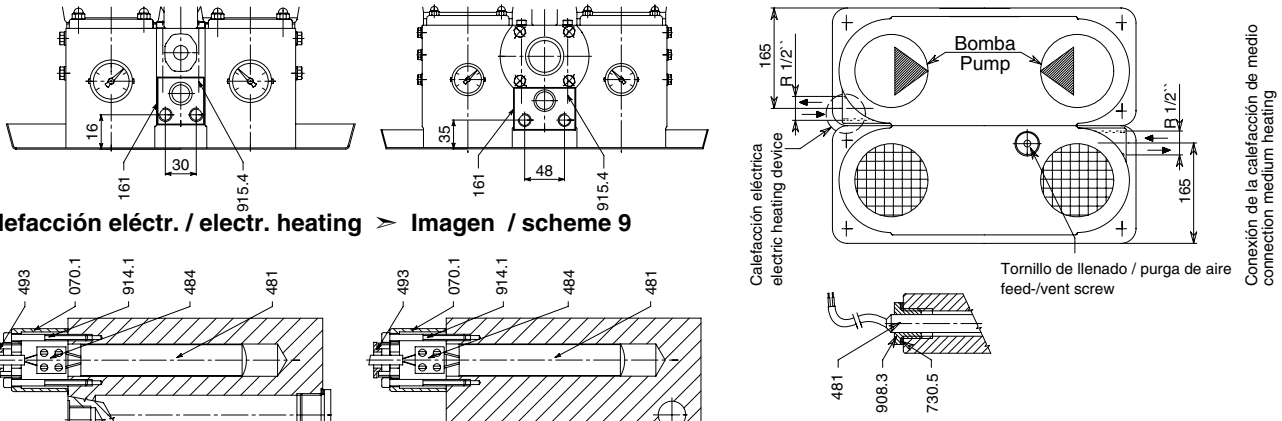
With steam heating it is important to avoid higher heating up temperatures than max. 100° C, measured in the station casing.

Tiempos de calentamiento/ Heating Up Period

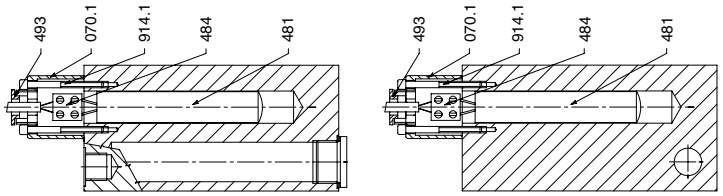
a)				b)	a)	c)	a)	
Eléctrica	Δt (min)		**A vapor**	p	t	Cantidad de vapor	Δt (min)	
Electrical	20°C	50°C	**Steam**	(bar)	(°C)	Steam Capacity	20°C	50°C
DS1 (180W)	60	180	DS1	15	180	5 kg/h	30	100
DS4 (250W)	120	240	DS4	15	180	5 kg/h	40	120
DS7 (400W)	180	420	DS7	5	150	5 kg/h	60	240

DS1 **DS3, DS4** **DS7, DCS7**

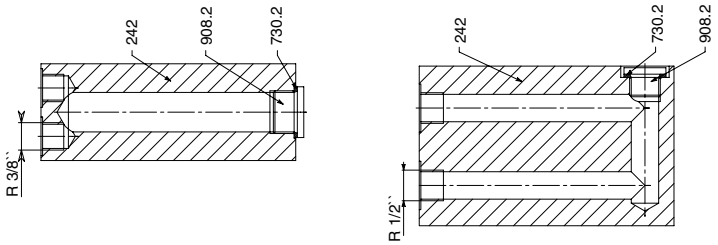
Modelo estándar con calefacción de medio instalada
Standard design with built in medium heating



Calefacción eléctr. / electr. heating ➢ Imagen / scheme 9



Calefacción de medio / medium heating ➢ Imagen / scheme 10



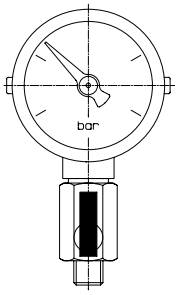
En caso de montaje posterior, la calefacción se enrosca lateralmente. Abra el tornillo de llenado / purga de aire y rellene termoaceite hasta aprox. 65 mm respecto del borde superior de la abertura de llenado y hasta el nivel de aceite (corresponde aprox. a 1,4 l de aceite).

When the heating device is installed later, it must be screwed in laterally. Open the feed-/vent screw and fill with thermo oil approx. 65 mm below the upper edge (approx. 1,4l oil).

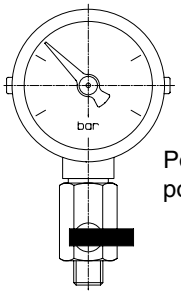
070,1	Tapa de cierre	*730,2	Junta plana	070,1	end cover	*730,2	flat gasket
161	Placa conductora de calor	*730,5	Junta plana	161	head conductor plate	*730,5	flat gasket
242	Bloque de calefacción	908,2	Tornillo de cierre	242	heating block	908,2	screw plug
*481	Cartucho calentador	908,3	Tornillo de cierre	*481	heating cartridge	908,3	screw plug
484	Barra de apriete	914,1	Tornillo de cabeza cilíndrica	484	porcelain terminal	914,1	socket screw
493	Unión a rosca	915,4	Tornillo de cabeza cilíndrica	493	screw connection	915,4	socket screw
	*piezas de repuesto recomendadas				* recommended spare parts		

4.8 Indicación de presión ➢ Imagen 11
Los grifos de cierre del manovacuómetro están básicamente cerrados. Ábralo únicamente para fines de control.

Posición abierto
position open



4.8 Pressure Display ➢ scheme 11.
Stop valves of mano- and vacuummeters are always closed. Open only for the purpose of checking!



Posición cerrado
position closed

5. MONTAJE

5.1 Disposición

5.1.1 En la elección del emplazamiento se deberán tener en cuenta los márgenes de aplicación y los valores NPSH. ➢ **Imagen 5**

5.1.2 Se deberán tener en cuenta las condiciones ambientales. El funcionamiento, la seguridad y la vida útil no deberán resultar perjudicados por la humedad, las influencias climáticas o las atmósferas explosivas.

5.1.3 Durante la disposición se deberá tener en cuenta que todas las piezas de la bomba sean fácilmente accesibles y sea posible realizar un mantenimiento de forma sencilla.

5. ASSEMBLING

5.1 Installation

5.1.1 To identify the best installation position consider the max. application limits and NPSH values.➢**scheme 5**

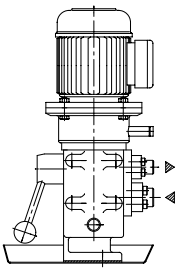
5.1.2 Consider the environmental conditions. Influence of temperature, moisture and explosive atmosphere can affect function, security and life time of the pump.

5.1.3 When locating the unit ensure that it can be worked on easily as you will need to maintain it.

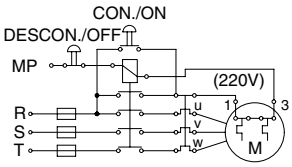
5.1.4 Posición de montaje / direcciones de paso ➢ Imagen 12

5.1.4 Assembling Position/Flow Direction: ➢scheme 12

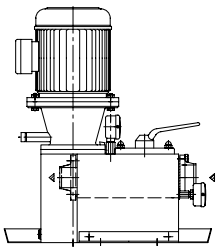
DL2



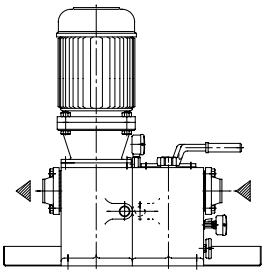
* Esquema de conexiones del motor
motor circuit schematic
para/for DL2/150 , DL2/240



DL3, DL4, DS1, DS3, DS4



DL7, DS7, DCL7, DCS7



5.2 Conexión de tubos

Evite las tensiones en los tubos. Por principio, las bombas no deberán utilizarse como punto de fijación de los tubos conectados. Procure evitar las posibles fuerzas y momentos que puedan aparecer (p. ej., arriostramientos, dilataciones de los tubos debido a las influencias de la temperatura, fuerzas reactivas). En caso de dilataciones de los tubos a causa del calor, se recomienda la instalación de elementos de dilatación. El conducto de aspiración se debe medir de forma que el caudal se encuentre entre 0,5 hasta un máx. de 1,3 m/seg. y el conducto de presión entre 2 a 3 m/seg. El conducto de aspiración se deberá disponer a prueba de vacío y en sentido ascendente. El sistema de tubos y la bomba deben estar libres de suciedad (p. ej., lavado). Si se comprueba la estanqueidad del sistema de tubos, se deberá tener en cuenta la máx. presión de entrada permitida en la junta del eje. Atención: no utilice agua debido a la formación de herrumbre. Durante el vaciado del líquido se deberá tener en cuenta que los tubos y la bomba estén limpios (p. ej., escoria de soldeo, escamas de óxido). Lleve a cabo las labores de conservación (véase el apartado Conservación). La oxidación y la suciedad pueden provocar averías en la bomba.

5.2 Pipework Connection

Avoid stress of pipes. The pumps should not serve as a fixed reference point for the installed pipe line. Such occurences should be avoided, if possible, e. g. bracing, the expansion of pipe due to variations in temperature and unit stress. We recommend to install a compensator in case of heat expansions of the pipes. The dimensions of the suction pipe must allow a liquid velocity of 0,5 up to max. 1,3 m/sec and the pressure pipe must allow a liquid velocity of 2 - 3 m/sec. The suction pipework must be installed with a gradual rise and air-tight. The pipework and the pump must be free of impurity (e.g. flushing). When the pipework installation is being tested for leaks pay attention to the max. admissible inlet pressure of shaft seal. Attention: don´t use water cause of rust formation. When draining the system it is important that pipe and pump are free from dirt (e. g. welding beads, pieces of steal etc). Carry out preservation (see Preservation). Oxydation and impurity can cause a breakdown.

5.5 Válvula de pie

Para el modo de aspiración se deberá instalar una válvula de pie con tamiz de aspiración. El proceso de aspiración se facilita y se evita la suciedad considerable y el vaciado del conducto de aspiración.

5.5 Foot Valve

With the suction operation it is necessary to install a foot valve with strainer. This process prevents the induction of impurity and draining of the suction pipe.

5.6 Conexión eléctrica

El motor se deberá conectar protegido contra sobrecargas cumpliendo las normativas locales y teniendo en cuenta la placa indicadora de potencia del motor. Compare la tensión de red existente con la placa indicadora de potencia del motor. Tenga en cuenta el diagrama eléctrico de la caja de conexiones del motor.

5.6 Electrical Installation

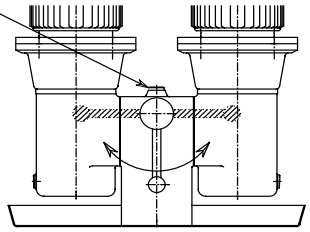
All electrical connections should be made overload protected in accordance with any local regulations and with the motor labels. Check motor labels for correct voltage and current ratings. Pay attention to the wiring schematic in the motor terminal box.

6. PUESTA EN MARCHA

6.1 Protección contra la marcha en seco

Las bombas no deben funcionar en seco, ya que se puede producir la rotura de las piezas de la bomba. Compruebe manualmente el funcionamiento suave de la bomba. Recomendación: purgue la bomba y el conducto de aspiración y llénelos con fluido (A – rellenar, B – purgar) ➢ **Imagen 16** .

Modelo / Type DL2



Procedimiento de llenado:

- Retire el tornillo de cierre 908,2
- Desplace la palanca hacia la izquierda - rellene aceite
- Desplace la palanca hacia la derecha - rellene aceite

- remove screw plug 908,2
- turn lever to the left - fill with oil
- turn lever to the right - fill with oil

Gire la bomba manualmente en la dirección de la flecha y compruebe que funciona con suavidad.

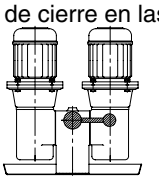
6.2 Control de la dirección de giro

La dirección de giro del motor debe coincidir con la flecha de indicación de la dirección de giro de la bomba. Para controlar la dirección de giro, el motor se puede conectar durante un breve espacio de tiempo con las válvulas de aspiración y de presión abiertas. En caso de que la bomba se gire en la dirección incorrecta, ésta no aspirará y se producirán daños en la misma. El control de la dirección de giro durante un espacio de tiempo más prolongado se deberá realizar sin bomba.

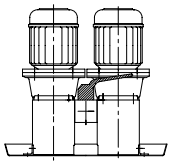
6.3 Arranque

Antes del arranque deberá abrir las válvulas del lado de aspiración y de presión. Durante el proceso de arranque se deberá purgar la bomba / estación. Los choques térmicos extremos pueden dañar considerablemente la bomba / estación. Tenga en cuenta la posición de la palanca en los grupos de bloque y la posición de las válvulas de cierre en las estaciones individuales y dobles. ➢ **Imagen 17**

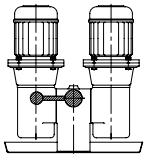
Modelo / Type **DL2**

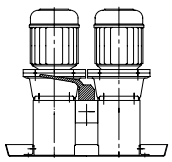


Modelos / Type **DL3, DL4, DS1, DS3, DS4**

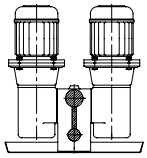


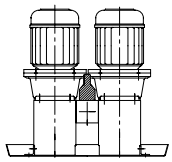
Palanca a la derecha: sólo la bomba derecha está lista para el funcionamiento
Lever right: only right pump is ready for operation





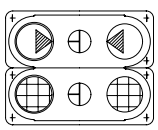
Palanca a la izquierda: sólo la bomba izquierda está lista para el funcionamiento
Lever left: only left pump is ready for operation



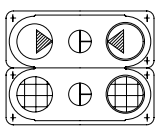


***Palanca en posición central**: ambas bombas están listas para el funcionamiento
Lever position middle: both pumps are ready for operation

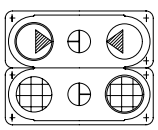
Modelos / Type **DL7,DS7, DCL7, DCS7**



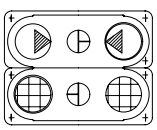
bomba izquierda y filtro izquierdo listos para el funcionamiento
left pump and left filter ready for operation



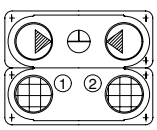
bomba derecha y filtro derecho listos para el funcionamiento
right pump and right filter ready for operation



bomba izquierda y filtro derecho listos para el funcionamiento
left pump and right filter ready for operation



bomba derecha y filtro izquierdo listos para el funcionamiento
right pump and left filter ready for operation



① ambas bombas y filtro izquierdo listos para el funcionamiento
② ambas bombas y filtro derecho listos para el funcionamiento

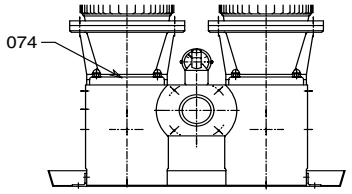
① both pumps and left filters ready for operation
② both pumps and right filters ready for operation

6. START UP

6.1 Dry Running Protection

The pumps must never be allowed to run dry, as this will cause severe damage to all the pump parts. Check by hand if the pump runs easy. We recommend: to fill the pump and suction pipe with the medium and vent. (A - to fill, B - to vent) ➢ **scheme 16**

Modelos / Type DL3, DL4, DL7, DS1, DS3, DS4, DS7, DCL7, DCS7



How to fill:

- Retire ambas tapas del filtro 074 y rellene la estación conaceite.

- Remove both filter covers 074 and fill station with oil.

Rotate the pump by hand in the direction of the arrow and check if the pump runs easy.

6.2 Checking the Direction of Rotation

The direction of rotation of the motor should correspond with the arrow shown on the pump. To check the direction of rotation it is allowed to start the motor for a short time, when the suction and pressure valves are open. In case of wrong sense of rotation pump does not prime and as a result this can cause damage of the pump. If checking the direction of rotation longer than recommended this process should be continued without the pump.

6.3 Start Up

Prior to start up open valves on suction and pressure side. Vent pump/station during start up. Extreme temperature shock may destroy the pump/station. Pay attention to the lever position at block aggregates and to the position of the stop valve at single and double stations. ➢ **scheme 17**

7. MANEJO / MANTENIMIENTO

7.1 Mantenimiento y control

Los controles visuales y de ruidos, así como el control de estanqueidad, se deberían realizar diariamente.

7.3 Limpieza del filtro

La limpieza del filtro dependerá del grado de suciedad del fluido de bombeo. Los vacuómetros instalados sirven para la indicación del grado de suciedad.

Vacío máx. permitido:

en gasóleo de calefacción	0,5 bares
en gasóleo de calefacción S	0,7 bares

En caso de alto grado de suciedad en los filtros existe peligro de cavitación (nivel elevado de ruidos). La limpieza del filtro no se podrá realizar con la palanca de cambio en la posición central. Conecte primero la bomba de reserva y seguidamente gire la palanca de cambio en dirección a la bomba que esté en funcionamiento (véase el apartado 6.3 Arranque / posición de la palanca) ➢ **Imagen 17**

7.4 Desmontaje de la bomba

Compruebe la desconexión eléctrica, bloquee la palanca de cambio o cierre las válvulas de aspiración y de presión, purgue las bombas (tornillo de purga) y compruebe los posibles daños que puedan presentar las juntas planas y al anillo tórico durante el remontaje. El desmontaje de una bomba de montaje se puede llevar a cabo sin interrupción del funcionamiento. El procedimiento de cambio se deberá realizar tal y como se describe en el apartado de Limpieza del filtro en el punto 7.3. Desmonte el motor y la lámpara. Suelte con cuidado la bomba de montaje utilizando 2 destornilladores y si existen fugas de aceite a través de válvulas de retención que no estén estancas. En caso de que el estado sea correcto, proceda a extraer la bomba de montaje. Antes del montaje, tenga en cuenta que en la carcasa de la estación el nivel de aceite sea como máx. de 5 cm. De lo contrario, el montaje de la bomba de montaje resultará más complicado debido a la expulsión de aceite. Compruebe los posibles daños en los anillos tóricos de la bomba de montaje y lubríquelos ligeramente. Inserte la bomba de montaje en la carcasa de la estación ejerciendo una ligera presión, monte la lámpara y el motor y sitúe la palanca de cambio en la posición central.

7.5 Conservación, almacenamiento

Durante la prueba de funcionamiento, la bomba se rocía con aceite para su conservación. Las piezas que no hayan sido sometidas al proceso de conservación de fábrica, deberán ser sometidas a dicho proceso por el propietario de acuerdo con las condiciones locales. En caso de tiempos prolongados sin funcionamiento o sin puesta en marcha, el propietario deberá aplicar un agente anticorrosivo.
Recomendación: Para el interior de la bomba – ácidos y aceite sin resinas. Para la parte exterior de la bomba - Castrol Rustilo DWX 33 u otro producto a elección del propietario, dependiendo de las condiciones locales.

7. MAINTENANCE

7.1 Maintenance and Inspection

We recommend that the unit is given a visual and noise check every day, as well as checking the function of gaskets.

7.3 Cleaning the Filter

The frequency of cleaning the filter is dependent on the contamination of the medium. The degree of contamination is visible on the vacuummeter built on.

admissible vacuum at:	light fuel oil	max. 0,5 bar
	heavy fuel oil	max. 0,7 bar

A high contamination of the filter will cause cavitation (noise). Cleaning the filter is not allowed when lever is in the middle position. Turn the lever first to the spare pump, then turn lever to the running pump (see 6.3 start / position of lever) ➢ **scheme 17**

7.4 Dismantling the Pump

Pay attention to the electrical switch off, close lever or suction- and pressure valve, drain pump (drain plug), when installing the pump again check if flat gaskets/o-rings are damaged. The insert pump can be removed without interruption of operation. Turn the lever as described under point 7.3 "Cleaning the Filter". Dismantle the motor and lantern. Loosen insert pump by using 2 screw drivers. Check whether non return valves are leaky and oil is penetrating. If not remove the insert pump. Before installing the insert pump, make sure that the level of oil in the station casing is max. 50 mm. Otherwise it may prove difficult to install due to oil displacement Check the O-rings of the insert pump whether they are damaged or not and grease them slightly. Push the insert pump under light pressure inside the station casing. Mount lantern and motor and turn the lever to the middle position.

7.5 Preservation and Storage

The pumps have been wetted and preserved with hydraulic oil ISO VG 46, during testing. The user has got to preserve all other parts, which are not preserved in the factory, in accordance with the local conditions. If the pump is not in operation for any period of time or stored the user has to preserve it with an anti rust lubricant. We recommend: The inside surface of the pump - acid and resin free oil. Pump outside - Castrol Rustilo DWX 33 or others, selected by the user regarding the local conditions.

7.6 Posibles daños

Los posibles daños que puedan aparecer en la bomba debido a la falta de estanqueidad, deberán evitarse por parte del propietario mediante la instalación de dispositivos de aviso.

7.7 Control de la bomba de reserva

El control de la bomba de reserva se debería llevar a cabo una vez semanalmente. Es recomendable controlar el funcionamiento suave de la palanca de cambio. Las válvulas de retención pueden presentar fugas a causa de la acumulación de suciedad. El cambio reiterado de la bomba 1 a la bomba 2, así como el funcionamiento común de las bombas, permite eliminar la posible suciedad acumulada. Si esto no resulta efectivo, póngase en contacto con el fabricante.

7.6 Preventation of Damage Caused by Leakage

The user must install an alarm device to prevent damage caused by leakage.

7.7 Checking of Spare Pump

It is necessary to check the function of the spare pump weekly. It is recommended to operate the lever weekly to guarantee that it doesn`t become stuck. Contamination of the non return valves can cause leakage. Contamination can be removed by switching over from pump 1 to pump 2 or when both pumps are operating together for a short period of time. If either of these solutions fail it is necessary to discuss it with the factory.

8. AVERÍAS / ELIMINACIÓN

8. FAILURES/REMEDIES

Avería en el funcionamiento	Posible causa / Propuesta de eliminación de la avería Possible Reasons, Remedies	Failures
- La bomba no aspira	1, 2, 3, 4, 5, 12	- pump does not prime
- La bomba no funciona a pleno rendimiento	3, 4, 5, 8, 9, 10, 11, 17, 18	- pump does not produce full capacity
- La bomba hace mucho ruido durante el funcionamiento	3, 4, 5, 6, 7, 10, 11, 13, 17	- pump is noisy
- El motor se calienta demasiado	9, 10, 13	- motor heats up
- Bombeo irregular	3, 5, 8, 10, 11, 18	- irregular flow
- La junta del eje no es estanca	7, 10, 14, 15, 16, 18	- leaking shaft seal

N° PROPUESTA DE ELIMINACIÓN DE LA AVERÍA

1 LA BOMBA ESTÁ SECA
Agrege fluido a la bomba

2 LA DIRECCIÓN DE GIRO DE LA BOMBA ES INCORRECTO
Ajuste la dirección de giro de acuerdo con la indicada por la flecha

3 EL FILTRO DE ASPIRACIÓN, LA VÁLVULA DE ASPIRACIÓN O EL CONDUCTO DE ASPIRACIÓN ESTÁN OBTURADOS
Compruebe y limpie las piezas

4 EL CONDUCTO DE ASPIRACIÓN O LA JUNTA DEL EJE PRESENTAN FUGAS
Compruebe el conducto de aspiración (puntos de unión, válvulas) o la junta del eje

5 EL NIVEL DE ASPIRACIÓN ES DEMASIADO ELEVADO
Reduzca el nivel de aspiración (diferencia de nivel), reduzca la longitud del conducto, aumente la sección transversal del conducto, reduzca la viscosidad del fluido (mediante su calentamiento), instale filtros de aspiración más grandes.

6 ERROR EN EL EJE
Bomba - Acoplamiento - Motor
Alinee el extremo del eje de forma exacta, equilibre el acoplamiento.

7 PRESENCIA DE OSCILACIONES Y PULSACIONES EN LA INSTALACIÓN
Verifique el soporte elástico del grupo, realice las conexiones con tubos flexibles.

8 LA VÁLVULA DE SOPREPRESIÓN ESTÁ ATASCADA O AJUSTADA DEMASIADO BAJA
Compruebe la válvula y vuelva a ajustarla.

9 TENSIÓN O FRECUENCIA INCORRECTA
Controle las revoluciones y el consumo de corriente del motor, compare la tensión y la frecuencia con la placa de características.

10 EL FLUIDO ES ESPESO
Aumente la temperatura del fluido, reduzca el número de revoluciones.

No. REMEDIES

1 PUMP IS DRY
fill pump with liquid

2 INCORRECT DIRECTION OF ROTATION
adjust rotation according to arrow on pump

3 CLOGGED SUCTION STRAINER, VALVE OR PIPE
check parts and clean

4 SUCTION PIPE LOOSE, SHAFT SEAL LEAKS
check suction pipe (connections, valves) resp. shaft seal

5 SUCTION HEAD TOO HIGH
reduce static suction head or length of suction pipe, increase suction pipe dia. or decrease viscosity of liquid (heat up), use larger suction filter.

6 PUMP-COUPLING-MOTOR NOT CORRECTLY ALIGNED
correct alignment, balance coupling

7 PIPEWORK "HAMMER"
support elastic, connect suction and discharge to station with flexible hoses

8 SAFETY VALVE JAMS, OR IS SET TOO LOW
check valve or change pressure setting

9 INCORRECT VOLTAGE OR FREQUENCY
check speed and current of motor and compare voltage and frequency with the data shown on the name plate of the motor

10 LIQUID OF HIGH VISCOSITY
increase temperature of liquid, select lower speed

11 EL FLUIDO CONTIENE BURBUJAS DE AIRE O GASES
Elimine los puntos de entrada de aire, reduzca el nivel de aspiración y aumente la presión de entrada.

12 LA BOMBA NO SE PURGA
Purgue el conducto de presión en el punto más elevado.

13 EL SOPORTE DEL MOTOR ESTÁ DAÑADO
Vuelva a colocar el motor sobre el soporte.

14 LA JUNTA DEL EJE ESTÁ DAÑADA
Sustituya la junta del eje.

15 LA PRESIÓN DE ENTRADA ES DEMASIADO ELEVADA O DEMASIADO BAJA
Reduzca la presión de entrada en el lado de la instalación, instale una válvula de retención en el lado de presión.

16 ARRANQUE EN FRÍO DURANTE EL BOMBEO DE ACEITE PESADO
Instale un sistema de calefacción en la bomba.

17 LA VÁLVULA DE SEGURIDAD OSCILA
Ajuste más elevada la presión de abertura girando el tornillo de ajuste en sentido horario.

18 LA VÁLVULA DE RETENCIÓN PRESENTA FUGAS
Limpie la válvula de retención.

11 AIR OR GAS IN LIQUID
check if suction is airtight, reduce suction head, resp. increase inlet pressure

12 PUMP DOES NOT VENT
vent at highest point of discharge pipe

13 MOTOR BEARING DAMAGED
replace motor bearing

14 SHAFT SEAL DAMAGED
replace shaft seal

15 SUCTION PRESSURE TOO HIGH OR TOO LOW
reduce suction pressure, install a non-return valve on discharge side

16 START WITH COLD LIQUID (Heavy fuel oil)
install a pump heating device

17 SAFETY VALVE FLUTTERS
increase opening pressure by turning the adjusting screw clockwise

18 LEAKY NON RETURN VALVES
clean non return valves

9. PIEZAS DE REPUESTO / DESMONTAJE

9.1 Indicaciones de montaje

- Desmonte el acoplamiento utilizando un dispositivo de desmontaje y retire la chaveta paralela fijada por tornillo.

- Señalice el lugar de montaje y la posición de las piezas individuales. Importante: El juego de husillos se deberá volver a montar en la posición original.

- Controle los posibles daños en la junta plana y en los anillos tóricos y sustitúyalos si fuera necesario.

- Limpie y pula la superficie de deslizamiento del husillo principal en la zona de los anillos tóricos y de las faldas obturadoras.

- Para proteger los anillos tóricos y las faldas obturadoras, el muñón de acoplamiento se deberá cubrir mediante un manguito de montaje o un elemento similar. Lubrique las superficies ligeramente para facilitar el montaje.

- Monte anillos obturadores radiales nuevos con anillo antiextrusión según el dibujo seccional y rellene los espacios intermedios con grasa. Recomendamos la aplicación de una pasta de disulfuro de molibdeno.

- Junta de anillo deslizante: Para facilitar el desmontaje, extraiga el anillo deslizante y el muelle del husillo principal girando en sentido horario. Extraiga el contra-anillo de la carcasa mediante un manguito de material sintético o un elemento similar. Durante el montaje, tenga en cuenta que el contra-anillo se encuentre situado de forma fija encima del anillo tórico.

- Manipule con sumo cuidado las superficies de la junta de anillo deslizante nueva. Límpielas con gasolina de lavado y aplique unas gotas de aceite lubricante sin resinas. Procure no tocarlas durante el montaje y evite que se ensucien. Monte el muelle girando en sentido horario.

- Durante el montaje tenga en cuenta que los orificios de evacuación de la carcasa coincidan con los de la junta.

- Tras el montaje, compruebe el funcionamiento suave girando manualmente.

9. DISMANTLING OF SPARE PARTS

9.1 Assembling Instructions

- Remove coupling with removal device and remove key also.

- Mark installation position of each part.
Attention: Spindle set must be reassembled in the original position.

- Check flat gaskets and o-rings whether they are damaged. If necessary replace them.

- Clean and polish the running surface of the main spindle in the range of the o-rings and seal lips.

- The coupling end should be covered with an installation sleeve to protect the o-rings and the seal lips. For an easy installation it is useful to grease the surface slightly.

- Install new radial shaft seals with spacer according to the section drawing and fill the space between with grease. We recommend Molybdenum Disulphide grease.

- Mechanical Seal:
To dismantle the mechanical seal, remove the slide ring and the spring from the main spindle by twisting it clockwise. Press counter ring with a plastic sleeve out of the casing. When reassembling, make sure that the counter ring is closed to the o-ring.

- Be careful about the flat surfaces of the new mechanical seal. Clean it with petroleum ether and grease it with a few drops of resin free oil. When installing try to avoid touching the part and try to avoid getting it dirty also. Slide on the spring by turning it clockwise.

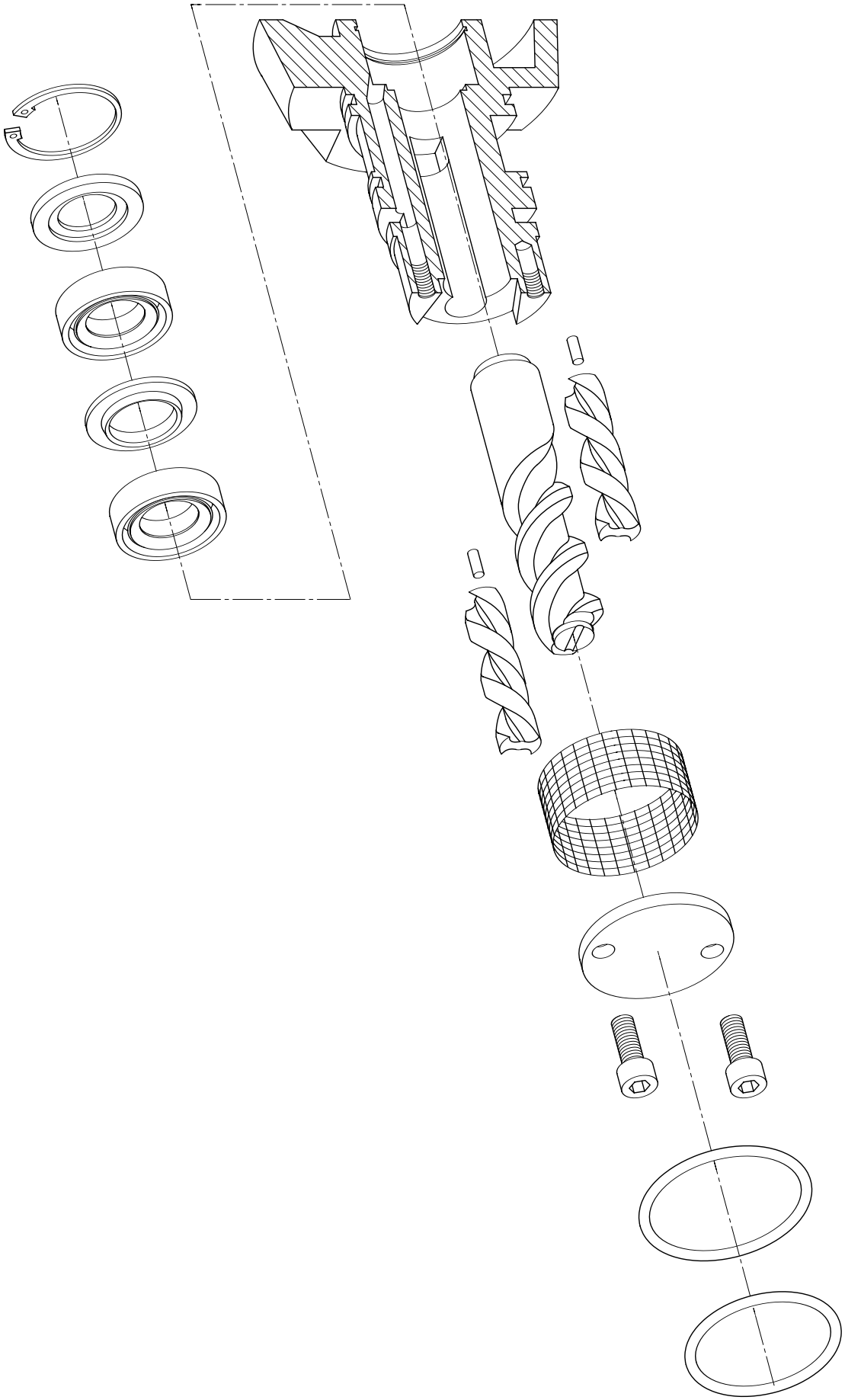
- When reassembling make sure also, that the overflow bypasses from casing and seal correspond.

- After installation it is necessary to check if the pump rotates easy when turning clockwise by hand.

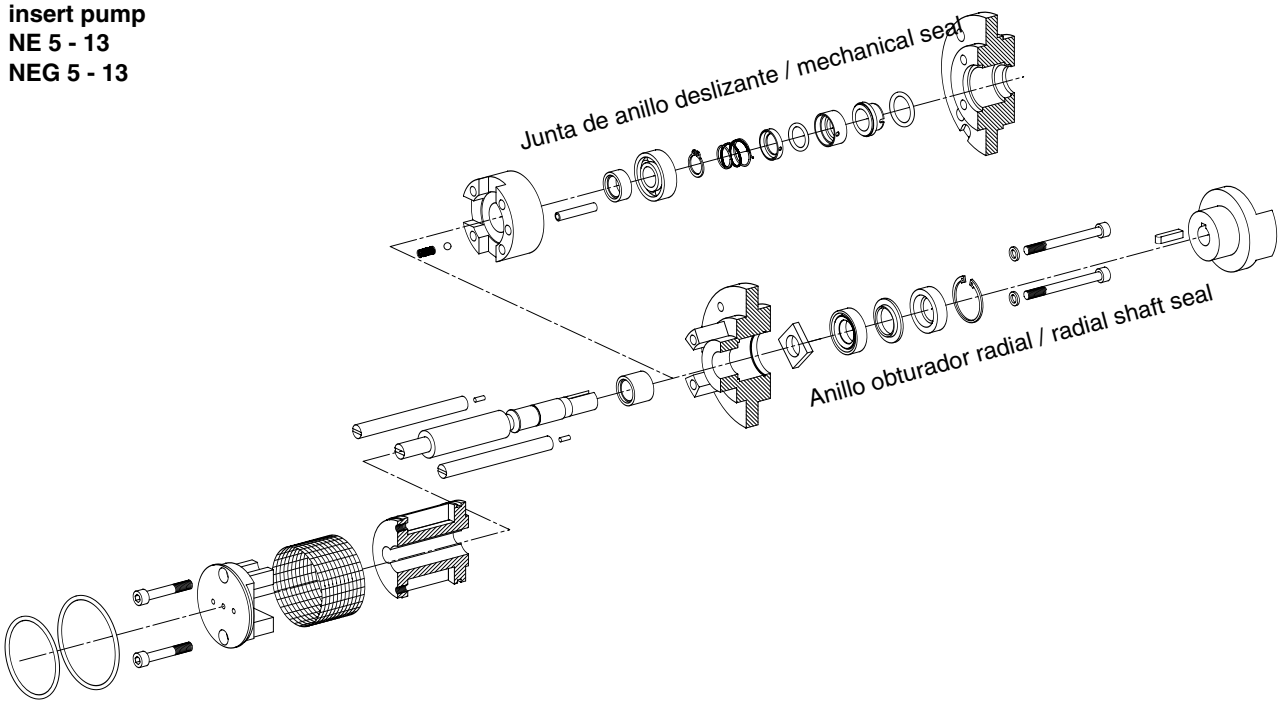
9.2. Despiece de la bomba ➢ Imagen 20

9.2 Cut View of Pump ➢ scheme 20

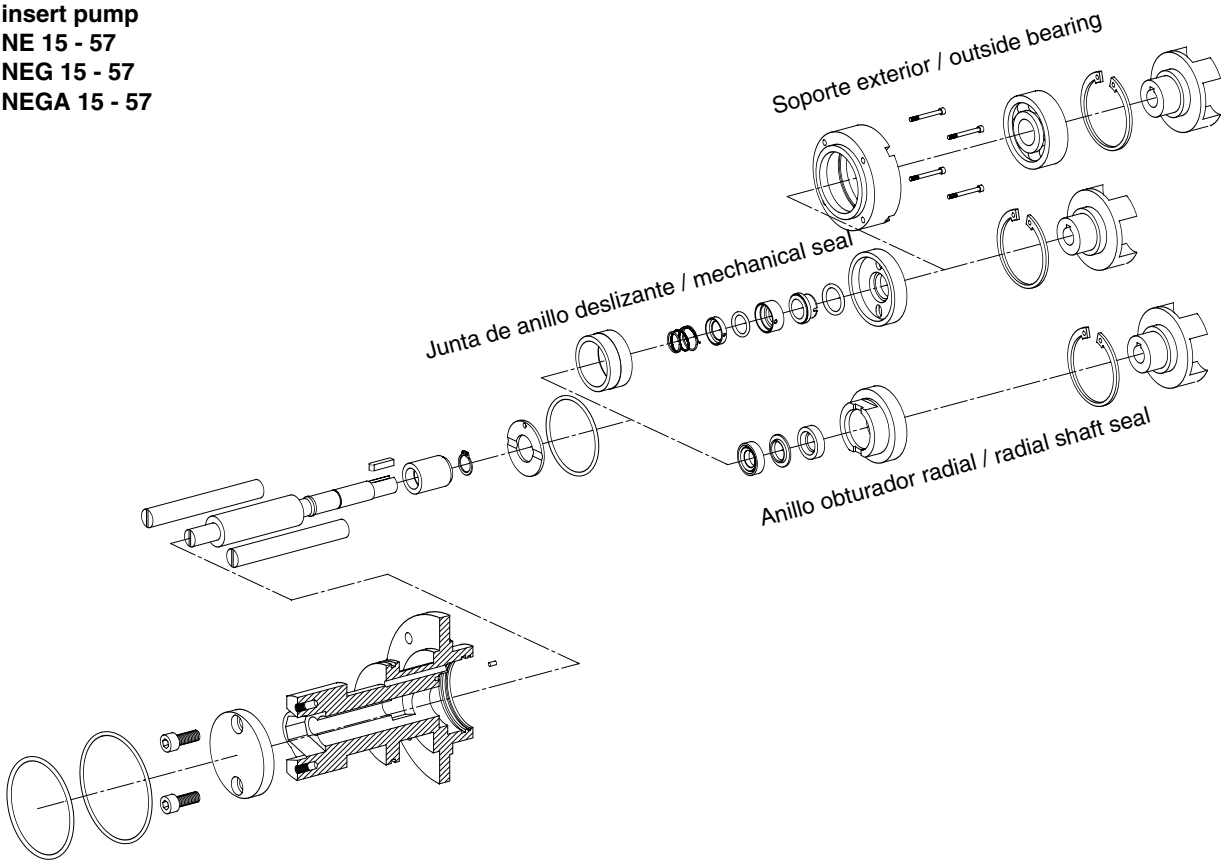
Bomba de montaje FE 5
Insert Pump FE 5



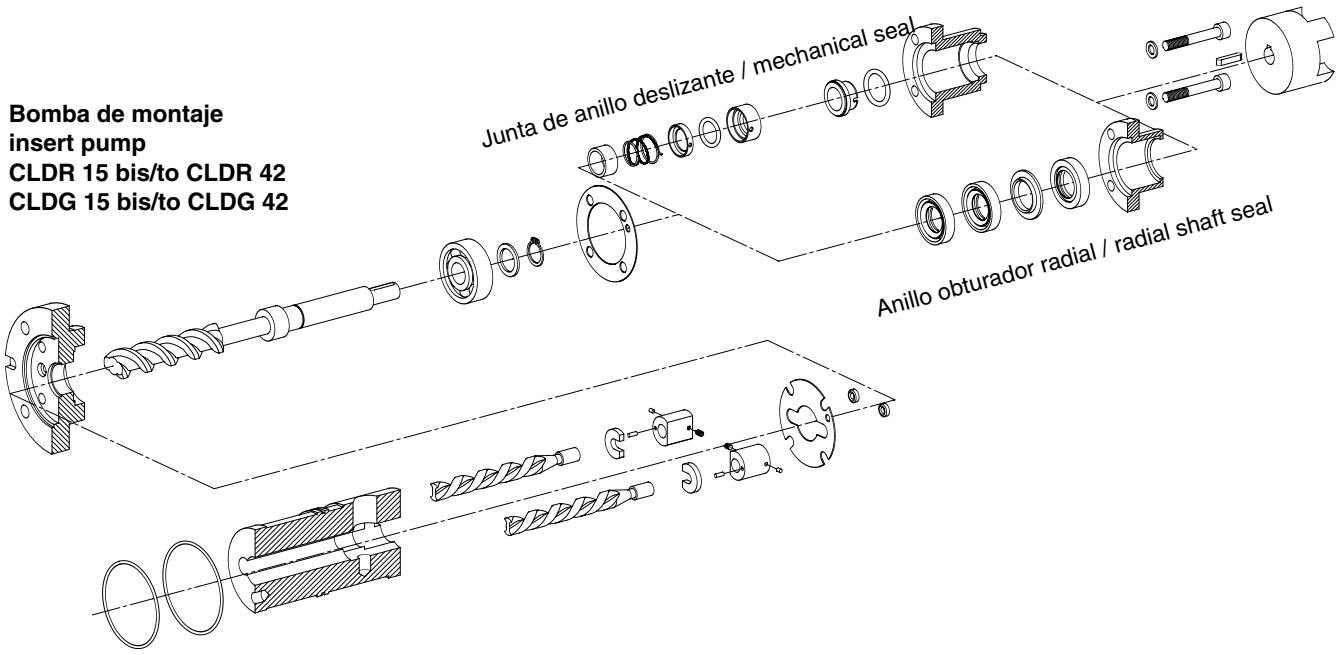
Bomba de montaje
insert pump
NE 5 - 13
NEG 5 - 13



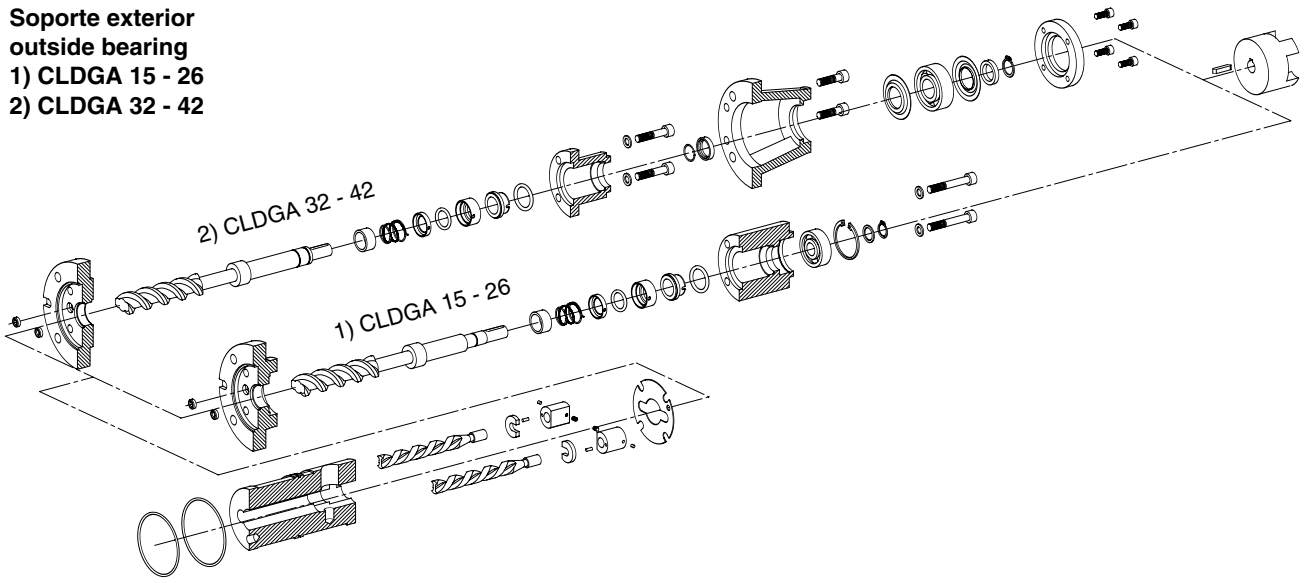
Bomba de montaje
insert pump
NE 15 - 57
NEG 15 - 57
NEGA 15 - 57



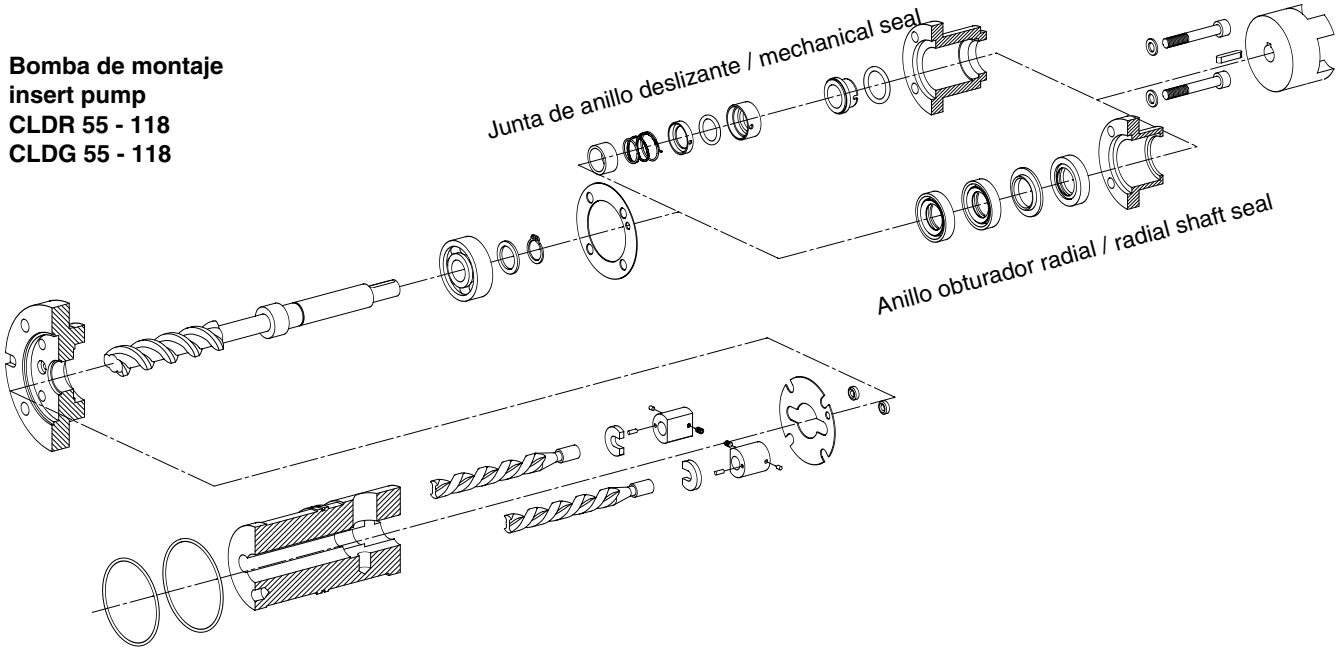
Bomba de montaje
insert pump
CLDR 15 bis/to CLDR 42
CLDG 15 bis/to CLDG 42



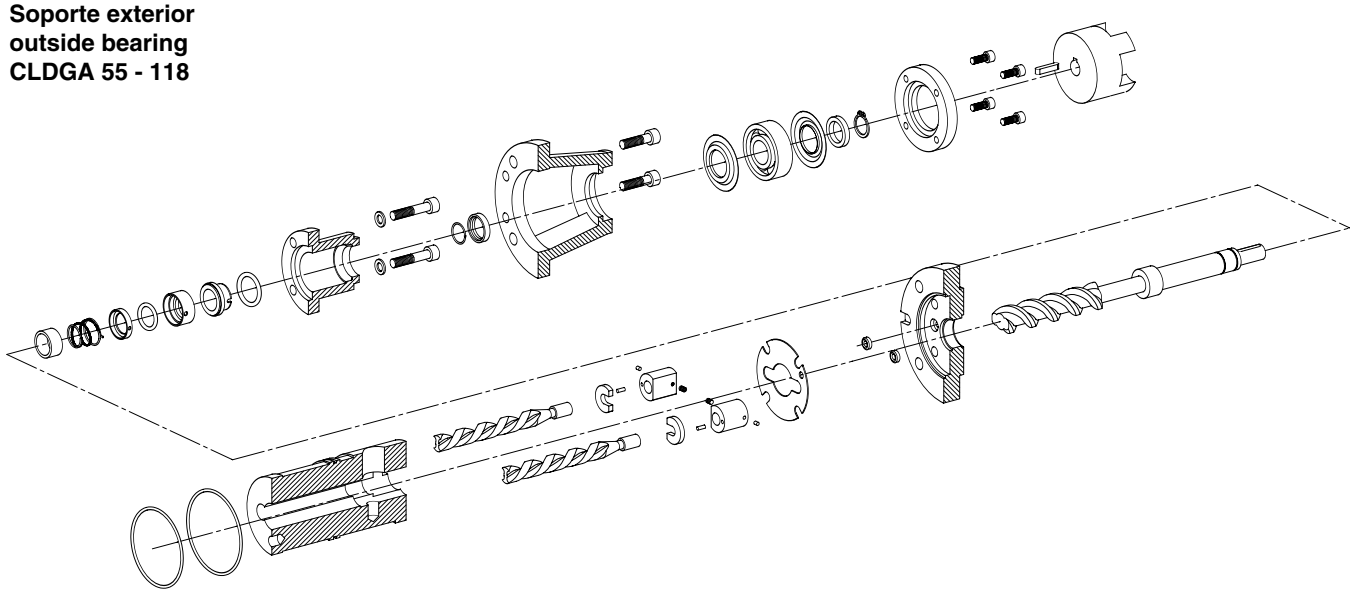
Soporte exterior
outside bearing
1) CLDGA 15 - 26
2) CLDGA 32 - 42



Bomba de montaje
insert pump
CLDR 55 - 118
CLDG 55 - 118



Soporte exterior
outside bearing
CLDGA 55 - 118



Reforma posterior del soporte exterior de las estaciones DCL y DCS

1. Desmonte el motor
2. Desenrosque las tuercas (HVM 09)
3. Retire portabombas
4. Extraiga la bomba
5. Desenrosque los pernos roscados
6. Repase las roscas de los pernos roscados y límpielas con diluyente para lacas nitrocelulósicas
7. Pegue los pernos roscados largos con p. ej. Loctite 270
8. Limpie la superficie de la junta corrija los posibles golpes que pueda presentar
9. Inserte las juntas (HPD...)
10. Monte portabombas
11. Inserte la bomba nueva
12. Apriete las tuercas (HVM 09) en describiendo una forma de cruz
13. Monte el motor

Para ello serán necesarias las siguientes piezas nuevas:

Acoplamiento

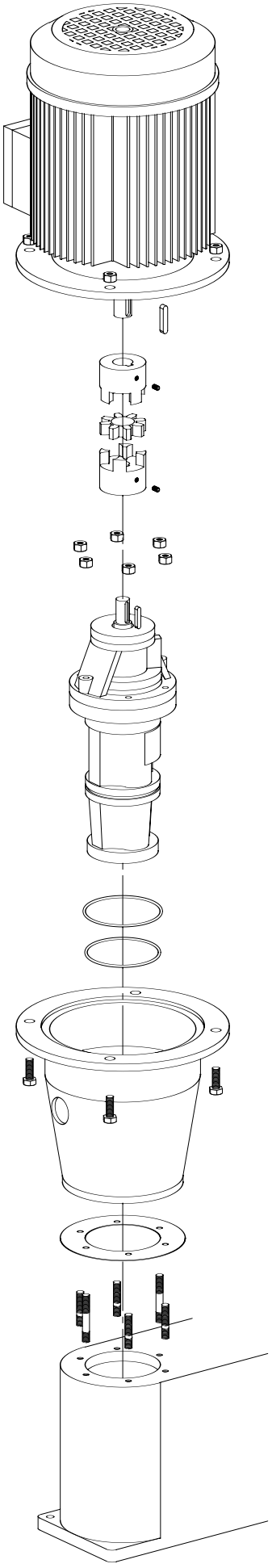
Bomba insertable con anillo tórico

Portabombas

Juntas (HPD)

Pernos roscados largos

Subsequent rebuilding of the station DCL and DCS with outside bearing



1. dismantle motor
2. remove hexagon nut (HVM 09)
3. remove old lantern
4. remove pump
5. remove bolt screw
6. cut again thread of bolt screws and clean it with nitro thinner
7. glue the long bolt screws in place e.g. with Loctite 270
8. clean the seal surface and re move dents
9. insert sealing (HPD...)
10. install new lantern
11. install new pump
12. tighten hexagon nut (HVM 09) crosswise
13. install motor

Necessary new parts:

coupling

insert pump with o-ring

lantern

gasket (HPD)

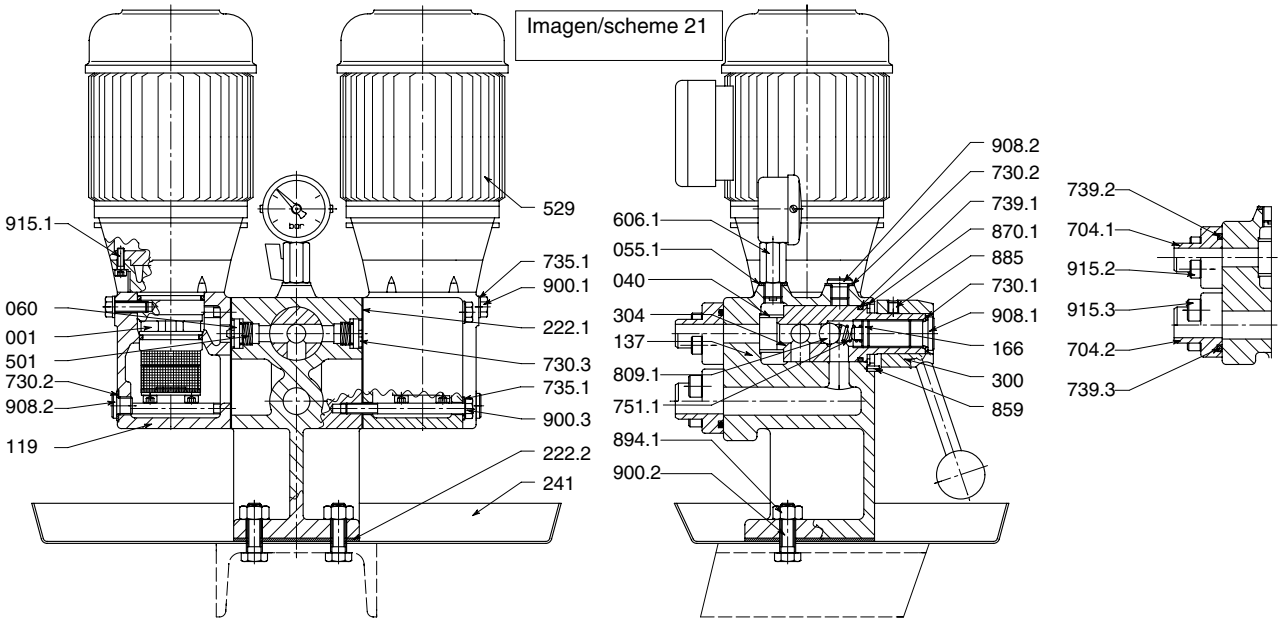
long stud screws

9. DESMONTAJE DE LAS PIEZAS DE REPUESTO

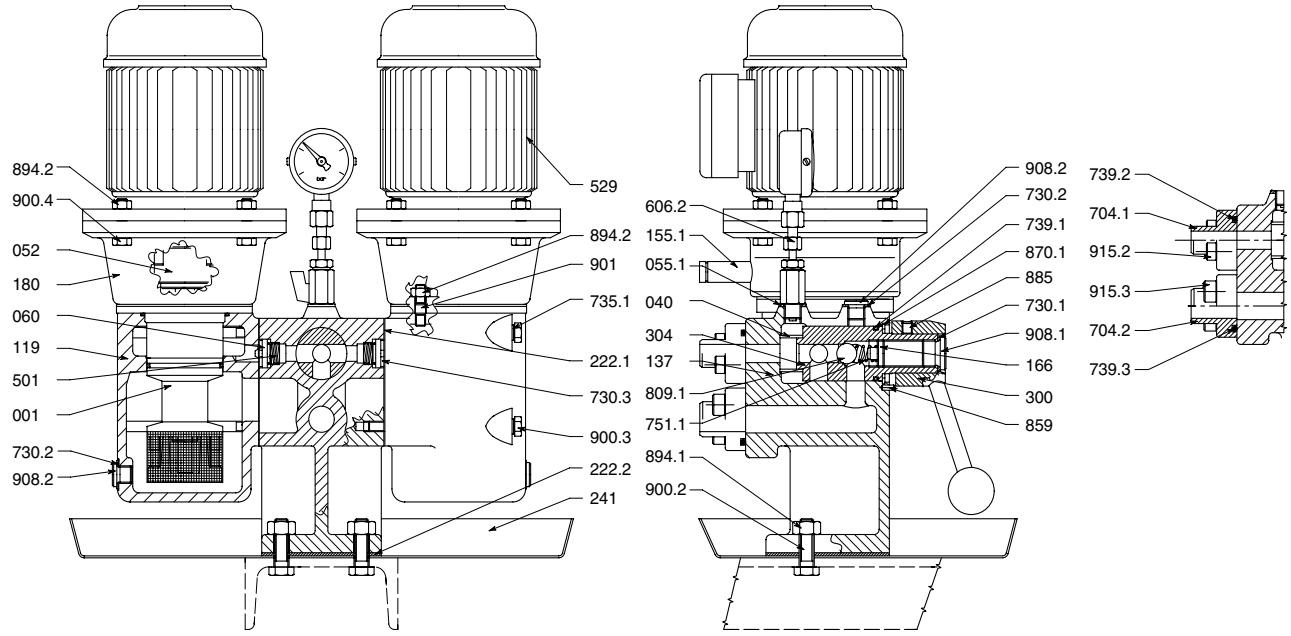
9.3 Dibujo seccional y lista de piezas Estación DL2/150-240

9. DISMANTLING OF SPARE PARTS

9.3 Section Drawing with Part List Station DL2/150-240



Estación / Station DL2/320-1300



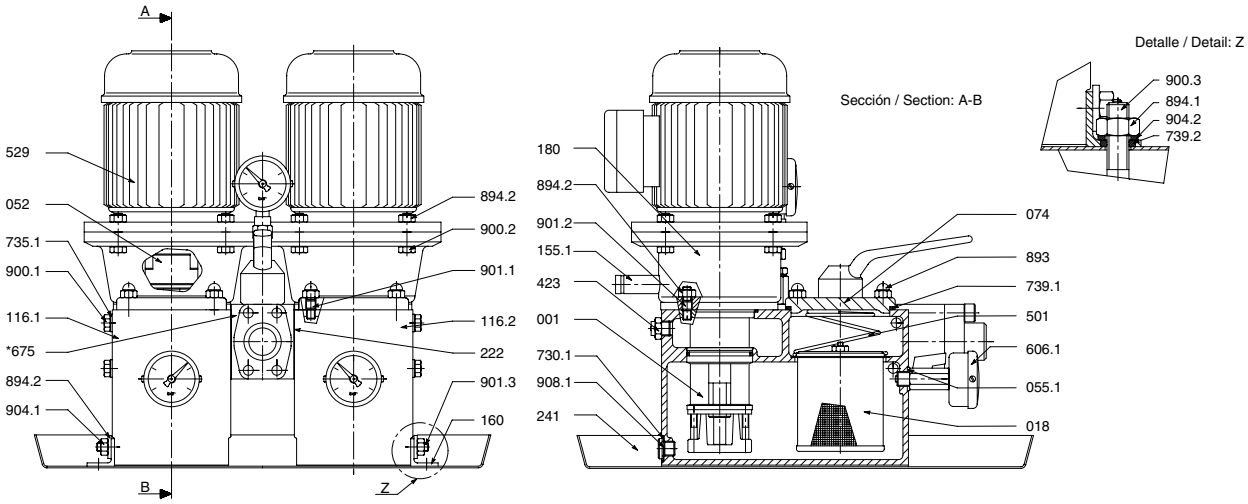
* 001	Bomba de montaje	* 735,1	Junta de cobre
040	Manguito	* 739,1	Anillo tórico
* 052	Acoplamiento	739,2	Anillo tórico
* 055,1	Anilo obturador	739,3	Anillo tórico
060	Disco	* 751,1	Muelle de compresión
119	Carcasa de presión	* 809,1	Bola
137	Carcasa de la válvula	859	Manguito de fijación
155,1	Tubo	* 870,1	Arandela de retención del eje
166	Tornillo de ajuste	885	Tornillo de sujeción
180	Portabombas	894,1	Tuerca hexagonal
* 222,1	Junta	894,2	Tuerca hexagonal
222,2	Junta	900,1	Tornillo de cabeza hexagonal
241	Depósito de aceite	900,2	Tornillo de cabeza hexagonal
300	Mango de la válvula	900,3	Tornillo de cabeza hexagonal
304	Macho de grifo de mando	900,4	Tornillo de cabeza hexagonal
* 501	Muelle de compresión	901	Perno roscado
529	Motor	908,1	Tornillo roscado
* 606,1	Manómetro bloqueable	908,2	Tornillo roscado
* 606,2	Manómetro bloqueable	915,1	Tornillo de cabeza cilíndrica
704,1	Brida	915,2	Tornillo de cabeza cilíndrica
704,2	Brida	915,3	Tornillo de cabeza cilíndrica
* 730,1	Junta plana		
* 730,2	Junta plana		
* 730,3	Junta plana		

*piezas de repuesto recomendadas

* 001	insert pump	* 735,1	Cu seal ring
040	spacer	* 739,1	O-ring
* 052	coupling	739,2	O-ring
* 055,1	seal ring	739,3	O-ring
060	disc	* 751,1	spring
119	casing	* 809,1	ball
137	valve casing	859	clamping sleeve
155,1	pipe	* 870,1	circlip
166	adjusting screw	885	set screw
180	lantern	894,1	hexagon nut
* 222,1	gasket	894,2	hexagon nut
222,2	gasket	900,1	hexagon screw
241	oilpan	900,2	hexagon screw
300	lever	900,3	hexagon screw
304	control lever spindle	900,4	hexagon screw
* 501	spring	901	locking screw
529	motor	908,1	screw plug
* 606,1	lockable manometer	908,2	screw plug
* 606,2	lockable manometer	915,1	socket screw
704,1	flange	915,2	socket screw
704,2	flange	915,3	socket screw
* 730,1	gasket		
* 730,2	gasket		
* 730,3	gasket		

*recommended spare parts

Estación / Station DS1



001	Bomba de montaje	* 730,1	Junta plana	001	insert pump	* 730,1	flat gasket
* 018	Alcachofa	* 735,1	Junta de cobre	* 018	filter basket	* 735,1	Cu seal ring
052	Acoplamiento	* 739,1	Anillo tórico	052	coupling	* 739,1	O-ring
* 055,1	Anillo obturador	739,2	Anillo tórico	* 055,1	gasket	739,2	O-ring
074	Tapa del filtro	893	Tuerca de sombrerete	074	filter cover	893	cap nut
116,1	Lado izquierdo de la carcasa del grupo	894,1	Tuerca hexagonal	116,1	left casing	894,1	hexagon nut
		894,2	Tuerca hexagonal	116,2	right casing	894,2	hexagon nut
116,2	Lado derecho de la carcasa del grupo	900,1	Tornillo de cabeza hexagonal	155,1	pipe	900,1	hexagon screw
		900,2	Tornillo de cabeza hexagonal	160	angle	900,2	hexagon screw
155,1	Tubo	900,3	Tornillo de cabeza hexagonal	180	flange lantern	900,3	hexagon screw
160	Codo	901,1	Perno roscado	* 222	flat gasket	901,1	locking screw
180	Portabombas	901,2	Perno roscado	241	oil pan	901,2	locking screw
* 222	Junta plana	901,3	Perno roscado	423	vent valve	901,3	locking screw
241	Depósito de aceite	904,1	Disco	501	conical spring	904,1	disc
423	Válvula de purga	904,2	Disco	529	motor	904,2	disc
501	Muelle de compresión cónico	908,1	Tornillo de cierre	* 606,1	lockable vacuummeter	908,1	screw plug
529	Motor						
* 606,1	Vacuómetro bloqueable						

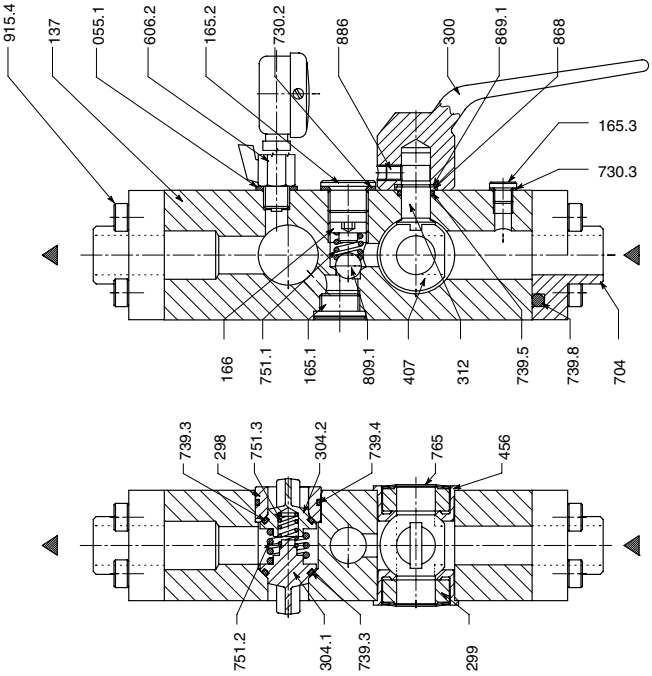
* empfohlene Ersatzteile

* recommended spare parts

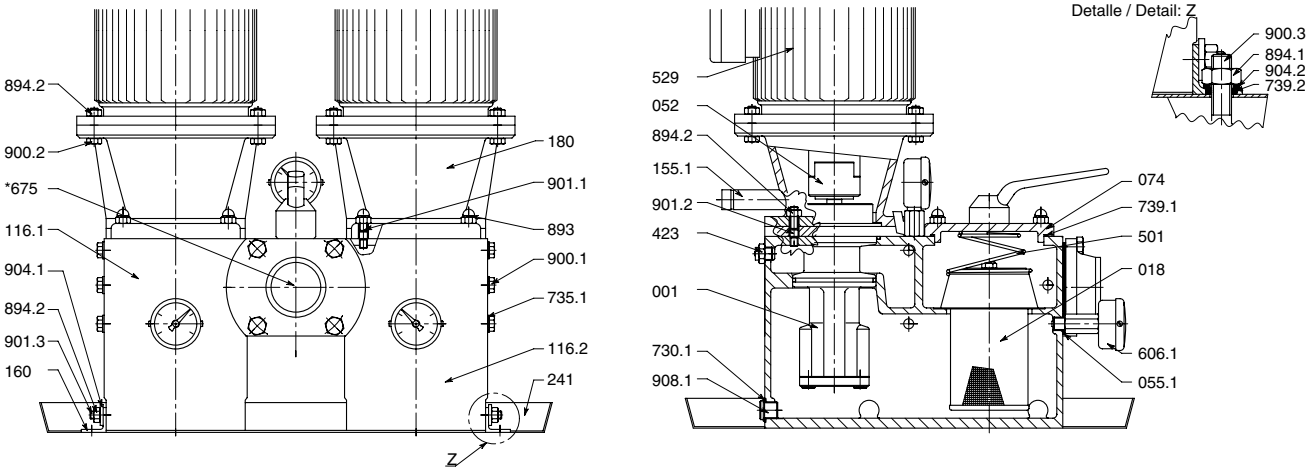
Bloque de mando *Pos. 675

Control device *pos. 675

* 055,1	Anillo obturador	* 055,1	seal ring
137	Carcasa de la válvula	137	valve casing
165,1	Tornillo de cierre	165,1	screw plug
165,2	Tornillo de cierre	165,2	screw plug
165,3	Tornillo de cierre	165,3	screw plug
166	Tornillo de ajuste	166	adjusting screw
298	Pieza insertada de la válvula	298	valve insert
299	Pieza insertada de la válvula	299	valve insert
300	Mango de la válvula	300	lever
* 304,1	Cono de válvula	* 304,1	valve cone
* 304,2	Cono de válvula	* 304,2	valve cone
312	Husillo de ajuste	312	valve spindle
407	Bola de mando	407	valve ball
* 456	Junta con forma	* 456	form gasket
* 606,2	Manómetro bloqueable	* 606,2	lockable manometer
704	Brida	704	flange
730,2	Junta plana	730,2	flat gasket
730,3	Junta plana	730,3	flat gasket
* 739,3	Anillo tórico	* 739,3	O-ring
* 739,4	Anillo tórico	* 739,4	O-ring
* 739,5	Anillo tórico	* 739,5	O-ring
739,8	Anillo tórico	739,8	O-ring
* 751,1	Muelle de compresión	* 751,1	spring
* 751,2	Muelle de compresión	* 751,2	spring
* 751,3	Muelle de compresión	* 751,3	spring
* 765	Muelle de disco	* 765	plate spring
* 809,1	Bola	* 809,1	ball
868	Anillo antiextrusión	868	supporting plate
* 869,1	Arandela de retención del eje	* 869,1	circlip
886	Tornillo de sujeción	886	set screw
915,4	Tornillo de cabeza cilíndrica	915,4	socket screw



Estación / Station DL3, DL4, DS3, DS4

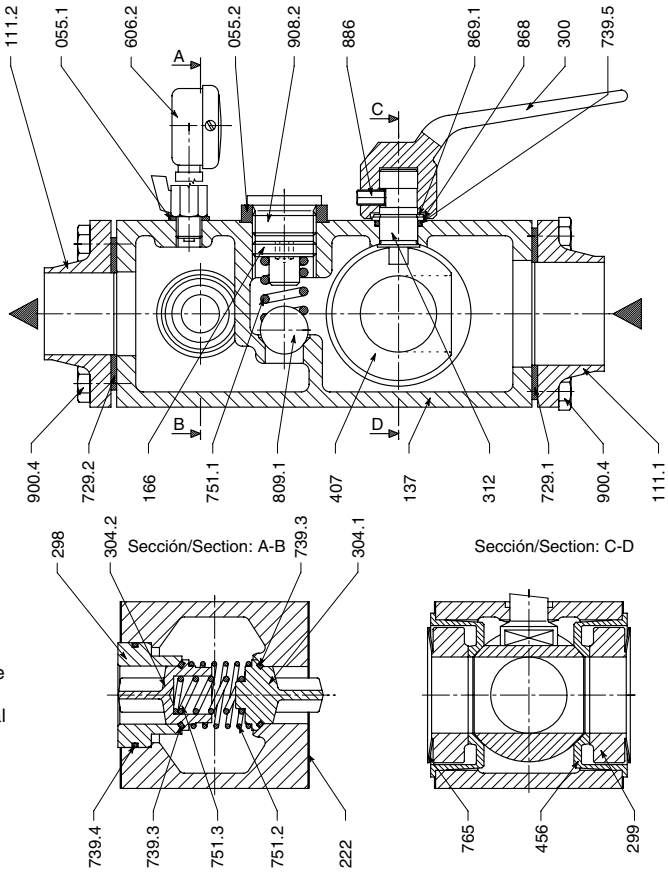


001	Bomba de montaje	*735,1	Junta de cobre	001	insert pump	*735,1	Cu seal ring
*018	Alcachofa	*739,1	Anillo tórico	*018	filter gasket	*739,1	O-ring
052	Acoplamiento	739,2	Anillo tórico	052	coupling	739,2	O-ring
*055,1	Anillo obturador	893	Tuerca de sombrerete	*055,1	seal ring	893	cap nut
074	Tapa del filtro	894,1	Tuerca hexagonal	074	filter cover	894,1	hexagon nut
116,1	Lado izquierdo de la carcasa del grupo	894,2	Tuerca hexagonal	116,1	left casing	894,2	hexagon nut
		900,1	Tornillo de cabeza hexagonal	116,2	right casing	900,1	hexagon screw
116,2	Lado derecho de la carcasa del grupo	900,2	Tornillo de cabeza hexagonal	155,1	pipe	900,2	hexagon screw
		900,3	Tornillo de cabeza hexagonal	160	angle	900,3	hexagon screw
155,1	Tubo	901,1	Perno roscado	180	flange lantern	901,1	locking screw
160	Codo	901,2	Perno roscado	241	oil pan	901,2	locking screw
180	Portabombas	901,3	Perno roscado	423	vent valve	901,3	locking screw
241	Depósito de aceite	904,1	Disco	501	conical spring	904,1	disc
423	Válvula de purga	904,2	Disco	529	motor	904,2	disc
501	Muelle de compresión cónico	908,1	Tornillo roscado	*606,1	lockable vacuummeter	908,1	screw plug
529	Motor						
*606,1	Vacuómetro bloqueable			*730,1	flat gasket		
*730,1	Junta plana						

Bloque de mando *Pos. 675

*055,1	Anillo obturador
*055,2	Anillo obturador
111,1	Brida para soldar
111,2	Brida para soldar
137	Carcasa de la válvula
166	Tornillo de ajuste
*222	Junta plana
298	Pieza insertada de la válvula
299	Pieza insertada de la válvula
300	Mango de la válvula
*304,1	Cono de válvula
*304,2	Cono de válvula
312	Husillo de ajuste
407	Bola de mando
*456	Junta con forma
*606,2	Manómetro bloqueable
729,1	Junta plana
729,2	Junta plana
*739,3	Anillo tórico
*739,4	Anillo tórico
*739,5	Anillo tórico
*751,1	Muelle de compresión
*751,2	Muelle de compresión
*751,3	Muelle de compresión
*765	Muelle de disco
*809,1	Bola
868	Anillo antiextrusión
*869,1	Arandela de retención del eje
886	Tornillo de sujeción
900,4	Tornillo de cabeza hexagonal
908,2	Tornillo roscado

* piezas de repuesto recomendadas

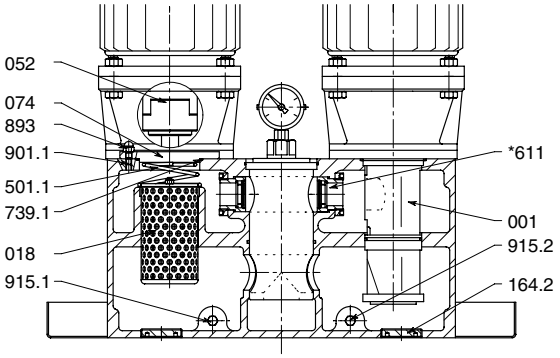


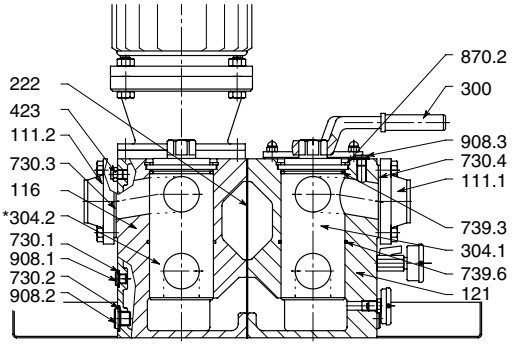
Control device *pos. 675

*055,1	seal ring
*055,2	seal ring
111,1	flange
111,2	flange
137	valve casing
166	adjusting screw
*222	flat gasket
298	valve insert
299	valve insert
300	lever
*304,1	valve cone
*304,2	valve cone
312	valve spindle
407	valve ball
*456	form gasket
*606,2	lockable manometer
729,1	flat gasket
729,2	flat gasket
*739,3	O-ring
*739,4	O-ring
*739,5	O-ring
*751,1	spring
*751,2	spring
*751,3	spring
*765	plate spring
*809,1	ball
868	supporting plate
*869,1	circlip
886	set screw
900,4	hexagon screw
908,2	screw plug

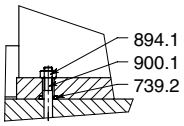
* recommended spare parts

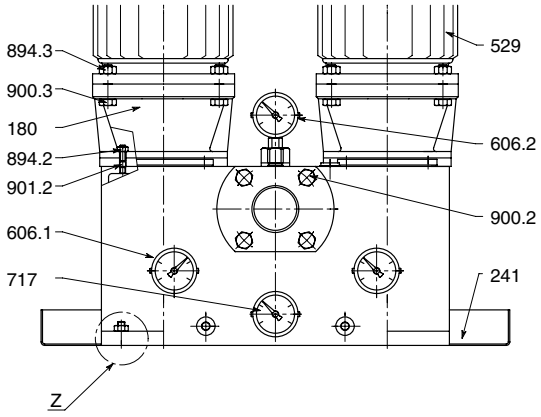
Estación / Station DL7, DS7, DCL7, DCS7



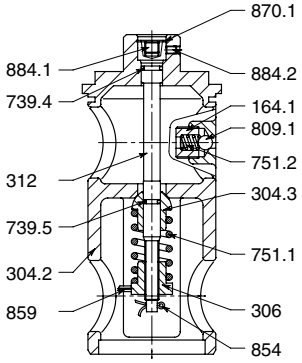


Detalle / Detail: Z

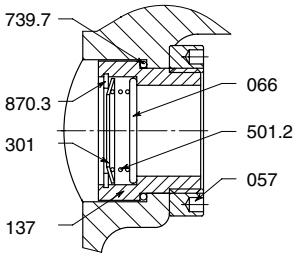




*Pos. 304.2



*Pos. 611



001	Bomba de montaje	*730,2	Junta plana
*018	Alcachofa	*730,3	Junta plana
052	Acoplamiento	*730,4	Junta plana
057	Anillo roscado	*739,1	Anillo tórico
066	Disco obturador	*739,2	Anillo tórico
074	Tapa del filtro	*739,3	Anillo tórico
111,1	Brida para soldar	*739,4	Anillo tórico
111,2	Brida para soldar	*739,5	Anillo tórico
116	Carcasa del grupo	*739,6	Anillo tórico
121	Carcasa del filtro	*739,7	Anillo tórico
137	Carcasa de la válvula	*751,1	Muelle de compresión
164,1	Tornillo de ajuste	*751,2	Muelle de compresión
164,2	Tornillo de ajuste	*809,1	Bola
180	Portabombas	*870,1	Arandela de retención del eje
*222	Junta plana	*870,2	Arandela de retención del eje
241	Depósito de aceite	*870,3	Arandela de retención del eje
300	Llave poligonal de vaso	854	Clavija hendida
301	Muelle de disco	859	Manguito de fijación
304,1	Macho de grifo de mando aspiración	884,1	Tornillo de sujeción
		884,2	Tornillo de sujeción
304,2	Macho de grifo de mando presión	893	Tuerca de sombrerete
		894,1	Tuerca hexagonal
*304,3	Cono de válvula	894,2	Tuerca hexagonal
*306	Tuerca de ajuste	894,3	Tuerca hexagonal
312	Husillo de ajuste	900,1	Tornillo de cabeza hexagonal
423	Válvula de purga	900,2	Tornillo de cabeza hexagonal
501,1	Muelle de compresión cónico	900,3	Tornillo de cabeza hexagonal
		901,1	Perno roscado
*501,2	Muelle de compresión	901,2	Perno roscado
529	Motor	908,1	Tornillo roscado
606,1	Vacuómetro bloqueable	908,2	Tornillo roscado
606,2	Manómetro bloqueable	915,1	Tornillo de cabeze cilíndrica
*611	Válvula de retención	915,2	Tornillo de cabeze cilíndrica
*717	Termómetro		
*730,1	Junta plana		

* piezas de repuesto recomendadas

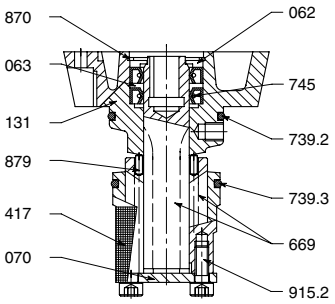
001	insert pump	*730,2	flat gasket
*018	filter basket	*730,3	flat gasket
052	coupling	*730,4	flat gasket
057	ring nut	*739,1	O-ring
066	seal disc	*739,2	O-ring
074	filter cover	*739,3	O-ring
111,1	flange	*739,4	O-ring
111,2	flange	*739,5	O-ring
116	casing	*739,6	O-ring
121	filter casing	*739,7	O-ring
137	valve casing	*751,1	spring
164,1	adjusting screw	*751,2	spring
164,2	adjusting screw	*809,1	ball
180	flange lantern	*870,1	circlip
*222	flat gasket	*870,2	circlip
241	oil pan	*870,3	circlip
300	lever	854	split pin
301	spring plate	859	clamping sleeve
304,1	control lever spindle suction	884,1	set screw
		884,2	set screw
304,2	control lever spindle pressure	893	cap nut
		894,1	hexagon nut
*304,3	valve cone	894,2	hexagon nut
*306	valve nut	894,3	hexagon nut
312	valve spindle	900,1	hexagon screw
423	vent valve	900,2	hexagon screw
501,1	cone spring	900,3	hexagon screw
*501,2	spring	901,1	locking screw
529	motor	901,2	locking screw
606,1	lockable vacuummeter	908,1	screw plug
		908,2	screw plug
606,2	lockable manometer	915,1	socket screw
		915,2	socket screw
*611	non return valve		
*717	thermometer		
*730,1	flat gasket		

* recommended spare parts

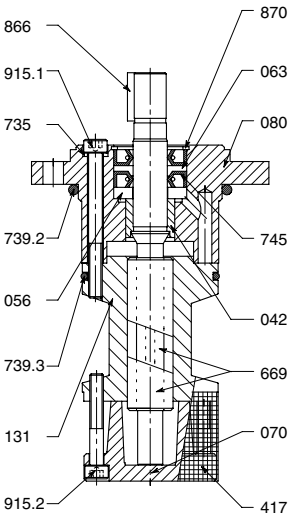
Bomba de montaje

Insert pump

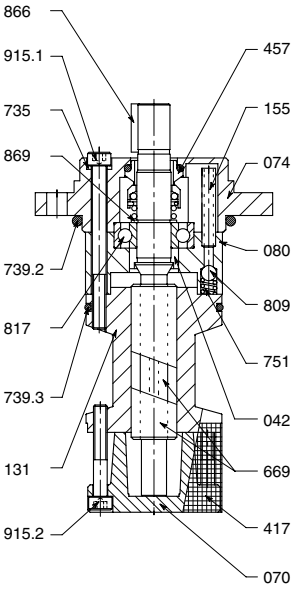
Modelo/Type FE 5



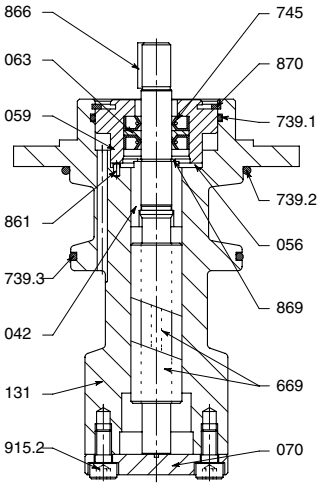
Modelo/Type NE 5-13



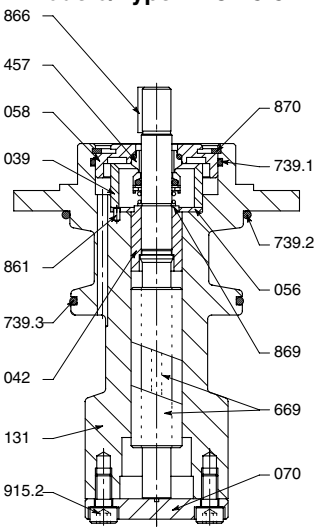
Modelo/Type NEG 5-13



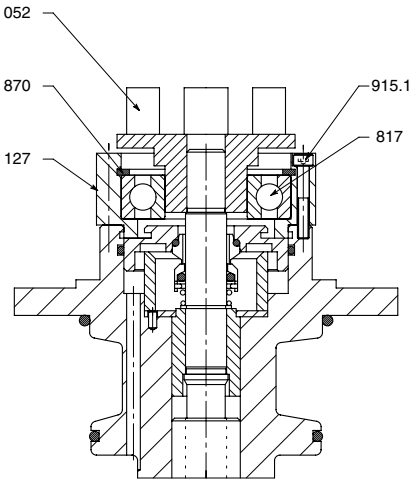
Modelo/Type NE 15-57



Modelo/Type NEG 15-57



Modelo/Type NEGA 15-57

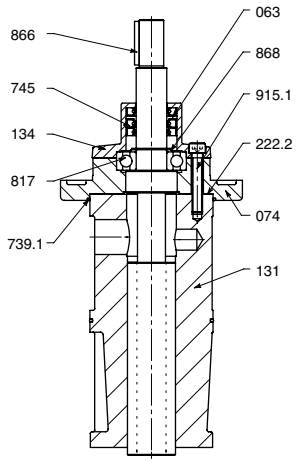


039	Casquillo distanciador	* 669	Juego de usillos	039	distance sleeve	* 669	spindle set
* 042	Casquillo de compensación	* 735	Junta de cobre	* 042	distance sleeve	* 735	Cu seal ring
052	Acoplamiento	* 739,1	Anillo tórico	052	coupling	* 739,1	O-ring
056	Anillo distanciador	* 739,2	Anillo tórico	056	spacer	* 739,2	O-ring
058	Anillo de sujeción	* 739,3	Anillo tórico	058	mounting ring	* 739,3	O-ring
059	Anillo de sujeción	* 745	Anillo obturador radial	059	mounting ring	* 745	radial shaft seal
062	Arandela distanciadora	751	Muelle de compresión	062	spacer	751	spring
063	Anillo antiextrusión	809	Bola	063	support plate	809	ball
070	Tapa de cierre	* 817	Cojinete de bolas	070	end cover	* 817	ball bearing
074	Tapa de brida	861	Pasador cilíndrico estriado	074	flange cover	861	pin
080	Tapa del cojinete	866	Chaveta paralela fijada por tornillo	080	bearing cover	866	key
127	Alojamiento del cojinete			127	bearing housing	* 869	circlip
* 131	Carcasa	* 869	Arandela de retención del eje	* 131	casing	* 870	circlip
155	Tubo			155	pipe	879	straight pin
* 417	Criba cilíndrica	* 870	Arandela de retención del eje	* 417	strainer	915,1	socket screw
* 457	Junta de anillo deslizante			* 457	mechanical seal	915,2	socket screw
	*piezas de repuesto recomendadas	879	Pasador cilíndrico				* recommended spare parts
		915,1	Tornillo de cabeza cilíndrica				
		915,2	Tornillo de cabeza cilíndrica				

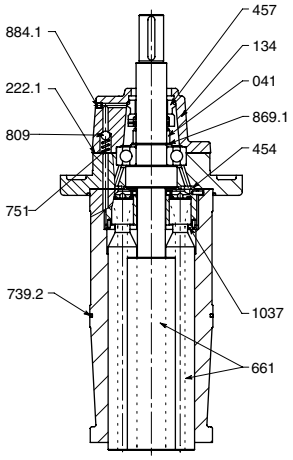
Bomba de montaje

Insert pump

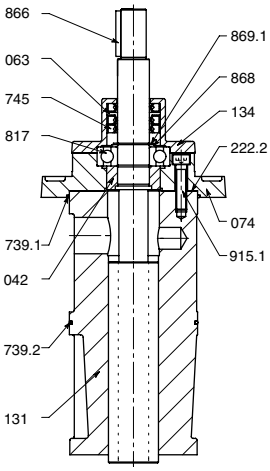
CLDR 15-42



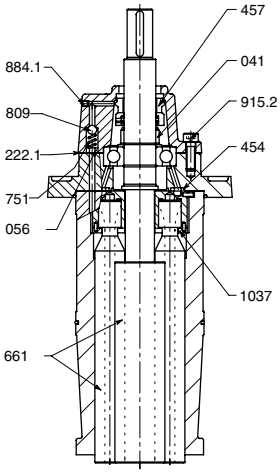
CLDG 15-42



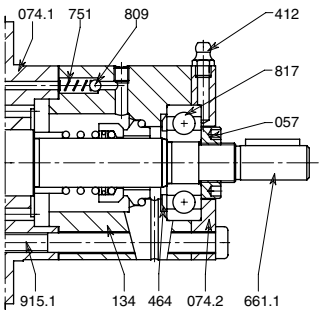
CLDR 55-118



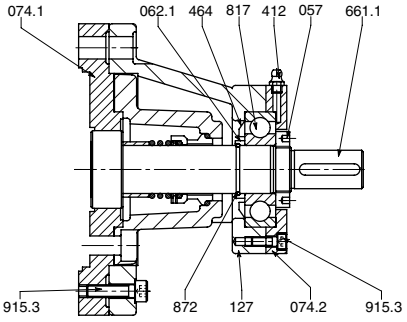
CLDG 55-118



CLDGA 15-26



CLDGA 32-118



041	Casquillo distanciador	457	Junta de anillo deslizante
* 042	Cilíndro de compensación	464	Anillo nilos
056	Anillo distanciador a partir de tamaño: CL55	661	Juego de usillos
057	Anillo roscado	661,1	Juego de usillos
062,1	Arandela distanciadora	* 739,1	Anillo tórico
063	Anillo antiextrusión	* 739,2	Anillo tórico
074	Tapa de brida	* 745	Junta radial
074,1	Tapa de brida	751	Muelle de compresión
074,2	Tapa de brida	809	Bola
127	Alojamiento del cojinete	* 817	Cojinete de bolas
* 131	Carcasa	866	Chaveta paralela fijada por tornillo
134	Carcasa de obturación	868	Anillo antiextrusión
* 222,1	Junta	* 872	Anillo de retención de alambre redondo
* 222,2	Junta	884,1	Tornillo de sujeción
412	Racor de lubricación	915,1	Tornillo de cabeza cilíndrica
454	Anillo con arista obturadora	915,2	Tornillo de cabeza cilíndrica
		915,3	Tornillo de cabeza cilíndrica
	*piezas de repuesto recomendadas	1037	Juego de manquitos

041	distance sleeve	457	mechanical seal
* 042	balance sleeve	464	Nilos-ring
056	spacer from size: CL55	661	spindle set
057	ring nut	661,1	spindle set
062,1	spacer	* 739,1	O-ring
063	support plate	* 739,2	O-ring
074	flange cover	* 745	radial shaft seal
074,1	flange cover	751	spring
074,2	flange cover	809	ball
127	bearing housing	* 817	ball bearing
* 131	casing	866	key
134	sealing housing	868	supporting plate
* 222,1	gasket	* 872	circlip
* 222,2	gasket	884,1	set screw
412	lubricating nipple	915,1	socket screw
454	edge seal	915,2	socket screw
		915,3	socket screw
		1037	bearing shell set

* recommended spare parts

Ampliaciones importantes para el manual de instrucciones
Important complements to operating instructions

OIX 04

Edición / edition 07/2004

Ampliaciones importantes para el manual de instrucciones

Las bombas de husillo roscado son bombas volumétricas cuyo principio de funcionamiento reside sobre la producción y el desplazamiento axial de cámaras cerradas en el conjunto de husillos. El aislamiento de las cámaras necesita forzosamente juegos muy estrechos entre los husillos y la carcasa para garantizar una eficacia elevada. Por esta razón, la bomba de husillo roscado no es adecuada por su diseño para el bombeo de fluidos que contengan partículas sólidas y suciedad.

Por ello, durante la **puesta en marcha** se deberán tener en cuenta los siguientes puntos:

- El filtro de poros suministrado de serie por KRAL no ha sido diseñado para separar partículas finas abrasivas.
- Antes de la puesta en marcha de la bomba / estación se deberá limpiar a fondo la red completa de tubos para proteger la bomba.
- Si esto se debe llevar a cabo a través del lavado mediante la bomba de husillo roscado, se deberá instalar antes del filtro de la bomba un **filtro de puesta en marcha (filtro de lavado)** con un **ancho de malla de 0,025 mm.** Como alternativa a este filtro de lavado también se podrá obtener un cartucho filtrante de puesta en marcha suministrable por KRAL. La potencia de aspiración de la bomba de husillo roscado no podrá ser sobrecargada por la pérdida adicional de presión del filtro (importante con líquidos con una viscosidad elevada). Por tanto, calcule la resistencia del filtro para determinar la potencia de aspiración restante. Las presiones de aspiración bajas no permitidas pueden provocar un funcionamiento en seco y, con ello, la rotura de la bomba y de la junta de anillo deslizante. Duración de lavado recomendada con filtro de puesta en marcha: 50 a 100 horas.
- Los tubos y la bomba deben llenarse necesariamente antes de la puesta en marcha (por ejemplo, a través del llenado del sistema desde un depósito situado a una altura mayor). No es posible realizar el llenado del sistema de tubos mediante el efecto de llenado de la bomba. Debido a la falta de lubricación / refrigeración de la junta de anillo deslizante y de los husillos de la bomba, es posible se produzca la rotura de la junta y / o de la bomba tras pocos segundos en marcha en seco!

Important complements to the operating instructions

Screw pumps are positive displacement pumps which rely on the formation and displacement of closed volumes within the set of screws. To ensure an appropriate efficiency it is indispensable to provide adequate sealing of these volumes. This can only be achieved by means of tight clearances between screws and casing. Screw pumps therefore are generally not suitable for the transfer of fluids which contain solid particles and impurities.

During **commissioning** therefore the following items have to be considered carefully:

- The coarse standard filter provided by KRAL is not suitable to separate fine abrasive particles.
- Prior to commissioning of a pump or pump station therefore the complete piping system has to be flushed in order to protect the pump from solid particles.
- In case that flushing is to be realized by means of operating the screw pump itself it is indispensable to install an **additional start-up filter** upstream of the actual pump filter with a **mesh width of less than 0,025mm**. As an alternative for this additional flushing filter also a start-up filter cartridge to be supplied by KRAL might used. The suction capacity must not be impaired by the additional pressure loss of the filter (particularly important for high viscous liquids!). To ensure this, the remaining suction capacity has to be calculated by means of determining the pressure loss in the filter. Inadmissible low suction pressure may result in dry running and subsequent destruction of pump and mechanical seal. Recommended period of flushing with start-up filter: 50 to 100 hours.
- Piping system and pump in any case have to be filled with fluid prior to starting the pump (for instance, by means of filling by gravity from a tank at elevated level). Filling of pipe and system by means of the suction capacity of the pump itself is not admissible! Due to the lacking lubrication/cooling of mechanical seal and pump screws already a few seconds of dry running might be sufficient to destroy mechanical seal and/or pump!

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Ignition oil pump

051868	Technical data for ignition oil pumps	21-2
OM5540_10	Ignition burner pump	21-4
4800000063	Ignition oil pump	21-7

Technical data for ignition oil pumps

1 General data

- Project No.:.....051868-01-1, 051868-02-1, 051868-03-1, 051868-04-1,
- 051868-05-1, 051868-06-1, 051868-07-1, 051868-08-1
- Hull No.:.....H2390, H2391, H2392, H2393,
- H2403, H2404, H2405, H2406
- Classification society:.....GL&CCS (H2390-91) CCS (H2392-93+H2403-06)
- Pressure gauge calibration:.....MPa
- Thermometer calibration:.....°C
- Language for signs:.....UK
- Colour of ignition oil pump unit:.....Munsell 7.5 BG 7/2
- Weight of ignition oil pump unit:.....10 kg

2 Data for ignition oil pump

- Pump type:.....Gear pump, type RSA
- Delivery head:.....0.7 – 1.4 MPa
- Inlet pressure, maximum:.....0.4 MPa
- Inlet pressure, minimum (at pipe bore 10 mm, length 50 m):.....0.01 MPa
- Pump capacity at 4 cSt, 7 bar:.....61 l/h
- Viscosity range:.....1.3 – 12.0 cSt
- Oil temperature, maximum:.....70ºC
- Filter mesh:.....150 m?

3 Data for pump motor

- Motor maker:.....EFACEC
- Motor type:.....BF7 63 M22
- Power supply:.....3 x 440 V, 60 Hz
- Rated output for motor:.....0.22kW
- Revolutions:.....3300r.p.m.
- Ambient air temperature:.....45°C
- Starting method:.....Direct On Line
- Starting current:.....2.2A

- Operating current (full load):.....0.6A
- Power consumption at 4 cSt:.....0.063 kW
- Cable gland size:.....1 x PG 13.5
- Heating element (standstill):.....None
- Thermostat protection:.....None
- Insulation class:.....F
- Degree of protection:.....IP 55

Ignition burner pump

1 Description

The ignition burner pump supplies the ignition burner with diesel oil. The pump is operated by the control system or the manual operating system. The ignition burner pump is only in operation during the ignition sequence. An illustration of the ignition burner pump is shown in Figure 1.

Illustration of the ignition burner pump

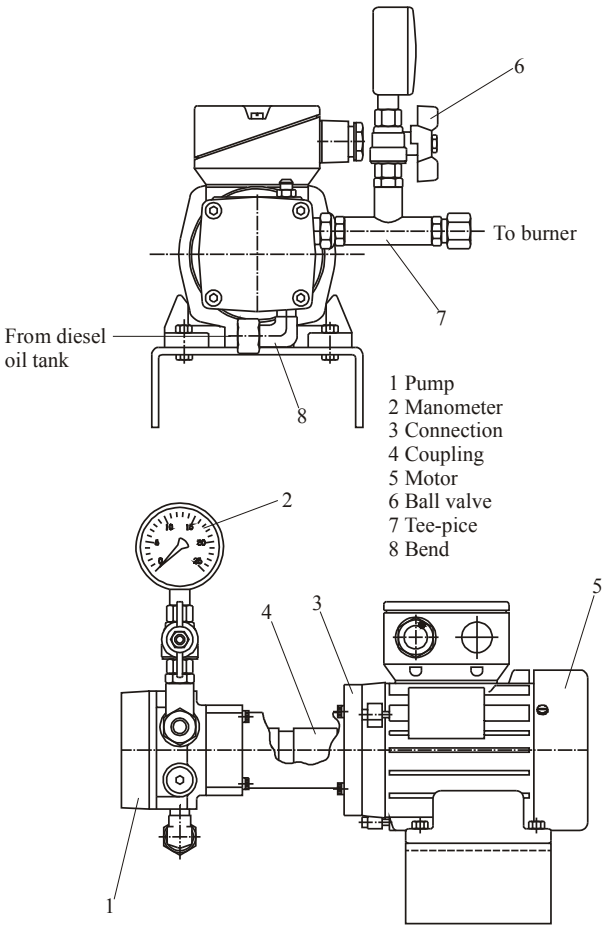


Figure 1 **om5540_10_ignibux0054090en.wmf**

1.1 Function

When the pump is started, oil is drawn through the suction side port “S” via the filter “H” to the suction side of the gearwheel set “C” as shown in Figure 2. The gearwheel set pumps the oil to the pressure side.

The pressurised oil is led to the cut-off and regulating valve “V”. When the opening set point is reached, the valve opens. Hereby oil is distributed to the nozzle port “P” and to the pump return side “R” via the shaft seal “F”.

The pressure is controlled and maintained at a constant level by the regulating valve “V”. The opening set point can be adjusted by means of an Allen key.

The quantity of oil supplied to the nozzle port “P” is determined by the pressure set on the regulating valve “V” and the resistance in the nozzle line and the oil nozzle.

When the pump is stopped, the pump output drops and produces a drop in the oil pressure. The spring in the regulating valve presses the regulating piston forward until it seats in port “P”. This cuts the oil flow to the nozzle and ensures that the line is effectively shut off.

Sketch of the oil pump system

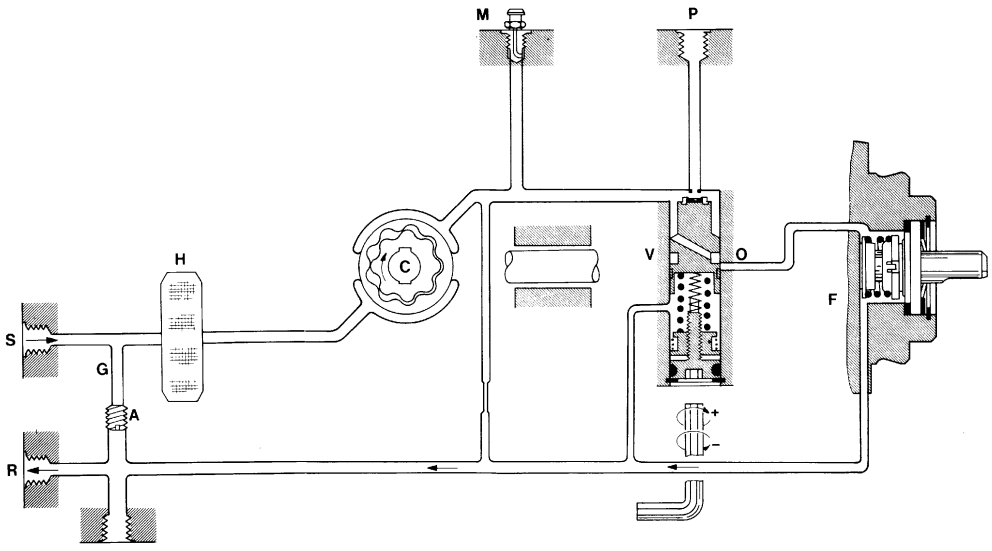


Figure 2 **om5540_10_ignibux0054080en.wmf**

If the pump is overloaded, i.e. more oil is demanded than the gearwheel is able to pump under the given conditions, the oil pressure falls below the set value because the regulating valve piston moves towards its closed position and partially or wholly cuts off the return oil via port “O”.

This condition can be remedied by:

- Reducing the pump pressure
- Reducing the capacity, i.e. smaller oil nozzle or larger resistance
- Changing to a pump with higher capacity

1.2 Commissioning

When the pump is commissioned, the pump and the pipe system must be filled with oil and ventilated. The pump can be ventilated on the ventilating screw “M”. If the pump is running without oil for more than five minutes, it may cause damage to the pump.

1.3 Pipe systems

One pipe system is used when the pump is placed lower than tank level (positive suction head).

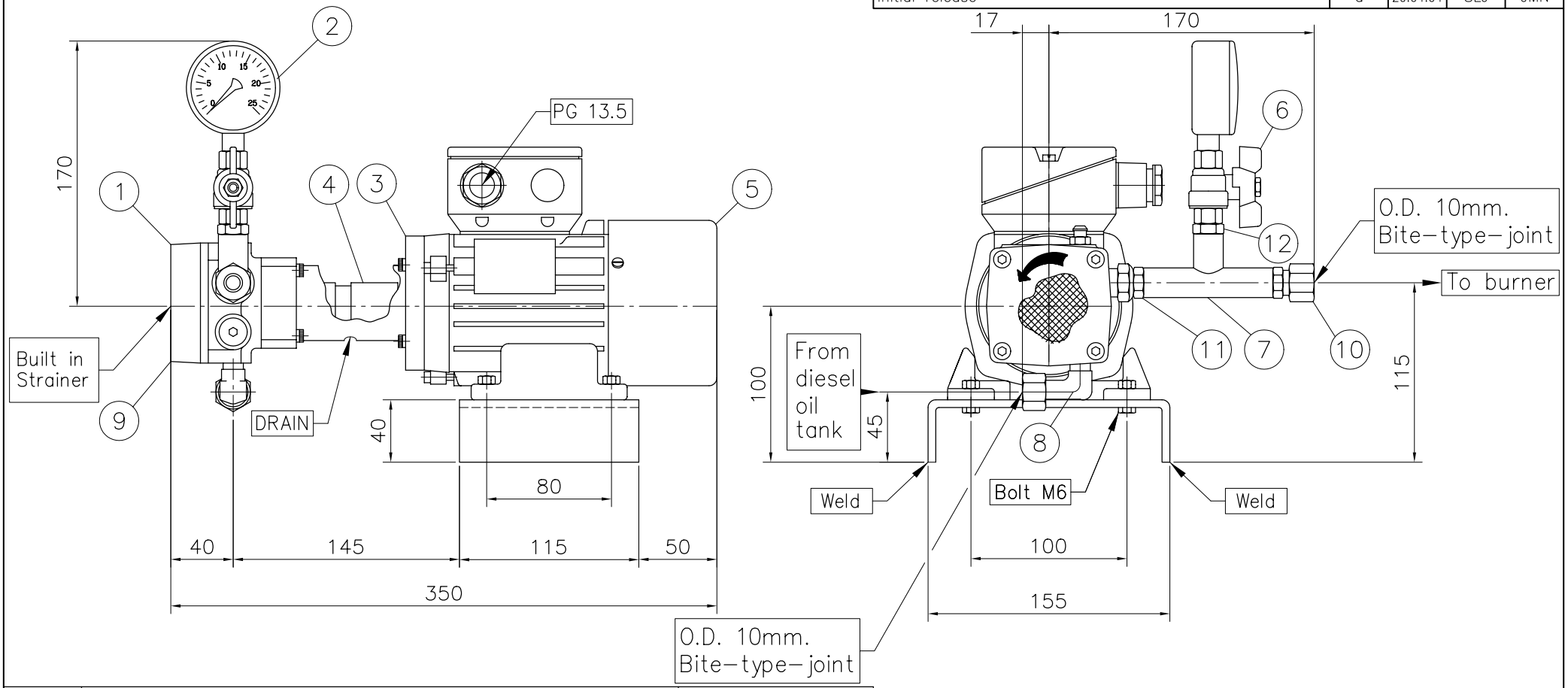
Two pipe system is used when the pump is placed higher than tank level (negative suction head).

In two-pipe systems the oil is returned direct to the oil tank. In one-pipe systems the setting screw “A” must be removed to give free flow to the suction side via by-pass “G” with return port “R” closed.

Normally the pump is delivered as a one-pipe system.

The pump is delivered with two suction ports and two return ports.

Description	Index	Date	Drawn	Appr.
Initial release	a	20.04.04	SLJ	JMN



ITEM	OBJECT	PART NO.
12	HEXAGON NIPPLE	6638104
11	HEXAGON NIPPLE	6638136
10	STRAIGHT MALE 10mm x 1/4"	6641089
9	STRAINER (INTERNAL)	
8	BEND – 10mm x 1/4"	6641069
7	TEE-PIECE	6638134
6	BALL VALVE	6666006
5	MOTOR 400/460 V – 50/60 Hz	6638133
4	COUPLING	6638132
3	CONNECTION	6638131
2	MANOMETER 0–25 Bar \ Kg/cm2 \ 0–2,5 MPa	6633121
1	PUMP	6638130

Part no. 4800000063

Final colour : Munsell 7.5 BG 7/2

AALBORG INDUSTRIES

Plot Date:

Title:
FUEL OIL SUPPLY SYSTEM
STANDARD

IGNITION OIL PUMP (G145)

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Drawn	Date
SLJ	20.04.2004
Appr. JMN	Date 20.04.2004
Weight	Scale: 1:2.5 / Size A3
Article/Drawing No: 71Z:031258	Index a

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Heater unit (MISSION OS)

051868	Technical data for heat-exchanger	22-2
OM8640_04	Heat-exchanger	22-3
26k3001	Heat Exchanger MY8, dimension drawing	22-8

Technical data for heat-exchanger

1 General data

- Project No.:.....051868-01-1, 051868-02-1, 051868-03-1, 051868-04-1,
- 051868-05-1, 051868-06-1, 051868-07-1, 051868-08-1
- Hull No.:.....H2390, H2391, H2392, H2393, H2403,
- H2403, H2404, H2405, H2406
- Classification society:.....GL&CCS H2390-91
- .....CCS H2392-93+H2403-06
- Pressure gauge calibration:.....Mpa
- Thermometer calibration:.....°C
- Language for signs:.....UK
- Colour of heat-exchanger unit:.....Heat resistant silver RAL 9006

2 Data for heat-exchanger

- Heat-Exchanger type:.....MY8 T10
- Number of heaters:.....1
- Fuel oil capacity:.....426 l/h
- Design pressure (oil side):.....1.6Mpa
- Design temperature (oil side):.....160 °C
- Fuel oil inlet temperature:.....55 °C
- Fuel oil outlet temperature:.....105 °C
- Steam consumption:.....16 kg/h
- Design pressure (steam side):.....1.6 Mpa
- Design temperature (steam side):.....204 °C
- Min. steam working pressure:.....0.7 Mpa
- Max. steam working pressure:.....0.9Mpa
- Steam inlet temperature:.....165 °C
- Steam/condensate outlet temperature:.....165 °C
- Weight of heat-exchanger unit:.....20kg

Heat-exchanger

1 General description

Aaborg Industries' MY heat-exchanger is of the shell and tube type, with U-tube heating surface and fixed single segmental baffles. The pressure part is all welded, except for the heating fluid channel, which is fastened with 4 bolts.

It is intended for heating of oil by means of steam, hot water or thermal oil. The design pressure is 10 bar, the maximum oil temperature is 150°C and the maximum heating media temperature is 185°C.The heat-exchanger can be used for other non corrosive fluids within the design conditions stated above.

The shell side is supplied with BSP connections for oil in- and outlet and two BSP connections for drain- and safety valve. Metallic compression fittings must be used for all oil side connections (class requirement), a mounting set with threaded nipples and metallic gaskets is available per request. However, other connection types may be supplied if required.

The MY heat-exchanger comply to marine class rules, and can be delivered with class certificate. However, due to the very small size of heat-exchanger, a certificate is not required by all societies

Illustration of the heat-exchanger

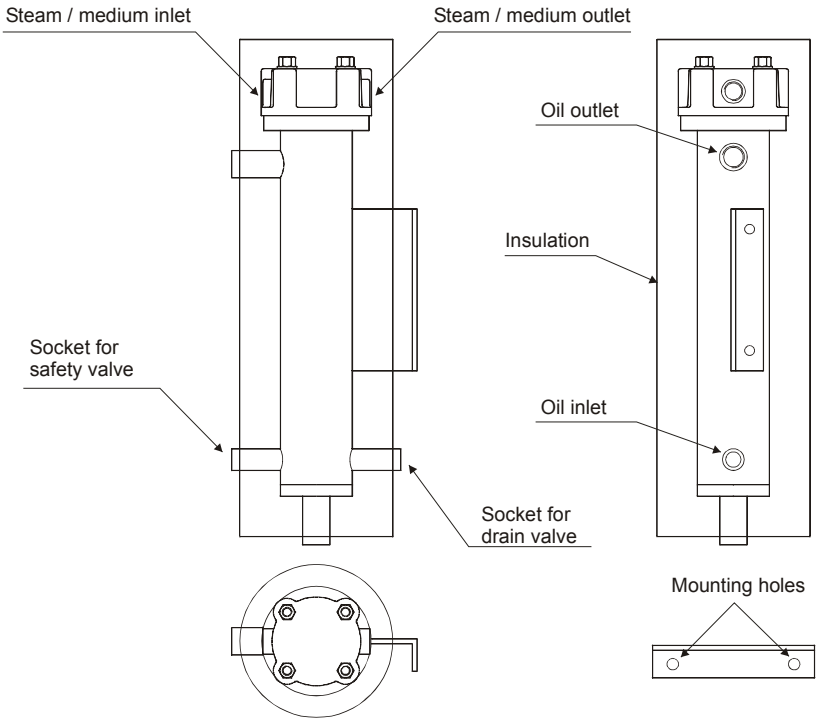


Figure 1 **om8640_04_my1x0059600en.wmf**

2 Handling and storage

2.1 Handling

The MY heat-exchanger is supplied with soft thermal insulation in aluminium foil coated mineral wool, with metal end covers. It should only be lifted in the mounting bracket or in the detachable lifting plug in the oil outlet.

2.2 Storage

The heat-exchanger should be stored in the delivery package if possible, and always be stored in a dry room to avoid formation of rust on machined surfaces. For shorter intervals (up to 3 months), the preserving agent in the test fluid will protect the internal parts from corrosion. For longer intervals, the heat-exchanger must be protected against surface corrosion with either a solvent, Castrol Rustilo Aqua 2 is recommended, or inert gas filling.

3 Installation

3.1 Mounting

The MY heat-exchanger is intended for either horizontal or vertical installation. When mounted horizontally, the oil nozzle closest to the header must face upwards and when mounted vertically, the axial oil nozzle must face upwards.

The mounting bracket is supplied with two holes.Use the bracket to mark up for drilling, place the mounting bolts and tighten well.

3.2 Installation

When mounted horizontally, the oil discharge nozzle must face upwards to allow for automatic deaeration of the heat-exchanger. At this position one socket for drain will face downwards, and one socket for safety valve will face upwards. Make sure that accessories fitted comply with the design data on the heater name plate. If a safety valve is not fitted on the heater, it must be installed in the adjacent piping, on the same side of the isolating valves as the heat-exchanger.

When mounted vertically, the heat-exchanger must be oriented with the steam header downwards to allow for deaeration of the shell and proper draining of the tube side. To prevent water hammering during start up, the steam supply line should be equipped with proper means of automatic draining of condensate. Always install control valves and steam traps with the correct orientation, as faulty installation may cause failure of the system.

3.3 Connecting the heat-exchanger

When connecting the heat-exchanger, it is important to use metallic compression fittings to adhere to common class requirements, as thread tightening is usually not accepted. The piping layout should be designed in such a way that no external forces are transferred to the nozzles. Nozzles cannot be used as anchor points for piping, and unsupported piping will be more likely to leak at the joints.

After the connections have been tightened the heat-exchanger should be pressure tested on both sides, the allowable test pressure is 1.5 times the design pressure. After successful testing, the heat-exchanger piping should be insulated, 50 mm of mineral wool will be able to keep the surface temperature below 60°C at most conditions. If heat shield is installed instead of insulation, the connecting points should be fitted with splash guards compliant with the joint type.

4 Operation

4.1 Commissioning

Before start up all connections must be checked for tightness and must be provided with appropriate thermal insulation and splash guards. Check that drain lines from the drain valve and safety valve are correctly connected, and that the drain valve is closed. Check that the set point of the safety valve is equal to or less than the system design pressure and higher than the normal working pressure. Make sure that the heat-exchanger and adjacent piping is thoroughly vented before start up of the heating system.

Operate the heat-exchanger at the required duty for one hour while checking for leaks, shut down the process and retighten all connections and bolts. The main bolts of the heat-exchanger should be checked and tightened with a torque wrench set at approximately 20 Nm.

4.2 Output

The thermal performance of the heat-exchanger is subject to the working conditions specified at the purchase. If the output is different than expected, check the following:

- Is the heating media supply full open, does the control valve and sensor work as intended
- Is the discharge line fully open, does any downstream control equipment such as steam traps work as intended
- Is the temperature or saturation pressure as specified
- Is the type and flow of the cold media as specified
- Is the inlet temperature of the cold fluid as specified
- Is the heat-exchanger clogged with heavy fuel oil residue

If the heating surface is dirty, it must be cleaned, please refer to the maintenance section. Never disconnect any part of the heat-exchanger without proper de-pressurisation and subsequent draining, and allow hot parts to cool before disassembly.

5 Maintenance

5.1 Cleaning

The heat-exchanger should be cleaned regularly by back flushing with either a cleaning solvent or moderately hot, clean diesel oil. The required cleaning intervals vary with the duty required, initially the interval should be 6 months, and the rate of fouling (decrease in output) over time should be observed and the cleaning intervals adjusted accordingly. The tube side can be inspected by removing the steam header, but usually this part of the heater does not need cleaning. Calcium deposits can be removed by

soaking or flushing with a mild citric acid solution. A new gasket must be fitted every time the heater is disassembled and the bolts tightened with a torque wrench.

If the heat-exchanger shell side has become clogged and cannot be cleaned by the above means, leave it to soak in carbon remover and repeat the normal cleaning procedure and then check the capacity again. If this does not work, replace the heat-exchanger with a new one.

5.2 Shut down and conservation

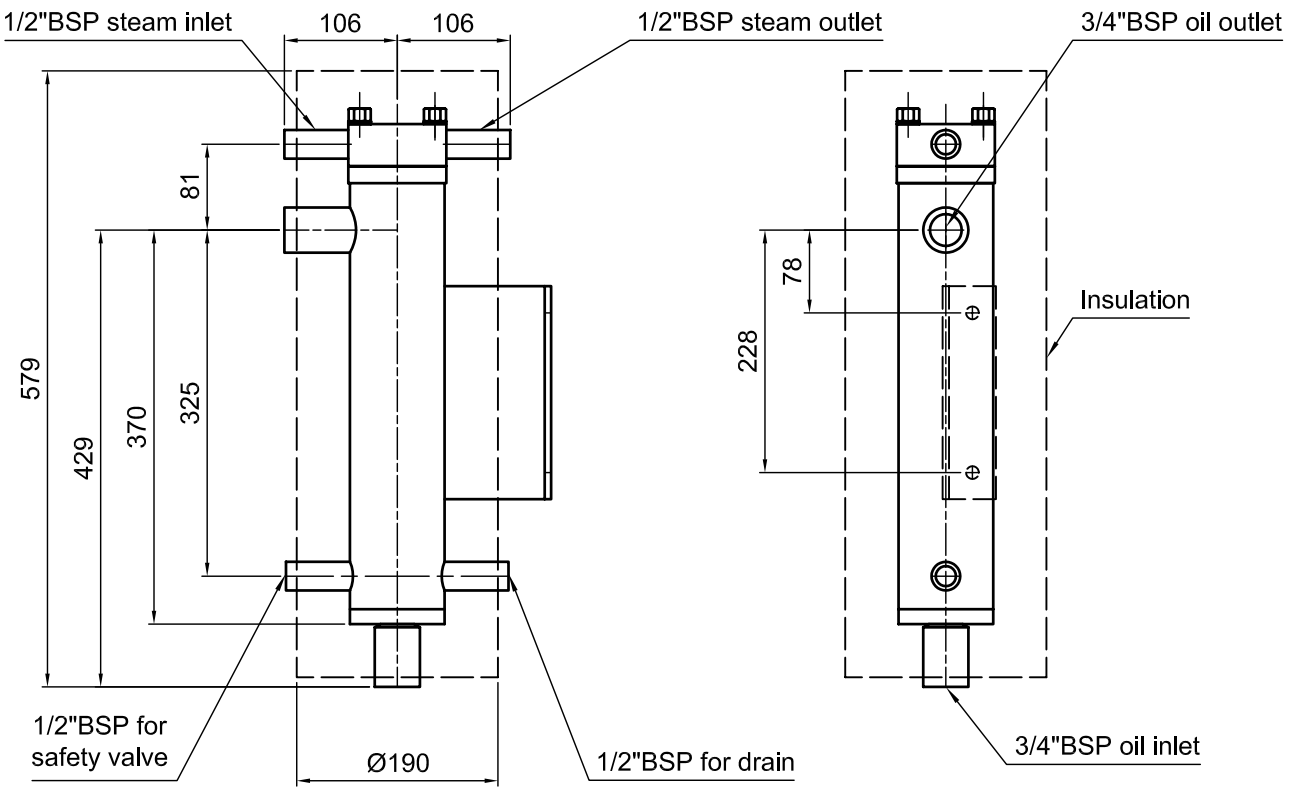
When the heat-exchanger is shut down, it should be operated a few minutes on diesel oil to flush out heavy hydrocarbon residue from both the heating surface and the adjacent piping. Then the heating media flow should be stopped and the cold media/ cleaning diesel left running to cool down the heater before de-pressurisation and draining.

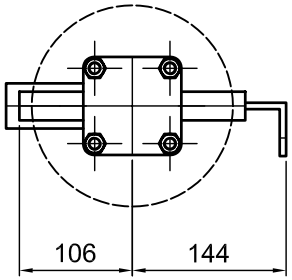
When the heat-exchanger is expected to be shut down for a longer period, it is important that it is drained properly, and that it is protected against corrosion. For the shell side flushing with clean diesel oil will usually provide sufficient protection. For both the shell and the tube side conservation it is also possible to use Castrol Rustilo Aqua 2 if a water based solution is preferred.

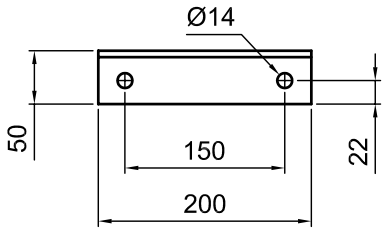
6 Spare parts

Only the main gasket is available as spare part, since the heat-exchanger is an all-welded design. The nozzles and sockets are threaded according to British Standard for metallic gaskets.

Description	Index	Date	Drawn	Appr.
3/4"BSP socket added for oil inlet. Length increased with 60mm.	A	02.09.05	HDu	
1/2"BSP connections for drain and safety valve added.	B	25.10.05	HDu	
Dimensions revised and updated.	C	23.12.05	HDu	
Drawing revised and updated.	D	03.05.06	HDu	
Drawing revised.	E	03.07.06	HDu	







Order no. :

No.of :

Class society :

Painting :

Insulation : YES NO

The tolerance class in accordance with ISO 2768-1 c
Toleranceklasse ifølge DS/ISO 2768-1 c

AALBORG INDUSTRIES

Project		Boiler data	
Weight kg.	Dept. 3200	Scale 1:5	Heat Exchanger MY8 T10 Dimension Drawing
Drawn HDu	Date 08.04.2005	Size A3	
Approved MT	Date	No. 26 K 3001	E

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Fuel oil pressure control valve (MISSION OS)

OM6050_06 Control valve, type 44-7.....23-2

Control valve, type 44-7

1 General description

The purpose of the control valve, type 44-7 is to maintain and control the upstream pressure at the adjusted set point in an oil ring-line system.Figure 2 illustrates the control valve.

The valve consists of the valve body with balanced valve plug and integrated actuator containing a diaphragm and spring assembly.The medium flows through the valve in the direction indicated by the arrow on the body. The upstream pressure to be controlled is transferred through an internal hole in the body to the operating diaphragm and is converted into a positioning force. This positioning force is used to move the valve plug depending on the force of the spring assembly. The set point adjuster can be turned to change the spring force and, consequently, the set point.The valve opens when the upstream pressure increases.

Illustration of the control valve, type 44-7

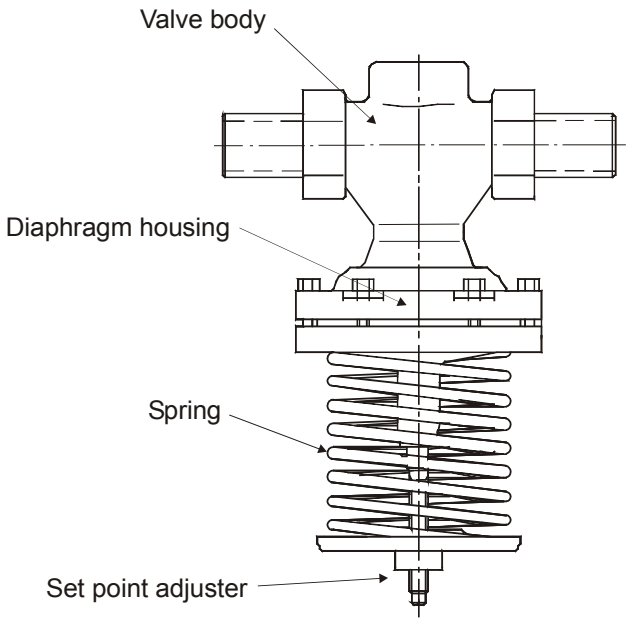


Figure 1 **om6050_06_44-7ax0056880en.wmf**

1.1 Mounting position

The control valve must be installed in horizontal pipelines with the actuator including the spring assembly suspended downwards. It must be ensured that the direction of flow corresponds to the arrow on the valve body.

1.2 Operation

The following work steps must be carried out when the control valve is put into operation:

Step A: Open the shut-off valve downstream of the control valve. Then slowly open the upstream shut-off valve.

Step B: Adjust the upstream pressure to the desired set point on the adjuster at the spring plate. Observe the upstream pressure gauge during adjustment.

Step C: Turn clockwise to increase the set point and anti-clockwise to reduce it.If the oil system is shut down for a period of time perform the following work steps:

Step D: Close the shut-off valve upstream of the control valve.

Step E: Close the shut-off valve downstream of the control valve.

1.3 Maintenance

The control valve is subject to natural wear. Depending on the operating conditions, it should be checked at regular intervals.

If the upstream pressure drops considerably after the burner has been stopped the valve fails to close tightly. This may be caused by a contaminated seat and plug, or when the valve has become un-tight due to natural wear.

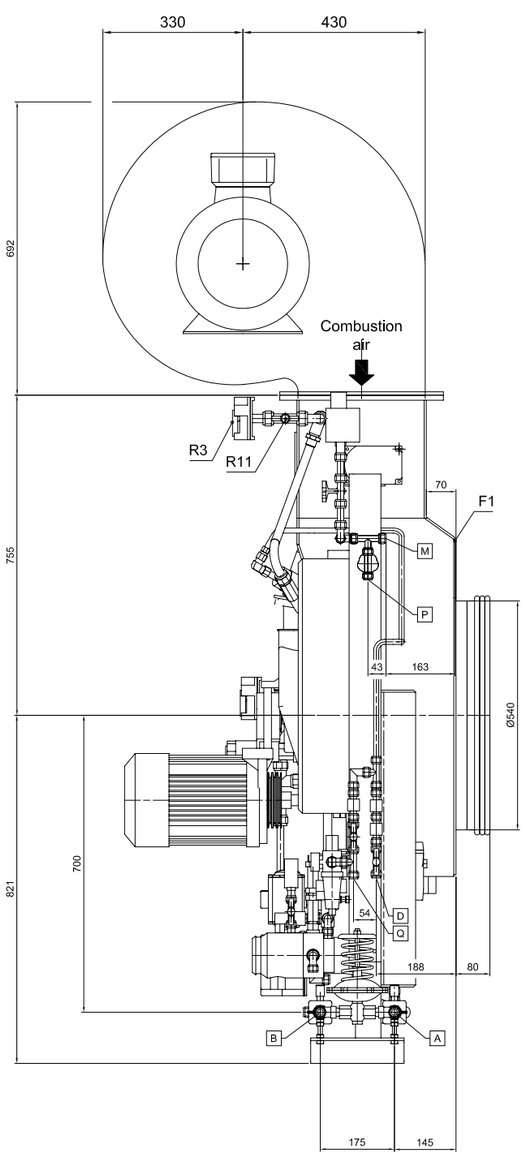
If external leakage occurs at the valve body, or if the upstream pressure increases suddenly, check the operating diaphragm and replace it, if necessary.

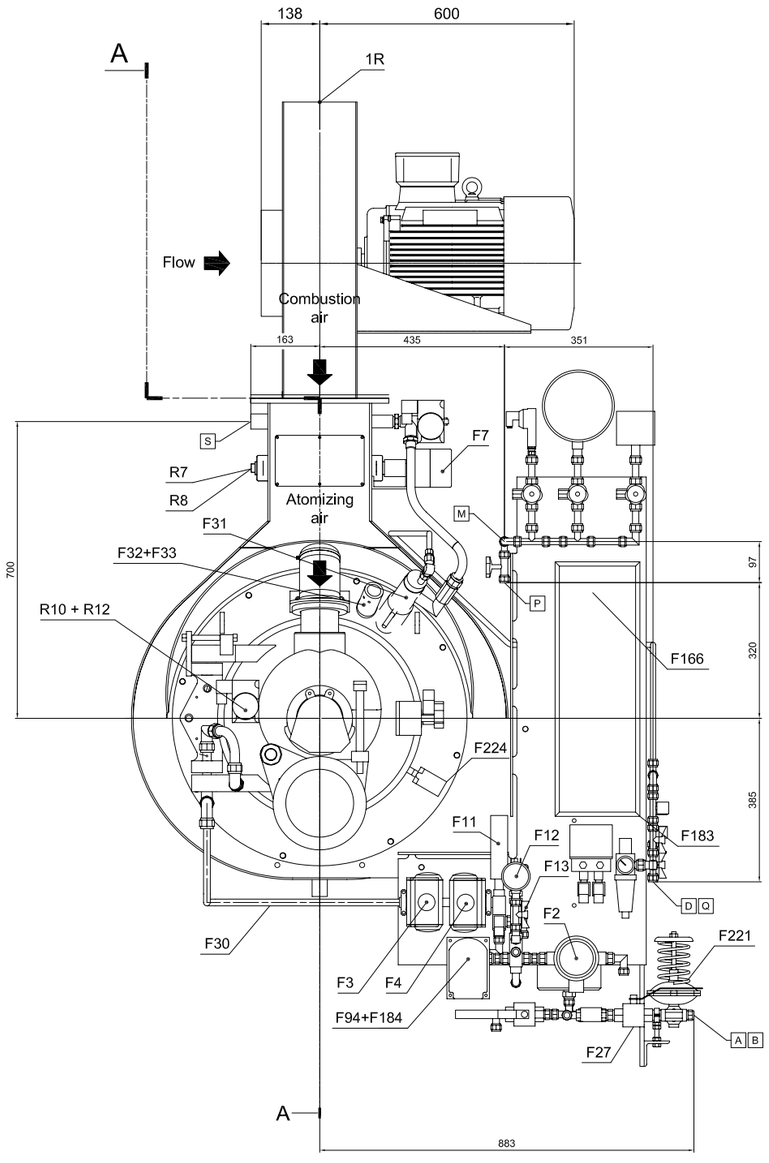
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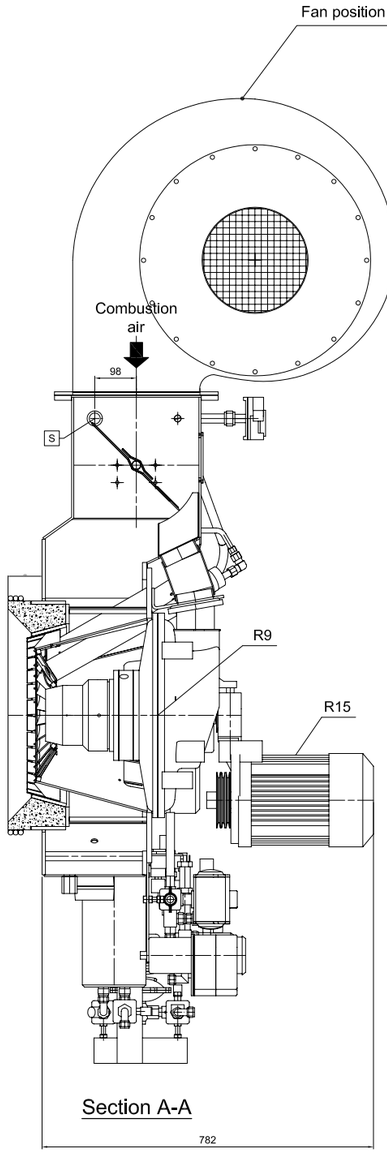
Drawing

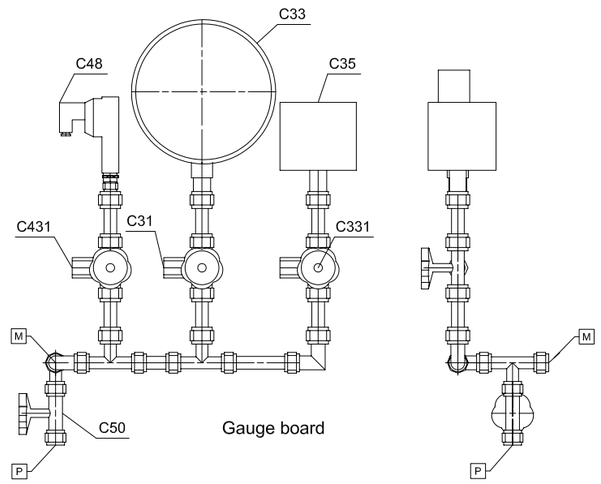
91Y_042963	Arrangment drawing	24-2
9210-1348	Fan drawing	24-3

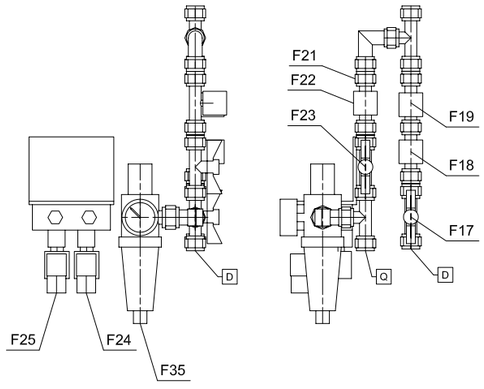
Alteration	Affix	Date	Drawn	Appr.
Gauge board revised.	A	11.01.07	ToG	

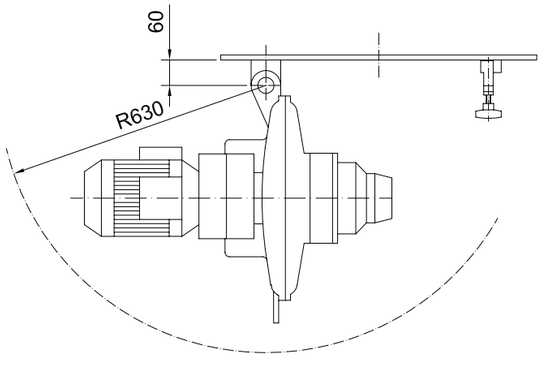












Piping connections			
A	Fuel oil Inlet	3/4" BSP female	Yard connection
B	Fuel oil return	1/2" BSP female	Yard connection
D	Diesel oil inlet	Bite type joint 10 mm	Yard connection
M	Boiler steam pressure	Bite type joint 10 mm	Yard connection
P	Waste water	Bite type joint 10 mm	Yard connection
Q	Service air Inlet	Bite type joint 10 mm	Yard connection
S	Scavenging air for boiler Inspection hole	1" BSP female	Yard connection

Tag nos. : See dwg. no. 91X02:042961
Welding details : See dwg. no. 90K:030430

Technical Data				
MEDIUM	WORKING PRESS. (BARG)	DESIGN PRESS. (BARG)	DESIGN TEMP. (° C)	TEST PRESS. (BARG)
FUEL OIL (suction side)	0 - 2	7	120	10.5
FUEL OIL (delivery side)	2 - 5	10	120	15
STEAM	6 - 16	16	SAT.	28.5

Customer	Jiangnan Shipyard							
Society	GL&CCS	GL&CCS	CCS	CCS	CCS	CCS	CCS	CCS
Newb. No.	H2390	H2391	H2392	H2393	H2403	H2404	H2405	H2406
Project No.	051868-01-I	051868-02-I	051868-03-I	051868-04-I	051868-05-I	051868-06-I	051868-07-I	051868-08-I
Boiler No.	18111	18112	18113	18114	18115	18116	18117	18118

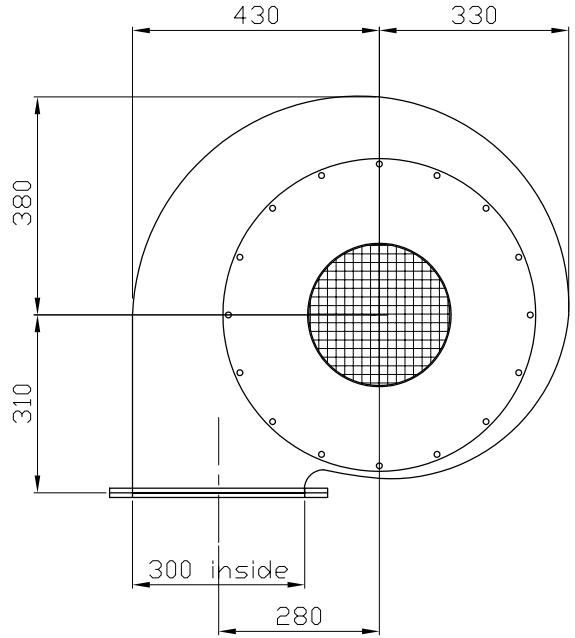
AALBORG INDUSTRIES

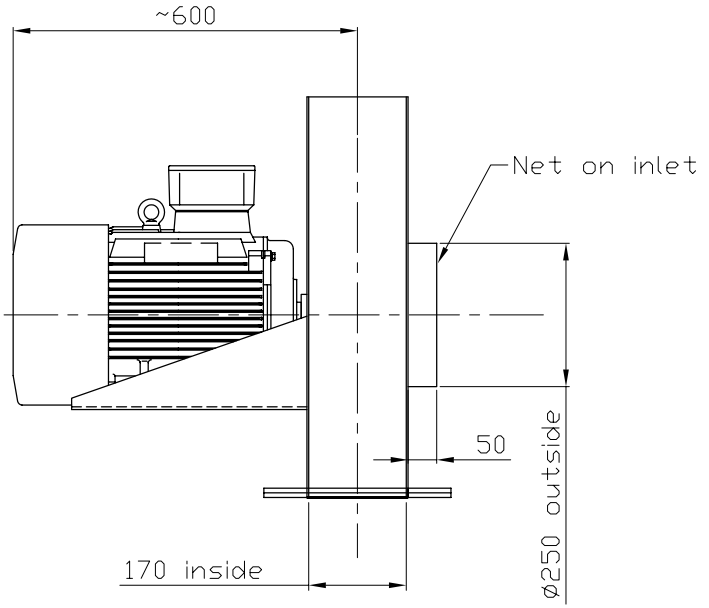
Title:
KBE 350 Burner
Rotary Cup Burner 150-550 - for DO/HFO
4000 kg/h
Arrangement Drawing

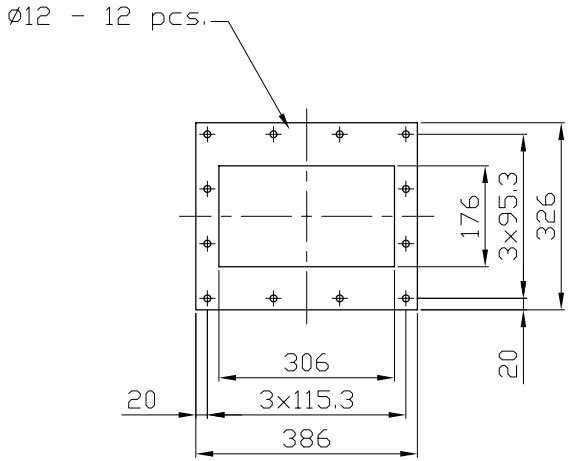
Drawn	Date
SLJ	12.09.2006
Appr. ToG	Date 12.09.2006
Weight	Scale: 1:1 Size A0
Article/Drawing No: 91Y:042963	Index A

THIS DRAWING AND DESIGN SHOWN HEREIN IS THE PROPERTY OF AALBORG INDUSTRIES AND MUST NOT BE USED IN OR REPRODUCED FOR THIRD PARTY

First Date:







WEIGHT		
	FAN	~100 KG.
	MOTOR	~125 KG.

REF.	AALBORG INDUSTRIES A/S		
OR. NO.		SERIAL NO.	
TYPE	MT 445(500)-250/D	POS.	RD 180 / V4
MOTOR	HOYER-Y2E2 160 M1-2 - 13 kW/3500 min.-1		
DRWN. NO.	9210-1348	DATE	14-09-06
		CORRECT.	

AALB. I. REF.: 051868-01-02-03-04-05-06-07-08
BJ NO.: 06-192/KEJ

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Type:

- Flow meter with remote pulser and safety sealing ring
- VZO 20

Application:

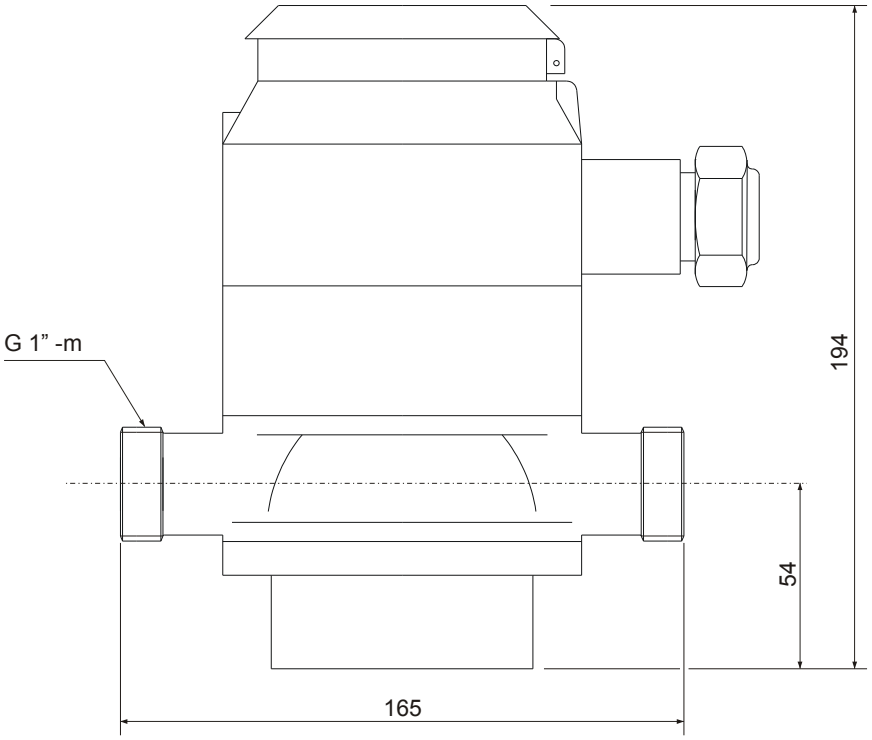
- Measuring of oil consumption

Technical data for flow meter:

- Nominal pressure: 16 bar
- Installation length: 165 mm
- Max. temperature: 130°C
- Ambient temperature: -10 to +70°C
- Flow rate:
  Maximum: 1500 l/h
  Nominal: 1000 l/h
  Minimum: 30 l/h
  Approx. starting: 12 l/h
- Weight with flanges: 2.5 kg

Technical data for remote pulser:

- Pulse values for remote pulser: 0.01 l/ Imp
- Switching element: slot initiator to DIN 19234
- Switching voltage: 5 to 15 V_{DC}
- Residual ripple: max 5%
- Switch current: > 3 mA at 8 V_{DC} / 1kOHM
- Static current: < 1 mA at 8 V_{DC} / 1kOHM
- ON-time: 50% ± 10%
- Protection: IP 65
- Cable cross section: 2 x 0.35 mm²



Type No.: 7060 Version: A.2	Flow meter, VZO 20 with remote pulser	6634047

Type:

- Stop ball valve, straight
- 133 BSP, full bore

Size:

- 3/4” BSPP

Application:

- For air, steam, or oil flow

Material

- Body: ASTM A105
- End connections: ASTM A105

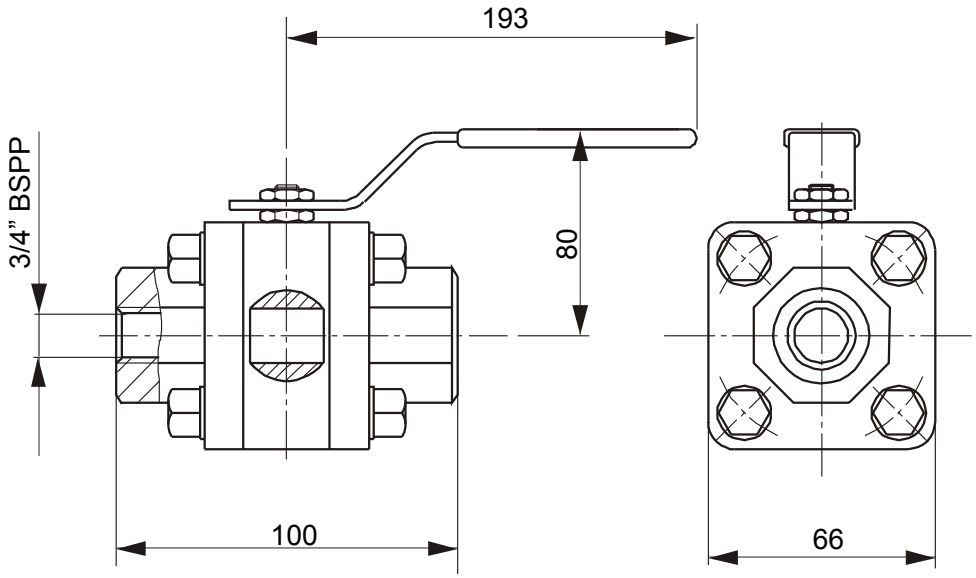
Technical data:

- Min./max temperature at 30 bar:
  - 29°C to + 200°C
- End connections: 3/4” threaded female, ISO 228/1
- Pipe size: DN 20
- Weight: 2.3 kg

Installation:

Information and caution before installation of the valve:

- Pipe must be free of tension.
- Pipe must be flushed to clean the dirt, burrs calamines, welding residues etc. which would damage the ball and seat.
- The valve must be kept in openposition during installation. Protective plastic covers must not be removed before the installation work commences.
- At the moment of the shipment the ball is lubricated with a pure vaseline oil, which can be easily removed with a solvent, if required.
- Ball valves normally have a space between ball and inside cavity of the body, which could trap the product, care should be taken to drain the cavity.



Type No.: 6010 **Version: A.2**	**Stop valve, ball, straight, 3/4"**	**6010000054**

Type

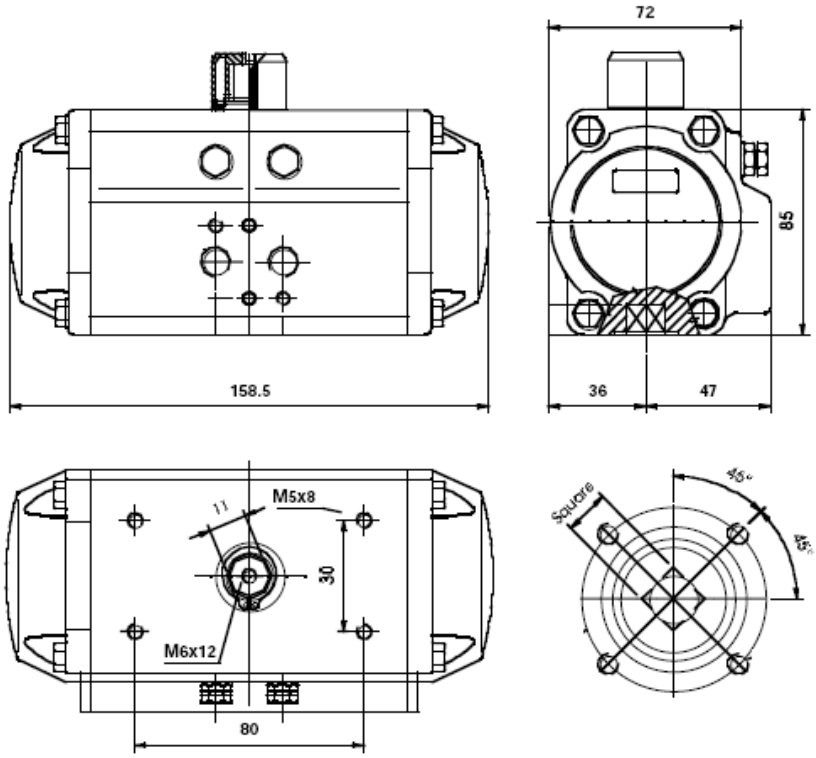
- Pneumatic actuator
- AT 101 SR

Application:

- For oil valves

Technical data:

- Operating media: Dry or lubricated air or inert/non-corrosive gases provided they are compatible with internal actuator parts and lubricant. The maximum particle size must not exceed 30 µm.
- Supply pressure: Max. 8 bar.
- Temperature operation: - 20°C to + 80°C.
- Construction: 90° rotation with stroke adjustment at 0° and 90° + or -4°.
- Lubrication: The actuators are factory lubricated for the life of the actuator in normal working conditions.



Type No.: 5520 Version: A.2	**Pneumatic actuator**	**6638650**

Type:

- Temperature switch
- RAK-TW.1000S

Range:

- 15°C to 95°C

Application:

- 2-position thermal reset limit thermostat with single-pole changeover micro switch for supervision of temperature.

Material:

- Cover: ABS + PC and has a viewing window
- Capillary tube and sensing element: Copper
- Diaphragm: Stainless steel
- Contacts: Ag. 1000/1000 (silver)

Technical data:

Switching mechanism:

- Nominal voltage: AC 24….250V
- Nominal current I (I_M) for contact connection 1 – 2: 0.1….10 (2.5)A
- Nominal current I (I_M) for contact connection 1 – 3: 0.1….6 (2.5)A
- External fuse: 10A
- Life expectancy at nominal rating: min. 100'000 switching cycles
- Safety class: I to EN 60 730
- Degree of protection: IP 43 to EN 60 529
- Temperature range: 15 to 95°C

Environmental conditions:

- Operation: class 3K5 to IEC 60 721-3-3
- Max. temperature on bulb: switch-off temperature + 25 K
- Ambient temperature at the housing: max. 50°C (T50)
- Humidity: < 95% r.h.
- Storage and transport temperature: ÷25 to +70°C
- Storage and transport humidity: < 95%r.h
- Max. temperature socket: 135°C
- Influence of the ambient temperature: -0.18°C/°C

Calibration:

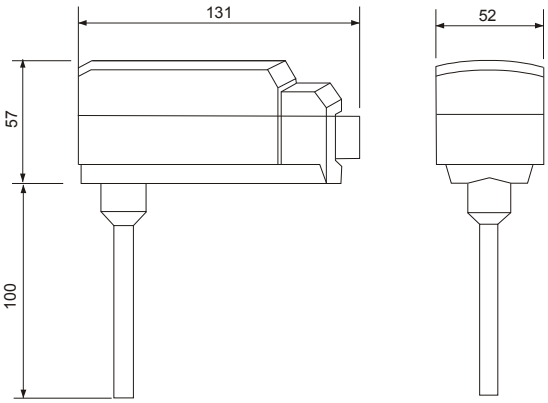
- Calibration temperature: Max. limit temperature
- Manufacturing deviation: ± 3°C
- Drift after life expectancy: < ±5%
- Calibrated for ambient temperature at the switching mechanism and capillary tube: 20°C to DIN 3440
- Time constant in water: < 45 s to DIN 3440
- Time constant in oil: < 60 s to DIN 3440
- Time constant in air: < 120 s to DIN 3440

Connections:

- Electrical connections: Screw terminals for wires 2 x 0.75….1.5mm²
- Earth connection: Screw terminal for wires 2 x 0.75….1.5mm²
- Cable gland: M16 x 1.5 (for max. 4-core cable)
- External wiring flexible cord: Type M attachment (designed to be connected with prepared conductors, e.g. ferrules)

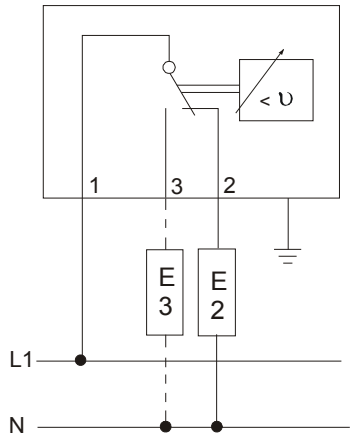
General data:

- Dimension of sensing element: 6.5 mm dia. x 87 mm
- Capillary length: 700 mm
- Min. bending radius of capillary: $R_{min.}$ = 5 mm
- Weight: 0.27 kg



Type No.: 8070 Version: A.2	**Temperature switch**	**6639041**

Connection diagram:



Type No.: 8070 **Version: A.2**	**Temperature switch**	**6639041**

Type:

- Servomotor
- D1

Range:

- 6 Nm (torque)

Application:

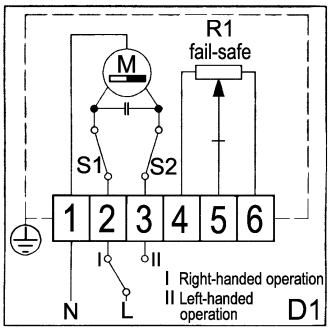
The units is used to control the position of Air-damper, and consist of synchronous motor with right-handed rotation or left-handed rotation. Servomotor with potentiometer response with fail-safe potentiometers has a fixed positioning angle, depending on the potentiometer transmission.

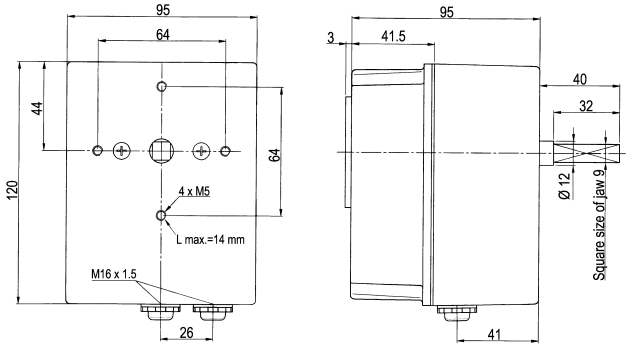
Material:

- Housing: cast aluminium
- Output shaft:steel

Technical data:

- Rated Torque: 6 Nm
- Positioning time: 90° in 64 sec. response
- Positioning angle: 90°
- Permissible ambient temperature:
- -20°C up to +60 °C
- Mounting position: any, except with the actuator hanging downwards
- Degree of protection: IP54
- Mounting: tap holes 4 x M5, screw in depth max. 14mm
- Output shaft: Square size of jaw 9, shaft length 40mm off housing
- Mechanical position indicator: above scale plate
- Power supply: 1~50/60 Hz/230V
- Electrical connection: via internal terminal strip via 2 compression glands M16x1.5
- Operating mode: S4-30% c.d.f.-1200 c/h
- End switching: 2 travel dependant signal switches “WE”, max. 250V AC for ohm load 10A
- Lubricant for gearing: Klüber Microlube GL151
- Operating voltage/frequency: 1-phase AC 50/60Hz
- Rated current: 21.3 mA
- Power consumption: 4.2W
- Power output: 0.42 W
- Rotation speed: 250 rpm
- Signalling unit: 1 potentiometer 1000Ω & 1 potentiometer 5000Ω, max. 1.5W, max. current 30mA.response 1 potentiometer 5 k-Ω failsafe for coupled control (not retrofittable), max. 0.5W, max.current 0.1µA





Type No.:5530 Version: A.2	Servomotor	5530000069

Type:

- Thermometer, straight

Size:

- DN150

Application:

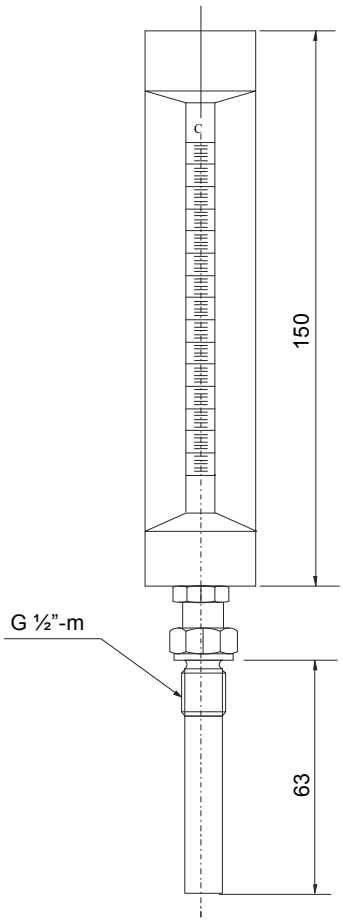
- For liquid

Material:

- Case material: Aluminium, gold coloured anodized
- Numerals: Black figures
- Glass inserts: Solid glass
- Capillary fluid: Blue fluid
- Immersion tubes: Brass

Technical data:

- Connection: G 1/2”BSP
- Range: 0 – 120°C
- Accuracy: Class 1,6



Type No.: 8080 Version: A.2	Thermometer, straight	6633008

Type:

- Pressure gauge, type P1116

Size:

- ø 63

Application:

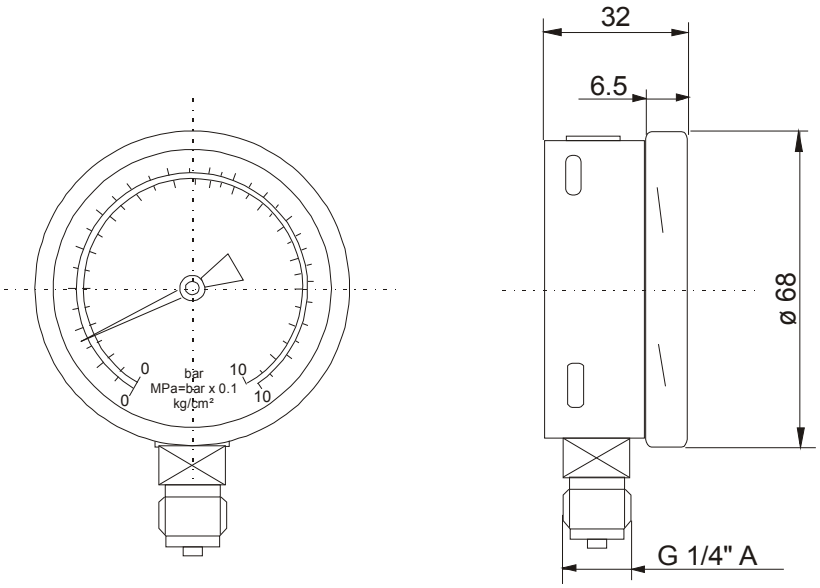
- For all gaseous and liquid media

Material:

- Case: Stainless steel
- Socket: Cu-alloy
- Liquid filling: Glycerine

Technical data:

- Connection: G 1/4”-m (1/4 BSP)
- Measuring unit: bar – Mpa - kg/cm²
- Measuring range: 0 – 10 / 1.0 /10
- Pressure utilisation:
  Static pressure: 75% of $P_{max.}$
  Dynamic pressure: 66% of $P_{max.}$
- Operating temperature: -20 to +80°C
- Accuracy: EN 837 Class 1,6



Type No.: 8050 Version: B.1	**Pressure gauge, ø 63**	**6633119**

Type

- Full Bore ball valve
- EURO-SFER 1720

Size:

- Nominal diameter: DN8

Application:

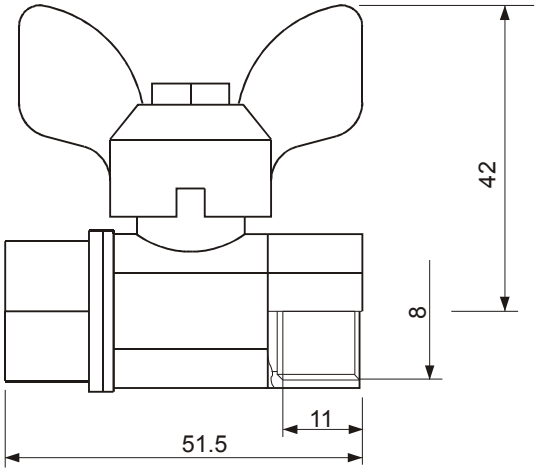
- Assembly in rigid pipe system
- Direction of low in both directions

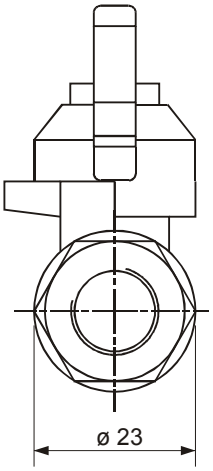
Material:

- Body: CW617N UNI EN 12165
- Lever: aluminium handle UNI 5076 painted black with epoxy powder

Technical data:

- Nominal pressure: PN 64
- Thread ends: female – female UNI ISO 7/1





Type No.: 6000 Version: A.2	Full bore ball valve, DN 8, PN 40	6666006

Type:

- Strainer

Size:

- 3/4” BSP

Application:

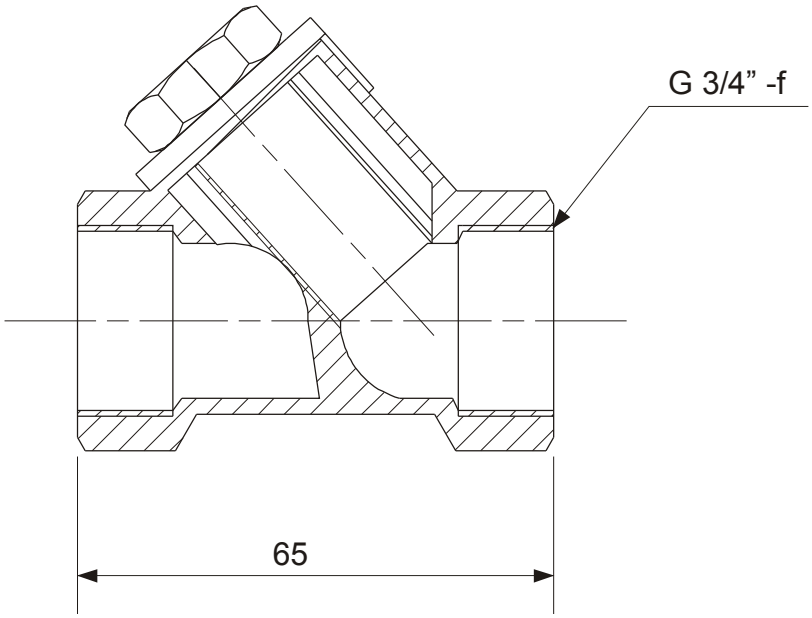
- For mechanical cleaning of different media in tube systems.

Material:

- Body: Bronze

Technical data:

- Nominal pressure: PN 16 at max.120°C



Type No.: 7040 **Version: A.2**	**Strainer, 3/4" BSP, PN 16**	**7040000063**

Type:

- Stop ball valve, straight
- 133 BSP, full bore

Size:

- 3/4” BSPP

Application:

- For air, steam, or oil flow

Material

- Body: ASTM A105
- End connections: ASTM A105

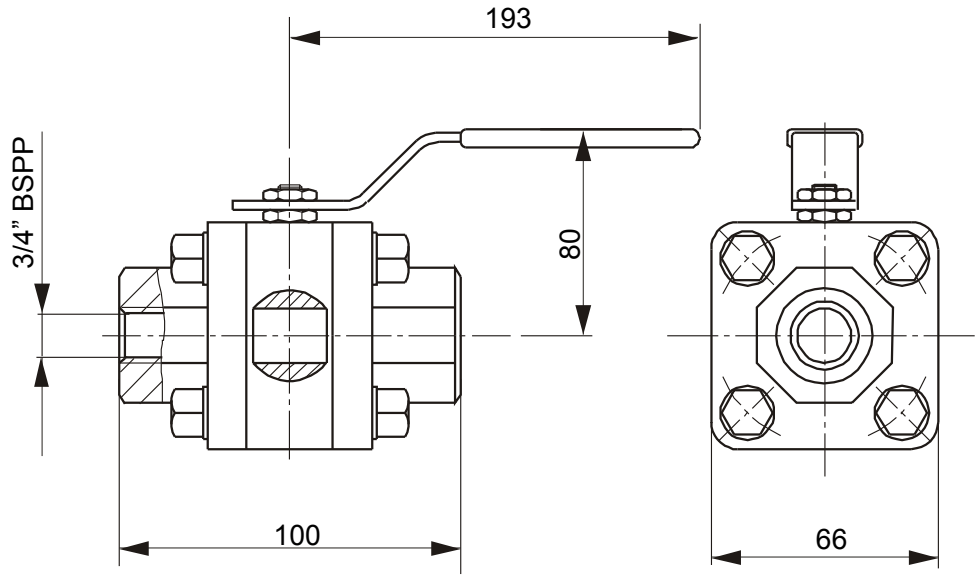
Technical data:

- Min./max temperature at 30 bar:
  - 29°C to + 200°C
- End connections: 3/4” threaded female, ISO 228/1
- Pipe size: DN 20
- Weight: 2.3 kg

Installation:

Information and caution before installation of the valve:

- Pipe must be free of tension.
- Pipe must be flushed to clean the dirt, burrs calamines, welding residues etc. which would damage the ball and seat.
- The valve must be kept in openposition during installation. Protective plastic covers must not be removed before the installation work commences.
- At the moment of the shipment the ball is lubricated with a pure vaseline oil, which can be easily removed with a solvent, if required.
- Ball valves normally have a space between ball and inside cavity of the body, which could trap the product, care should be taken to drain the cavity.



Type No.: 6010 **Version: A.2**	**Stop valve, ball, straight, 3/4"**	**6010000054**

Type:

- Solenoid valve
- BV01

Size:

- G 1/4" -f

Application:

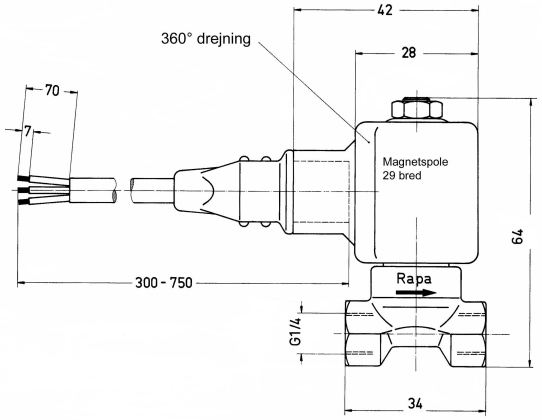
- For oil burners with small and medium capacity.
- The valve is protected against oil-impurities.

Material:

- House: Brass
- Core: Stainless steel

Technical data:

- K_V value with a viscosity at 30 cSt.: 1.4 l/min.
- Valve opening diameter: 2 mm
- Working pressure: 0 – 24 bar
- Working temperature: ÷15°C to +70°C
- Ambient temperature: : ÷ 20°C to + 40°C
- Viscosity max.: 150 cSt.
- Degree of protection: IP 54
- Input voltage: 230 V_{AC}
- Input frequency: 50/60 Hz
- Power consumption: 8 W



Type No.: 6240 **Version: A.2**	**Solenoid valve**	**6638146**

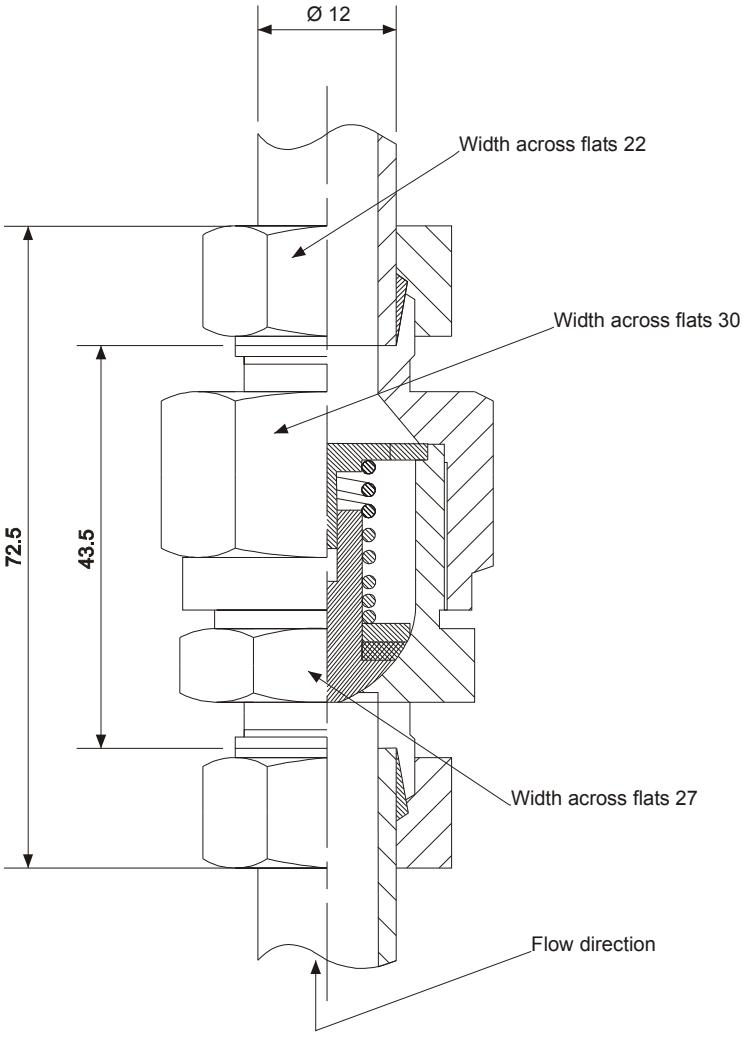
Type:
- Check valve
- RD12L

Size:
- Diameter 3/8”

Application:
- For oil and/or air flow

Material:
- Steel

Technical data:
- Nominal working pressure: PN 250
- Weight: 0.21 kg



Type No.: 6020 Version: A.2	Check valve, 3/8", PN 250	6638103

Type:

- Solenoid valve 3/2 way

Material:

- Body: Aluminium
- Spindle: Stainless steel, NRB seals
- Stem: Stainless steel, NRB seals
- Stem rings: Stainless steel, NRB seals
- Core tube: Stainless steel, NRB seals
- Plug: Stainless steel, NRB seals
- Seat: Stainless steel, NRB seals
- Gasket: Stainless steel, NRB seals
- Spring: Stainless steel, NRB seals
- Shading coil: Stainless steel, NRB seals

Technical data:

- Pressure, max. operating: 6 bar
- Pressure, differential: 0-10 bar
- Temperature, min. of medium: 0-80°C
- Coil insulation class: Class H
- Protection class: IP54 40050
- Connector: PG11
- Connector specification: mod. 124-800

Electrical specification:

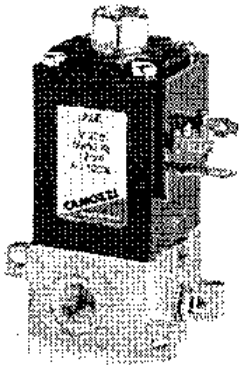
- Power supply:220 V_{AC}
- Power consumption: (at inrush) AC = 19VA, during operation = 12VA – DC 10W

Installation:

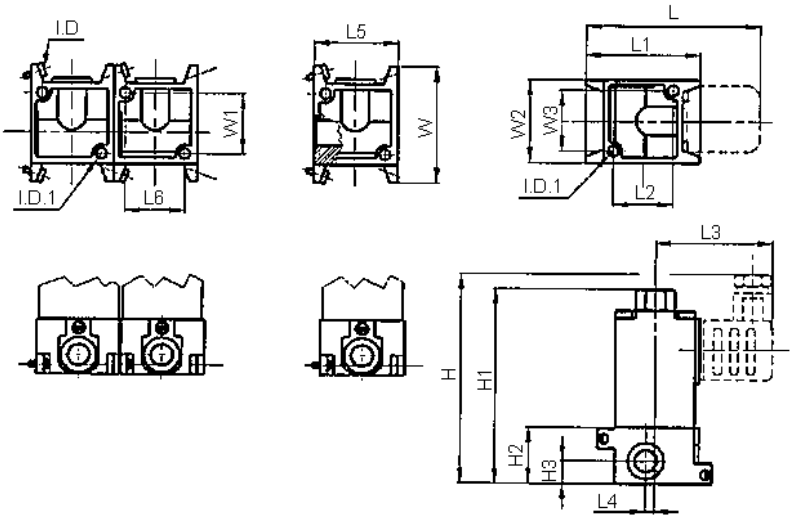
- In any position.

Dimension:

- L: 70
- L1: 46
- L2: 24
- L3: 46,5
- L4: 3,5
- L5: 33
- L6: 24
- H: 85
- H1: 79
- H2: 22,5
- H3: 9
- W: 46
- W1: 24
- W2: 33
- W3: 24
- I.D.: M4
- I.D.1: M5



Type No.: 6240 **Version: A.2**	**Solenoid valve**	**6666232**



Type No.: 6240 **Version: A.2**	**Solenoid valve**	**6666232**

Type:

- Pneumatic valve, normally open

Size:

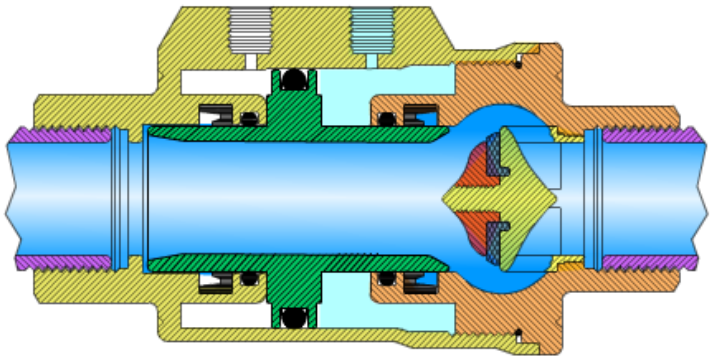
- 1/2”

Application:

- For oil

Technical data:

- Pressure, max. operating media: 10 bar
- Temperature, operating media – 20°C to 150°C
- Vacuum tightness, operating media: 740 mm Hg
- Weight: 1 kg



Type No.: 6000 **Version: A.2**	**Pneumatic valve**	**6638152**

Type:

- Ball valve
- JIP II 065N0805

Size:

- DN 20

Application:

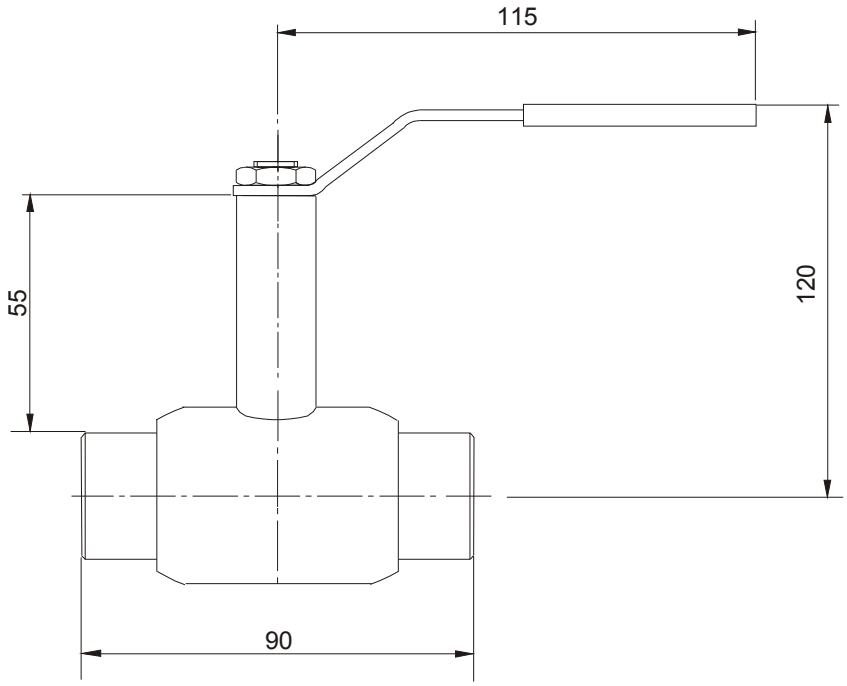
- For hot-water systems, in which the water has been treated in order to avoid corrosion.

Material:

- Body: St. 37.0
- Stem: Stainless steel
- Ball: Stainless steel
- Seat rings: Carbon reinforced PTFE
- Seals: PTFE/graphite

Technical data:

- Max. working pressure: 40 bar
- K_V values: 14 m^3/h
- Min. temperature: 0°C
- Max. temperature: 180°C
- Threaded connection: 3/4” RG
- Weight: 0.8 kg



Type No.: 6000 **Version: A.2**	**Ball valve, DN 20, PN 40**	**6641120**

Type:

- Heating cable
- IHT / F30

Application:

- To secure a continuous heavy fuel oil flow to the burner, it is necessary to fit heating cables on the oil pipes.

Material:

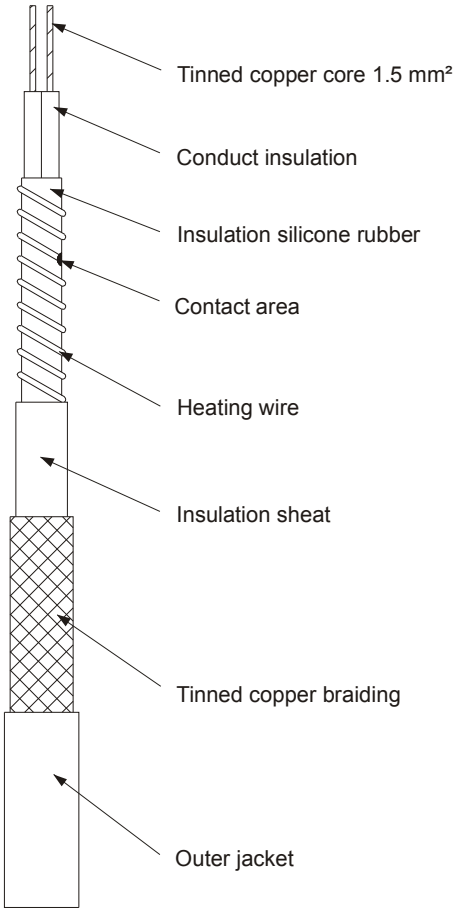
- Primary insulation: Silicone rubber
- Secondary insulation: FEP
- Earth braiding: Tinned copper
- Outer jacket: FEP

Technical data:

- Nominal temperature: 200°C
- Max. working temperature: 150°C
- Nominal voltage: 230 V
- Output: 30 W/m
- Dimension: 5 x 7.5 mm
- Mechanical strength: Excellent
- Bending radius: 25 mm

Installation:

- The thermostat will normally be adjusted 5-10°C below normal operating temperature for the burner.
- The cable is flexible and pliable with one-end connection which makes it easy to divide the length of the cable.
- E.g. on pipe lines the cable is wound round the pipe or is mounted along the pipe and is then secured by clamps or aluminium tape with intervals of approx. 30 cm.
- The windings must not cross each other and the intervals must be at least 10 mm, the heating cable must not be stretched along the pipe, but must lie in soft curves between the clamps. Finally aluminium foil is wound round the cable and pipe before insulating and will then press the cable against the pipe.
- Thermostat control of the surface temperature of the subject to be heated is necessary.



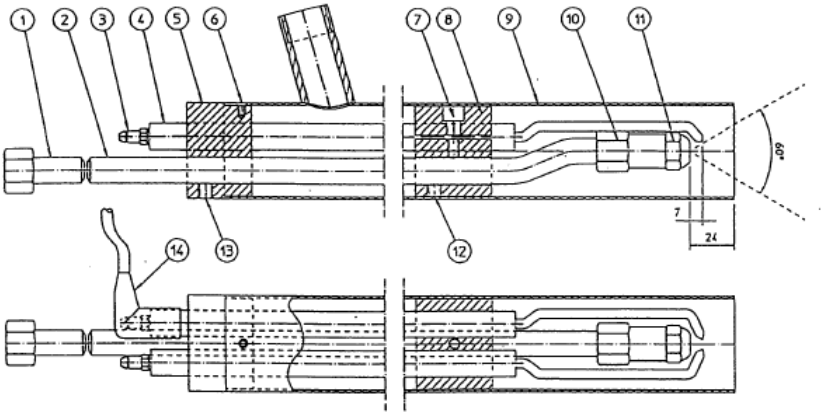
Type No.: Version: A.2	Heating cable	6639099

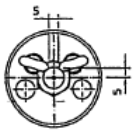
Type:
- Ignition burner

Application:
- For diesel oil

Item	Designation		Dimension	Article No.
14	Cap for electrodes	2		6666009
13	Allen screw	1	M 8 x 6	6636297
12	Allen screw	1	M 8 x 6	6636297
11	Oil Nozzle	1	60° - 14 kg/h	6638041
10	Nozzle retainer	1		6638038
9	Mixing tube	1		6638092
8	Electrode holder	1		6666019
7	Allen screw	1	M6 x 15	6636073
6	Allen screw	1	M4 x 6	6636323
5	Fixture for ignition burner	1		6638080
4	Ignition electrodes	2	ø14 / ø5	6638095
3	Connection for electrodes	2		6666041
2	Oil supply pipe	1	1/4”	6638097
1	Connection sleeve	1	12 mm	6638099

Table 1





Type:

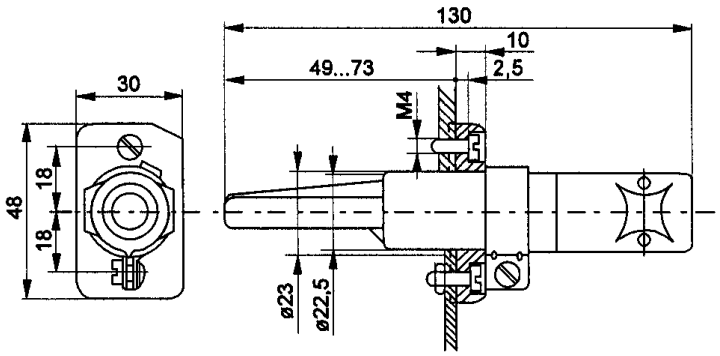
- Photo cell
- RAR7

Application:

- The RAR7 detector is used for supervision of yellow burning oil flames.

Technical data:

- Length of detector lead: up to 20 m
- Permissible ambient temperature: -20°C to + 60°
- Protection standard: I
- Degree of protection: IP 40
- Weight: approx. 85 g



Type No.: 8630 **Version: A.2**	**Photo cell**	**6639045**

Type:

- Filter regulator with semi-automatic, manual drain

Size:

- Connection ports 1/8”
- Gauge ports 1/8”

Application:

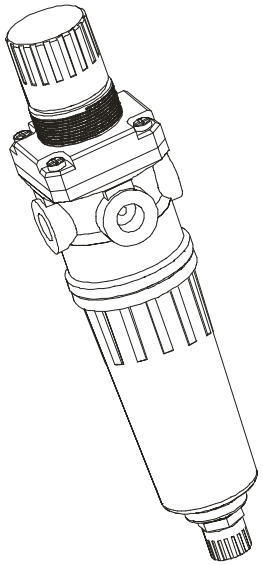
- Instrument air for regulating pressure

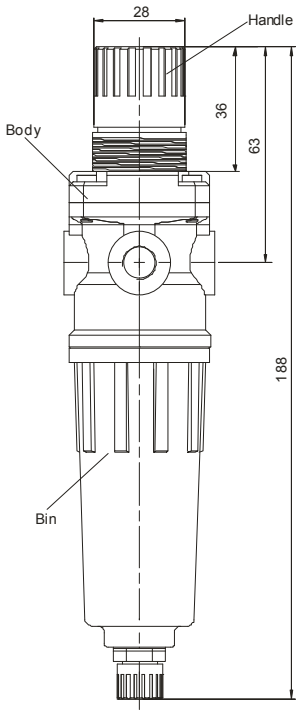
Technical data:

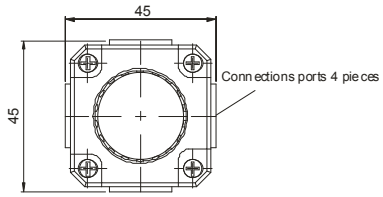
- Medium: instrument air only
- Max. inlet pressure: 16 bar
- Operating temperature: 0-60 °C at 10 bar
- Filter element: 5 µm
- Outlet pressure: 0.5 - 10 bar
- Pressure gauge: 0 - 10 bar
- Weight: 0.37 kg

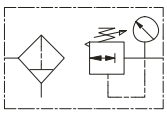
Material:

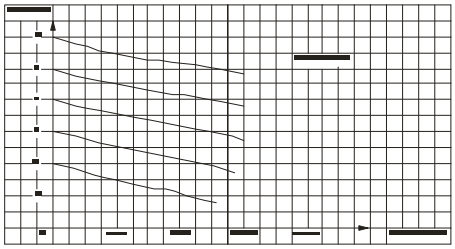
- Handle: Nylon
- Bin: Grillamid
- Body: Metal











Type No.: 8000 Version: A.2	**Filter regulator with automatic, manual drain**	**6639046**

Type:

- Pressure transmitter

Range:

- 0 – 10 barg

Application:

- The pressure transmitter converts pressure to an electric signal. The units are supplied as two wire transmitters with an output signal of 4-20 mA. The output current is linearly proportional to the input pressure.

Material:

- Housing: Stainless steel with ceramic measuring cell and electronics module. The temperature-compensated ceramic measuring cell has a thin-film strain gauge which is mounted on a ceramic diaphragm.
- Process connection: Stainless steel
- Gasket: Viton

Technical data:

Electrical specification:

- Current output signal: 4 to 20 mA
- Voltage output signal (only measuring range ≥ 1 bar: 0….10 V_{DC}
- Power supply terminal voltage for current output: 10….36V_{DC}

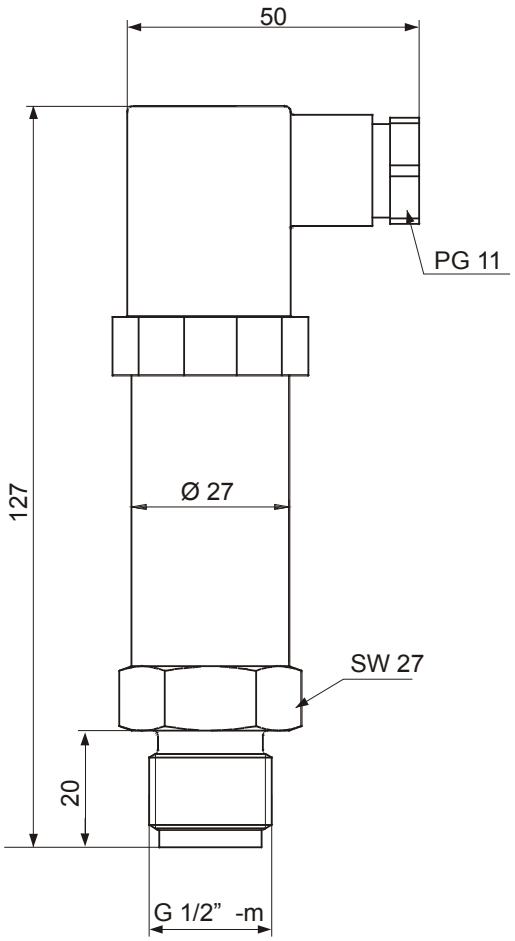
Accuracy:

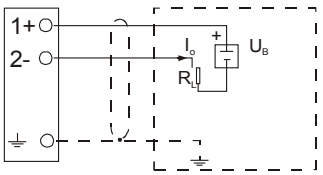
- Response time T_{99}: < 0.1 s
- Influence of ambient temperature at start of scale: 0.25%/10K (0.25%/10K) of full scale value
- Influence of ambient temperature at full scale value: 0.25%/10K (0.25%/10K) of full scale value

Mechanical:

- Process temperature: ÷30°C to +120°C
- Ambient temperature: ÷25°C to +85°C
- Degree of protection to EN 60529: IP65
- Weight: 0.25 kg

Connection diagram:





I_0 Output current
U_B Power supply
R_L Load

Connections:
1 (+U_B)
2 (-U_B)

Type No.: 8012 Version: A.2	**Pressure transmitter 0 - 10 barg**	**8010000012**

Type:

- Pressure gauge valve needle straight.

Size:

- 3/8” x 3/8”

Application:

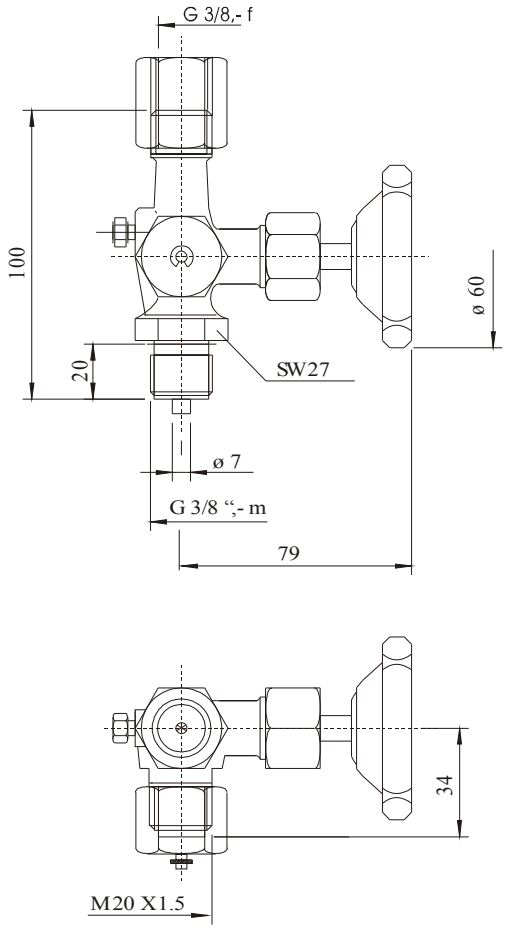
- For instrument connections

Material:

- Body: C22.8
- DIN-material No. 1.0460

Technical data:

- Nominal pressure: PN 400
- Test connection: M20 x 1.5 mm threaded male
- Weight: 0.4 kg



Type No.: 6210 **Version: A.2**	**Needle valve, straight, 3/8" x 3/8", PN 400**	**87D3050**

Type

- Flow control valve
- 24-VK2-3.3

Size:

- Connection, nominal: 1/2”

Pressure rating:

- Pressure, nominal: PN 40

Connection type:

- Connection type:

Application:

- The flow control valve is designed for use in or on oil burners equipped either with return flow atomisers, compressed air atomisers, or steam atomisers.
- Turning the flow control valve shaft changes the fuel flow rate. Both flanges at the regulator shaft are marked with a “+”, a scale in 15° steps and a “-“. The pointer mounted on one side of the flow control valve shaft shows the actual position of this shaft.

Material:

Technical data:

- Fuel temperature: up to 140°C

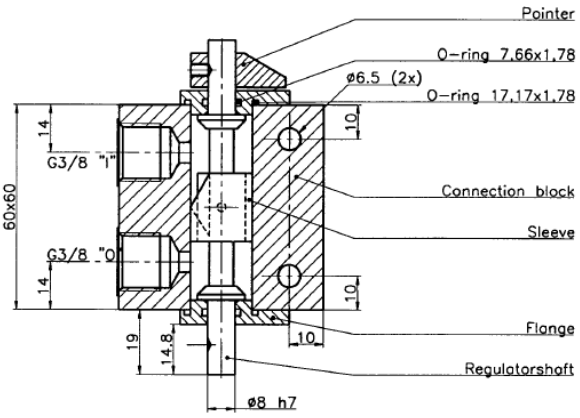
Function:

- Turning the flow control valve shaft changes the flow through the flow control valve. The marking of “+” and “-“ always refers to the throughput of the-flow control valve and not to the output of the actual atomiser. The throughput of the flow control valve is at minimum with the pointer at “-“. Turning the flow control valve shaft towards “+” increases the throughput of the flow control valve. Therefore, incase of air or steam atomisation, the output of an atomiser is at maximum if the pointer is at “+”. On the other hand, for a return flow atomiser, the output of the atomiser will be a minimum if the pointer is at “+”.
- The throughput of the regulator always is related to a certain pressure difference between the inlet and the outlet of the regulator. The pressure drop across the regulator and the maximum throughput depend on the actual atomiser and system particulars.

Maintenance:

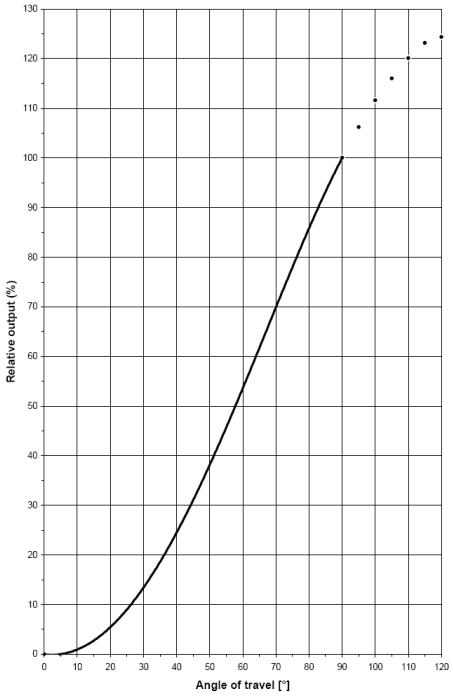
- The regulator normally does not require any maintenance. Wear or damage highly depends on fuel quality. The only moving part is the flow control valve shaft
- To exchange the o-rings in the flange, remove the pointer, held by 1 screw. Remove any damages and polish any sharp edges at both ends of the control valve shaft. Remove both flanges, each held by 2 screws, but leave the flow control valve shaft in its place. Carefully remove both o-rings from their grooves using a sharp needle without damaging the flanges in any way. Complete seal sets are available for replacement.Re-assemble the flow control valve in reverse order.
- The position of the pointer on the flow control valve shaft has been pre-set at the factory. Both ends of the flow control valve shaft have a pit for fixing the pointer in the correct position. If the flow control valve shaft is mounted properly and the pointer is fixed again using this pit, the characteristic of the flow control valve will not change after replacement of o-rings.

Type No.: 6050 **Version: A.2**	**Flow control valve**	**6050000376**



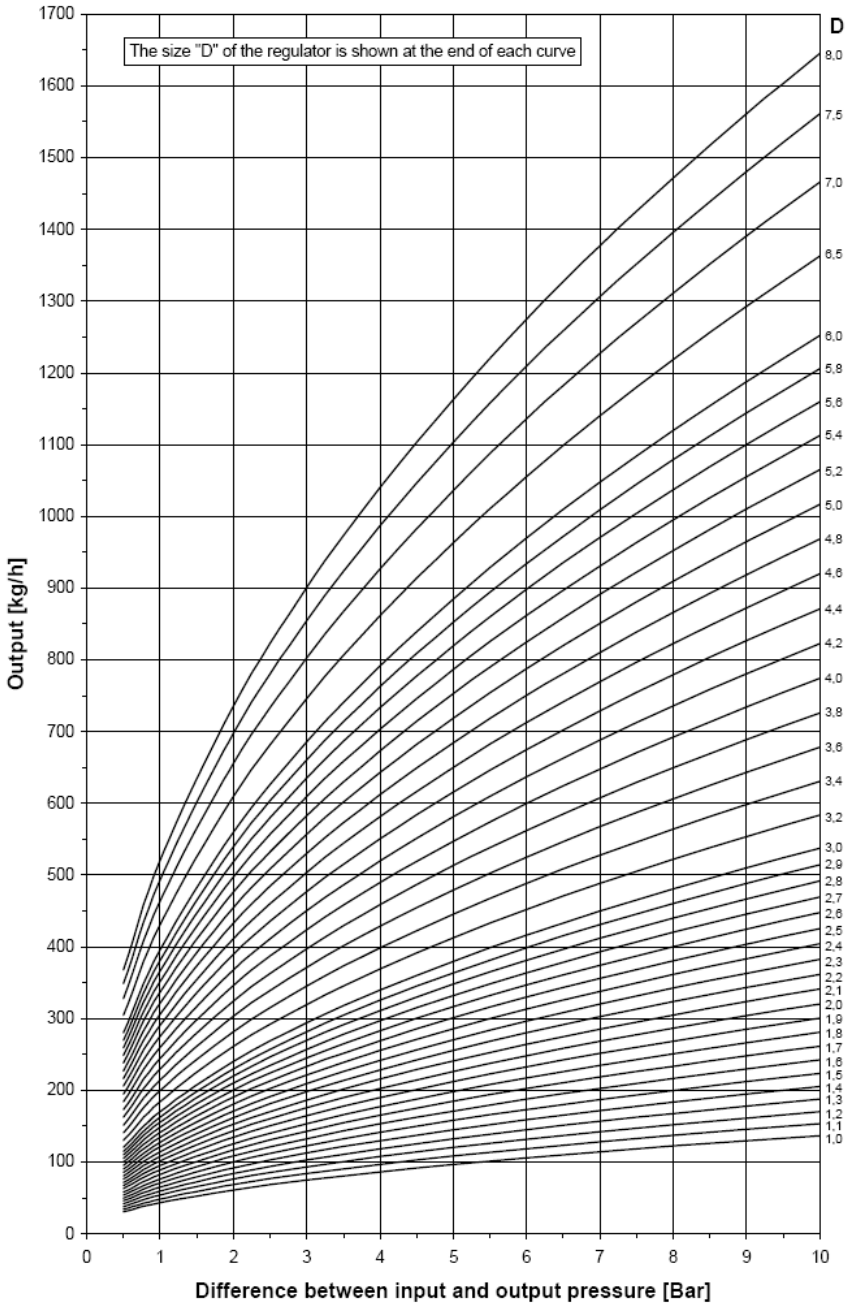
Output characteristic

- Constant pressure drop over regulator



Type No.: 6050 **Version: A.2**	**Flow control valve**	**6050000376**

- Output at 90°C opened
- Viscosity 5 cSt.



Type No.: 6050 **Version: A.2**	**Flow control valve**	**6050000376**

Type:

- Stop ball valve, straight
- 133 BSP, full bore

Size:

- 3/4” BSPP

Application:

- For air, steam, or oil flow

Material

- Body: ASTM A105
- End connections: ASTM A105

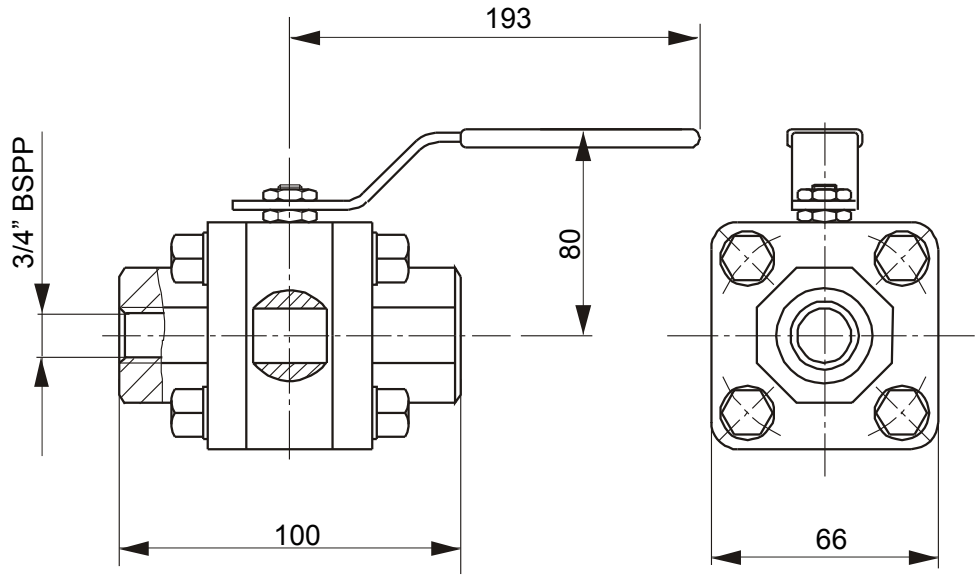
Technical data:

- Min./max temperature at 30 bar:
  - 29°C to + 200°C
- End connections: 3/4” threaded female, ISO 228/1
- Pipe size: DN 20
- Weight: 2.3 kg

Installation:

Information and caution before installation of the valve:

- Pipe must be free of tension.
- Pipe must be flushed to clean the dirt, burrs calamines, welding residues etc. which would damage the ball and seat.
- The valve must be kept in openposition during installation. Protective plastic covers must not be removed before the installation work commences.
- At the moment of the shipment the ball is lubricated with a pure vaseline oil, which can be easily removed with a solvent, if required.
- Ball valves normally have a space between ball and inside cavity of the body, which could trap the product, care should be taken to drain the cavity.



Type No.: 6010 **Version: A.2**	**Stop valve, ball, straight, 3/4"**	**6010000054**

Type:

- Servomotor
- D1

Range:

- 6 Nm (torque)

Application:

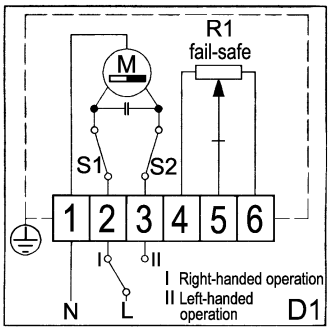
The units is used to control the position of Air-damper, and consist of synchronous motor with right-handed rotation or left-handed rotation. Servomotor with potentiometer response with fail-safe potentiometers has a fixed positioning angle, depending on the potentiometer transmission.

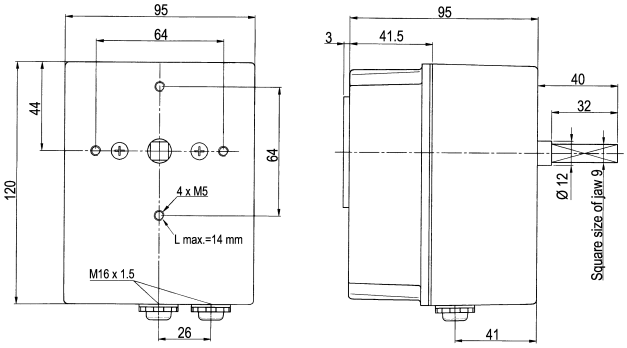
Material:

- Housing: cast aluminium
- Output shaft:steel

Technical data:

- Rated Torque: 6 Nm
- Positioning time: 90° in 64 sec. response
- Positioning angle: 90°
- Permissible ambient temperature:
- -20°C up to +60 °C
- Mounting position: any, except with the actuator hanging downwards
- Degree of protection: IP54
- Mounting: tap holes 4 x M5, screw in depth max. 14mm
- Output shaft: Square size of jaw 9, shaft length 40mm off housing
- Mechanical position indicator: above scale plate
- Power supply: 1~50/60 Hz/230V
- Electrical connection: via internal terminal strip via 2 compression glands M16x1.5
- Operating mode: S4-30% c.d.f.-1200 c/h
- End switching: 2 travel dependant signal switches “WE”, max. 250V AC for ohm load 10A
- Lubricant for gearing: Klüber Microlube GL151
- Operating voltage/frequency: 1-phase AC 50/60Hz
- Rated current: 21.3 mA
- Power consumption: 4.2W
- Power output: 0.42 W
- Rotation speed: 250 rpm
- Signalling unit: 1 potentiometer 1000Ω & 1 potentiometer 5000Ω, max. 1.5W, max. current 30mA.response 1 potentiometer 5 k-Ω failsafe for coupled control (not retrofittable), max. 0.5W, max.current 0.1µA





Type No.:5530 Version: A.2	Servomotor	5530000069

Type:

- Temperature sensor
- 5560 (084Z4021)

Range:

- -0°C to 100°C

Application:

Designed for use in harsh maritime

Environments where reliable, robust and accurate equipment is required

Material:

- Housing: Stainless steel
- Enclosure (AISI 316L)

Technical data:

Performance:

- Accuracy:<± 0.5 % FS (typ.), <± 1 % FS (max.)
- Response time: Water 0.2m/s : t05= 10 sec / t09= 30 sec
- Response time: Air 1m/s:t05= 95 sec
- / t09= 310 sec
- Max. load protection tube : 100 bar

Electrical specifications:

- Output signals: 4-20 mA
- Electrical connection 43650-A. Pg 9 (2 wire)
- Supply voltage: 10 to 32 V_{DC}
- Current limitation: 30mA
- Output impedance: < 225 ohm
- Degree of Protection: IP65

Mechanical:

- Connection: G ¼"A
- Weight: 0.15 kg

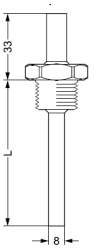
Dimension:

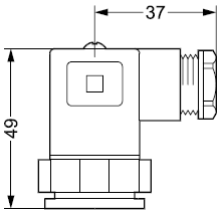
- L = 100

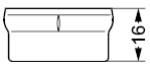
Electrical connection:

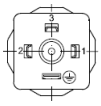
- Pin1: + supply
- Pin 2: - supply
- Pin 3: Not used
- Earth: Not connected to housing











Type No.: 8060 Version: B.1	**Temperature sensor, 0°C to 100°C**	**8060000029**

Type:

- Control valve
- 44-7

Size:

- Nominal diameter: DN 15

Application:

- Pressure regulation for liquids up to 150°C, non-flammable gases up to 80°C

Material:

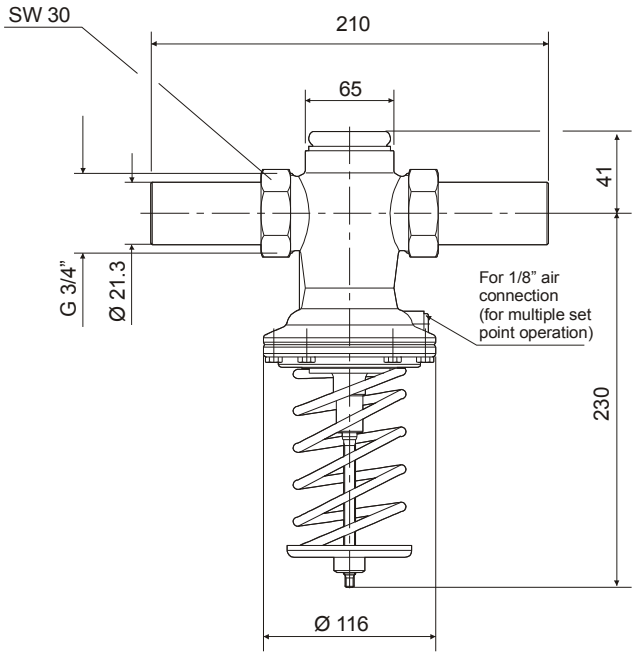
- Body: Red casting brass CC491K (G-CuSn5ZnPb; Rg5)
- Seat: Stainless steel 1.4305
- Plug: Brass 2.0402 (CuZn40Pb) and stainless steel 1.4305 with FKM soft sealing
- Valve spring: Stainless steel 1.4310
- Diaphragm: FKM with fabric insert
- Sealing rings: FKM

Technical data:

- K_{vs} value: 4.0
- Nominal pressure: PN 25
- Max. permissible difference pressures Δp: 11 bar
- Max. permissible temperature: 150°C
- Leakage rate: ≤ 0.05% of k_{vs} value
- Set point range: 1 to 4 bar
- Weight: 2 kg

Installation:

- The direction of flow must correspond with the arrow on the valve body.
- The valve assembly, including the actuator must hang downwards.
- The actuator connection port is plugged if the valve is operated only with one set point.
- When two or more set points are applied, the actuator connection port (1/8") must be connected.
- Please note that pipe and fittings are not part of the supply.
- The actual application is shown on the oil system diagram.



Type No.: 6050 Version: A.2	**Control valve, DN 15, PN 25**	**6050000355**

Type:
- Micro switch

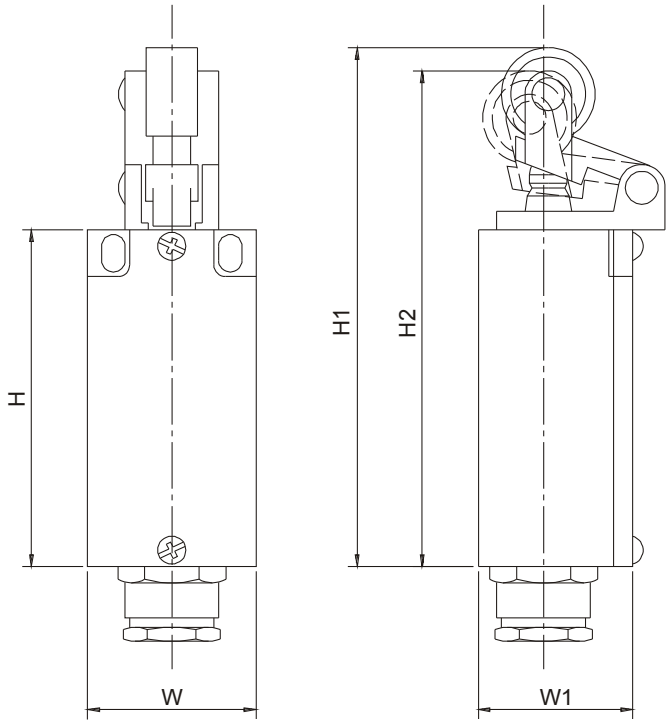
Size:
- Gable gland: PG 11

Application:
- For burner swing out

Technical data:
- Weight:

Electrical specifications:
- Voltage: 500 V
- Current: 10 A

Dimension
- H = 72
- H1 = 111 (non activated)
- H2 = 106 (activated)
- W = 36
- W1 = 33



Type No.:8000 **Version: A.2**	**Micro switch**	**6638145**

Type:

- Solenoid valve 2 x 3/2 way

Material:

- Body: Aluminium
- Spindle: Stainless steel, NRB seals
- Stem: Stainless steel, NRB seals
- Stem rings: Stainless steel, NRB seals
- Core tube: Stainless steel, NRB seals
- Plug: Stainless steel, NRB seals
- Seat: Stainless steel, NRB seals
- Gasket: Stainless steel, NRB seals
- Spring: Stainless steel, NRB seals
- Shading coil: Stainless steel, NRB seals

Technical data:

- Pressure, max. operating: 6 bar
- Pressure, differential: 0-10 bar
- Temperature, min. of medium: 0-80°C
- Coil insulation class: Class H
- Protection class: IP54 4005
- Port connection: G 1/8
- Connector:PG 11
- Connector specification: mod. 124-800

Electrical specification:

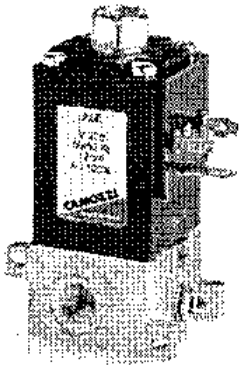
- Power supply:220 V_{AC}
- Power consumption: (at inrush) AC = 19VA, during operation = 12VA – DC 10W

Installation:

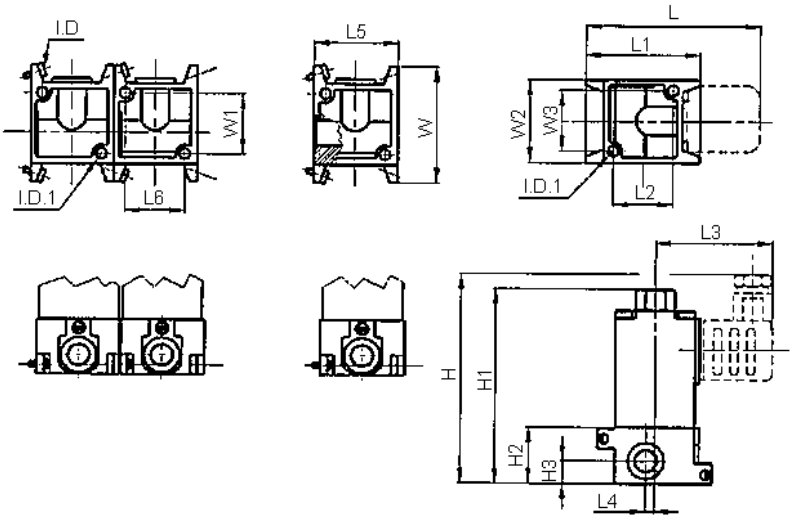
- In any position.

Dimension:

- L: 70
- L1: 46
- L2: 24
- L3: 46,5
- L4: 3,5
- L5: 33
- L6: 24
- H: 85
- H1: 79
- H2: 22,5
- H3: 9
- W: 46
- W1: 24
- W2: 33
- W3: 24
- I.D.: M4
- I.D.1: M5
-

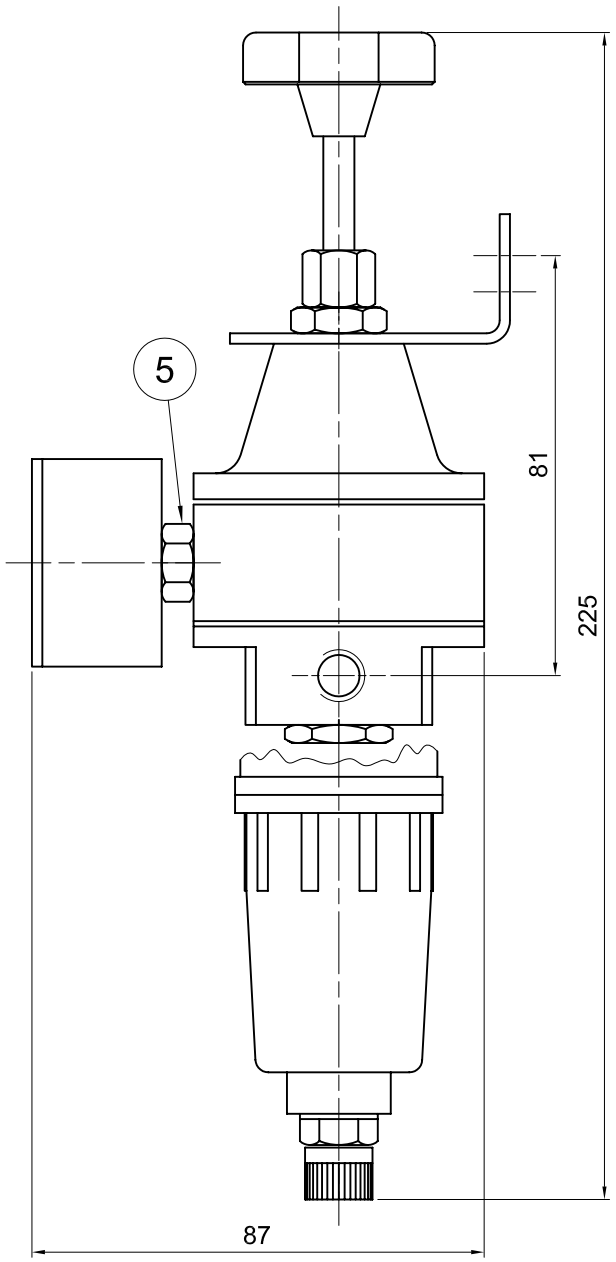


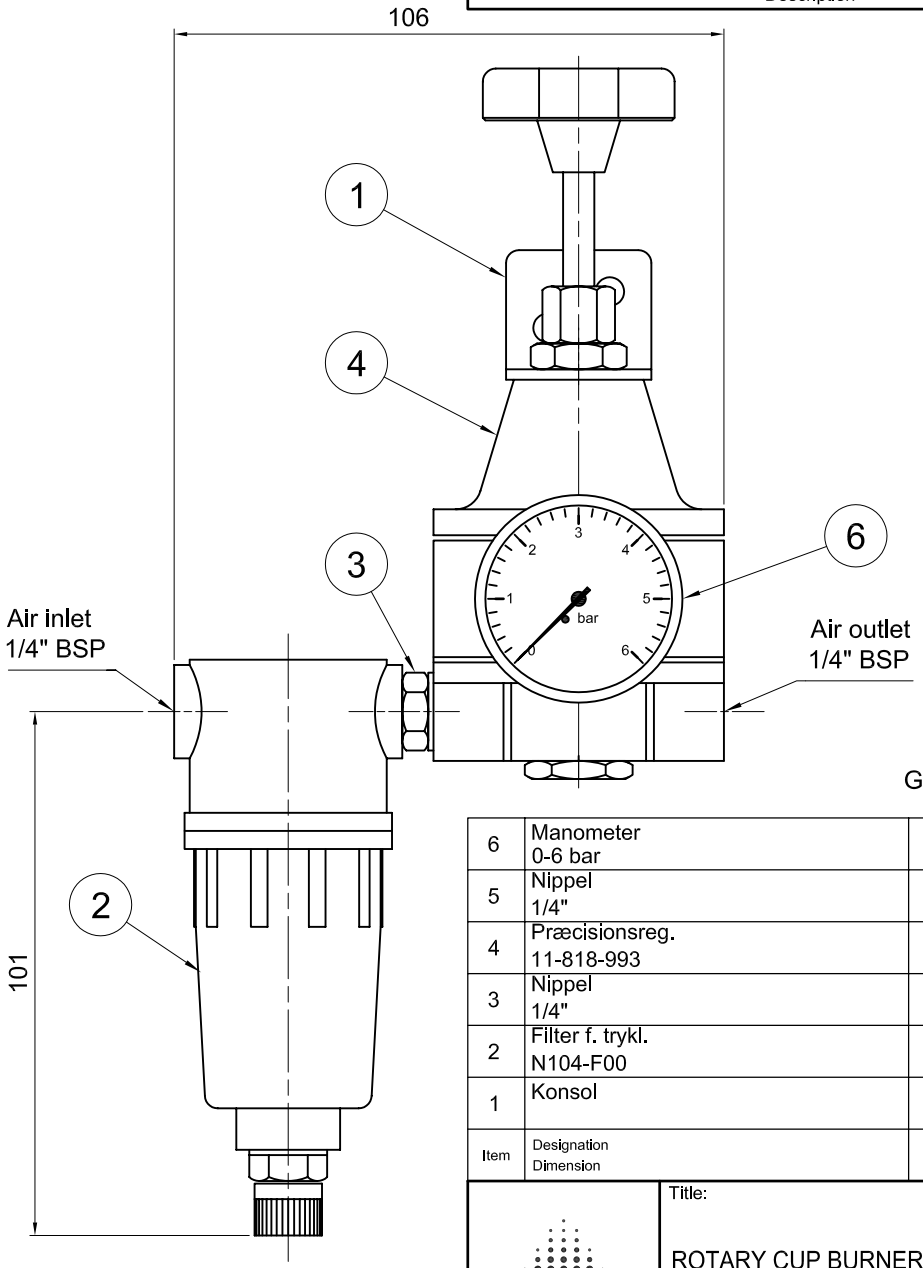
Type No.: 6240 Version: B.1	Solenoid valve, 230 V 50/60 Hz	6666230

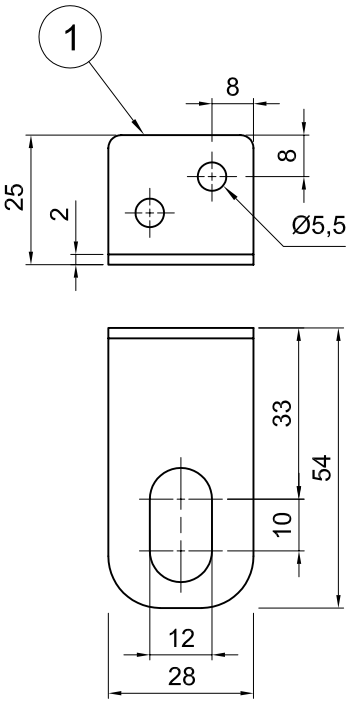


Type No.: 6240 **Version: B.1**	**Solenoid valve, 230 V 50/60 Hz**	**6666230**

Description	Index	Date	Drawn	Appr.







G31

Item	Designation Dimension	Pcs.	Material code Material type	Cert.	Article No. Detail drawing No.
6	Manometer 0-6 bar	1			
5	Nippel 1/4"	1			
4	Præcisionsreg. 11-818-993	1			
3	Nippel 1/4"	1			
2	Filter f. trykl. N104-F00	1			
1	Konsol	1			

AALBORG INDUSTRIES

Plot Date:

Title:

ROTARY CUP BURNER - KB

Part No. 8000000031

AIR REDUCTION STATION

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Drawn	Date
BHa	09.04.2002
Appr.	Date
Weight	Scale: 1:1 / Size A3
Article/Drawing No: 91Y : 020896	Index

Pressure switch:

- GW 50 A6

Application:

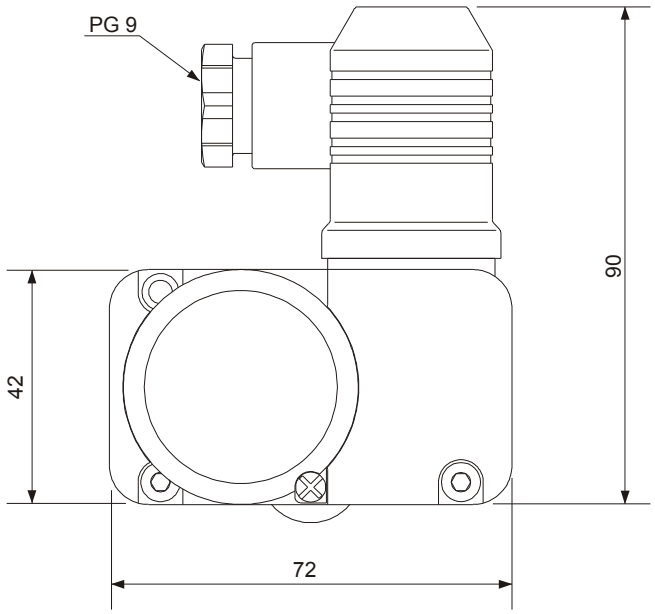
- Pressure switch for firing systems.

Material:

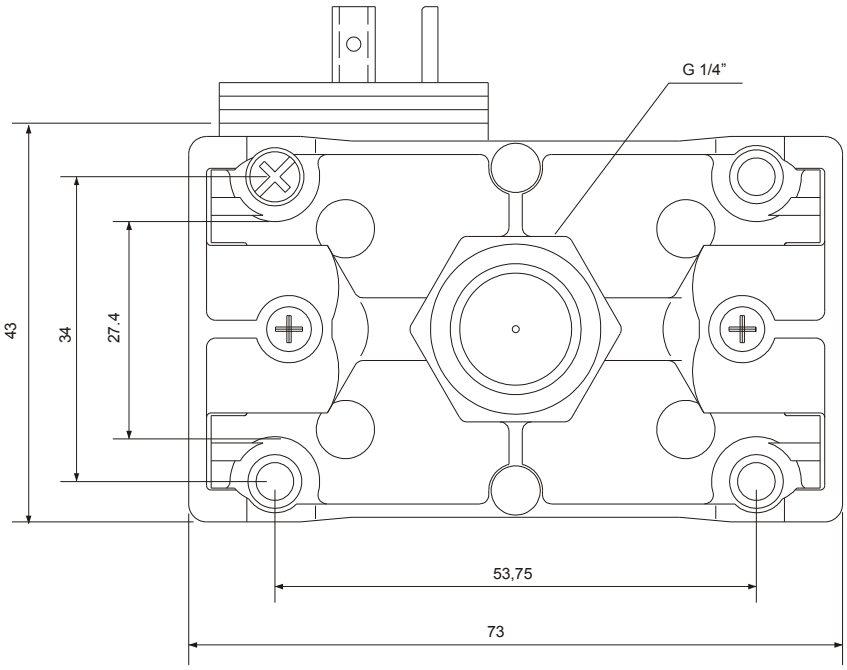
- Housing: Aluminium die cast
- Switch part: Polyamide
- Diaphragms: NBR
- Switching contact: Ag (fine silver)

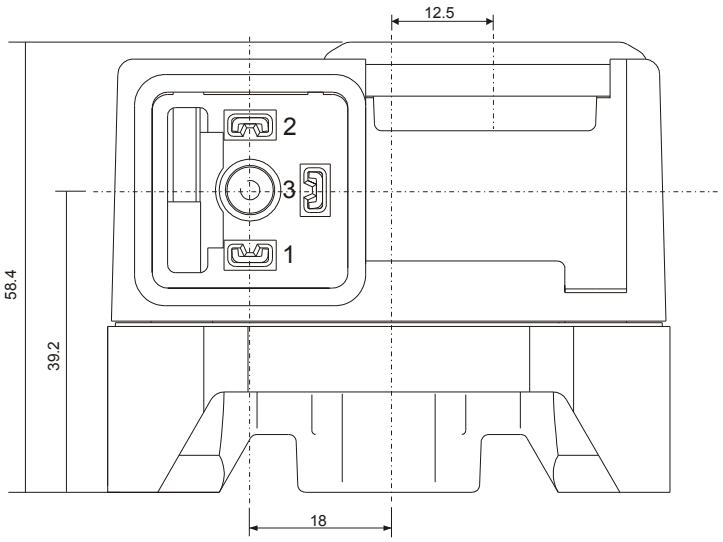
Technical data:

- Operating pressure: 5 to max. 50 mbar
- Ambient temperature range: ÷15°C to +70°C
- Medium temperature range: ÷15°C to +70°C
- Storage temperature range: ÷30°C to
- +80°C
- Pressure connection: G 1/4" inner thread as per ISO 228
- Measuring connection: Test nipple in metal housing ø 9
- Switching voltage: effective min. 24 V_{AC}max. 250V_{AC}
- Switching voltage: effective min. 24 V_{DC} max. 48V_{DC}
- Electrical connection: Terminal connection for line sockets as per DIN EN 175 301-803, 3-pin, protection-insulated without ground connection
- Degree of protection: IP 54 as per IEC 529 (EN 60529)
- Setting tolerance: ± 15% switch point deviation referred to set point, adjusted for dropping pressure, vertical diaphragm position



Type No.: 8030 Version: A.2	**Pressure switch**	**6639010**





Type No.: 8030 **Version: A.2**	**Pressure switch**	**6639010**

EFF2 - 2-polet (3000 RPM)

Type Series MS			Effekt (kW) Power (kW) 50 Hz	60 Hz	RPM RPM 50 Hz	60 Hz	Mærkestrøm (A) 50/60HZ Design current (A) 50/60HZ 230V	400V	690V	Virknings-grad Efficiency %	Effekt faktor Power factor Cos φ	Nominel moment Nominal torque (Nm)	Start-strøm Starting current Is/In	Start-moment Starting torque Ms/Mn	Kip-moment Pull-out torque Mmax/Mn	Inerti-moment Moment of inertia j (kgm2)	Vægt Net weight (kg)
MS	56	1-2	0,09	0,11	2640	3168	0,61	0,35	0,21	56,0	0,66	0,31	4,2	4,8	4,8	0,00010	3,7
MS	56	2-2	0,12	0,14	2640	3168	0,70	0,40	0,25	65,0	0,71	0,43	3,4	3,7	3,6	0,00012	3,9
MS	63	1-2	0,18	0,22	2715	3258	0,92	0,53	0,31	60,0	0,74	0,63	3,9	3,5	3,6	0,00013	4,1
MS	63	2-2	0,25	0,30	2715	3258	1,22	0,70	0,40	65,0	0,76	0,88	4,3	3,9	3,9	0,00015	4,6
MS *	63	3-2	0,37	0,44	2800	3360	1,91	1,10	0,57	68,0	0,74	1,26	4,5	2,5	2,7	0,00020	5,6
MS	71	1-2	0,37	0,44	2730	3276	1,62	0,93	0,57	73,5	0,82	1,29	5,0	3,8	3,6	0,00044	5,5
MS	71	2-2	0,55	0,66	2715	3258	2,31	1,33	0,81	75,5	0,82	1,93	4,7	3,4	3,3	0,00055	6,0
MS *	71	3-2	0,75	0,9	2800	3360	3,48	2,00	1,10	73,0	0,80	2,56	5,0	2,6	2,9	0,00066	8,1
MS	80	1-2	0,75	0,9	2715	3258	3,04	1,75	1,10	74,0	0,88	2,64	4,8	3,0	3,0	0,00068	9,5
MS	80	2-2	1,1	1,32	2700	3240	4,37	2,51	1,44	76,2	0,88	3,89	4,8	3,2	3,1	0,00086	10,8
MS *	80	3-2	1.5	1.8	2800	3360	5.62	3.23	1.91	78.5	0.85	5.12	6.0	2.8	3.1	0.00104	12.0
MS	90	S-2	1,5	1,8	2760	3312	5,60	3,22	1,90	78,5	0,86	5,19	5,2	3,2	3,2	0,00146	14,3
MS	90	L-2	2,2	2,6	2760	3312	8,16	4,69	2,67	81,0	0,87	7,61	5,1	3,1	3,1	0,00184	16,2
MS *	90	L2-2	3,0	3,6	2800	3360	11,08	6,37	3,48	82,6	0,83	10,23	6,0	3,6	3,4	0,00225	18,8
MS	100	L-2	3,0	3,6	2870	3444	10,68	6,14	3,41	82,6	0,86	9,98	6,0	2,8	3,3	0,00253	24,0
MS *	100	L2-2	4.0	4.8	2880	3456	13.60	7.91	4.59	84.2	0.87	13.26	7.0	3.0	3.4	0.00310	27.6
MS	112	M-2	4,0	4,8	2890	3468	13,50	7,87	4,56	84,2	0,88	13,22	6,9	2,3	3,1	0,00511	31,3
MS *	112	M1-2	5,5	6,6	2900	3480	18,40	10,7	6,19	85,7	0,88	18,11	4,0	2,5	3,4	0,00720	35,4
MS	132	S1-2	5,5	6,6	2910	3492	18,30	10,4	6,03	85,7	0,90	18,05	6,4	2,3	3,2	0,00978	49,0
MS	132	S2-2	7,5	9,0	2900	3480	24,50	14,0	8,01	87,0	0,91	24,70	6,0	2,1	2,8	0,01125	54,0
MS *	132	M1-2	9,2	11,0	2900	3480	33,80	19,3	11,19	87,0	0,91	30,30	7,0	2,1	2,7	0,01380	58,0
MS *	132	M2-2	11,0	13,2	2900	3480	40,30	23,0	13,33	88,4	0,91	36,22	7,0	2,1	2,7	0,01550	60,5

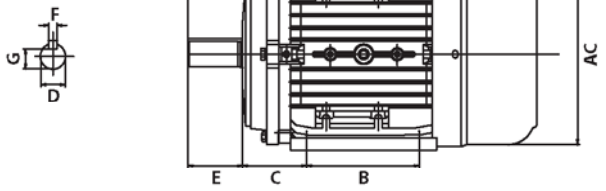
* Motorer med forhøjet effekt ** Motors with high power / Small frame*

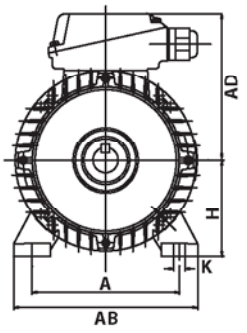
EFF2 - 4-polet (1500 RPM)

Type Series MS			Effekt (kW) Power (kW) 50 Hz	60 Hz	RPM RPM 50 Hz	60 Hz	Mærkestrøm (A) 50/60HZ Design current (A) 50/60HZ 230V	400V	690V	Virknings-grad Efficiency %	Effekt faktor Power factor Cos φ	Nominel moment Nominal torque (Nm)	Start-strøm Starting current Is/In	Start-moment Starting torque Ms/Mn	Kip-moment Pull-out torque Mmax/Mn	Inerti-moment Moment of inertia j (kgm2)	Vægt Net weight (kg)
MS	56	1-4	0,06	0,07	1380	1656	0,59	0,34	0,18	51,0	0,50	0,42	2,7	3,7	3,6	0,00020	3,5
MS	56	2-4	0,09	0,11	1380	1656	0,89	0,51	0,24	51,7	0,51	0,62				0,00021	3,7
MS	63	1-4	0,12	0,14	1350	1620	0,97	0,56	0,26	50,0	0,63	0,85	2,6	2,3	2,5	0,00025	4,0
MS	63	2-4	0,18	0,22	1340	1608	1,23	0,71	0,36	57,9	0,62	1,28	3,0	2,7	2,8	0,00028	4,2
MS *	63	3-4	0,25	0,30	1360	1632	1,46	0,84	0,47	60,0	0,69	1,76	3,5	2,2	2,4	0,00032	5,4
MS	71	1-4	0,25	0,30	1390	1668	1,39	0,80	0,46	67,0	0,68	1,72	3,7	2,4	2,8	0,00044	6,0
MS	71	2-4	0,37	0,44	1360	1632	1,90	1,09	0,65	69,5	0,73	2,60	3,4	2,1	2,3	0,00054	6,5
MS *	71	3-4	0,55	0,66	1360	1632	2,82	1,62	0,84	70,0	0,69	3,86	3,9	2,6	2,8	0,00067	7,8
MS	80	1-4	0,55	0,66	1370	1644	2,64	1,52	0,82	73,0	0,76	3,83	3,9	2,2	2,3	0,00120	9,0
MS	80	2-4	0,75	0,90	1380	1656	3,57	2,05	1,05	75,5	0,73	5,19	4,3	2,7	2,6	0,00150	10,6
MS *	80	3-4	1,10	1,32	1400	1680	4,96	2,85	1,61	76,5	0,76	7,50	5,0	2,3	2,5	0,00190	13,2
MS	90	S-4	1,10	1,32	1385	1662	4,70	2,70	1,57	78,0	0,78	7,58	4,6	2,5	2,8	0,00177	13,8
MS	90	L-4	1,50	1,80	1410	1692	6,09	3,50	2,03	79,0	0,77	10,16	4,9	3,0	3,3	0,00228	16,0
MS *	90	L2-4	2,20	2,60	1400	1680	9,08	5,22	2,87	77,0	0,79	15,01	5,5	2,5	2,7	0,00284	18,0
MS	100	L1-4	2,20	2,60	1430	1716	8,12	4,67	2,78	81,0	0,84	14,69	5,8	2,2	2,9	0,00494	24,0
MS	100	L2-4	3,00	3,60	1410	1692	11,50	6,63	3,71	82,7	0,82	20,32	5,0	2,1	2,5	0,00612	25,6
MS *	100	L3-4	4,00	4,80	1400	1680	14,70	8,91	5,17	81,0	0,80	27,29	6,0	2,5	2,7	0,00755	29,1
MS	112	M-4	4,00	4,80	1440	1728	14,60	8,63	5,10	84,5	0,80	26,53	6,2	2,5	3,2	0,01064	35,0
MS *	112	M2-4	5,50	6,60	1410	1692	20,70	11,90	6,90	84,0	0,81	37,25	7,0	2,7	3,0	0,01675	36,7
MS	132	S-4	5,50	6,60	1450	1740	19,00	10,90	6,32	85,8	0,85	36,22	5,6	2,0	2,6	0,02818	50,5
MS	132	M-4	7,50	9,00	1450	1740	24,80	14,30	8,30	87,1	0,86	49,39	6,2	2,0	2,8	0,02833	59,5
MS *	132	M2-4	9,20	11,00	1470	1764	30,30	17,50	10,14	88,0	0,83	59,77	7,0	2,2	2,5	0,03110	61,5
MS *	132	M3-4	11,00	13,20	1470	1764	37,10	21,40	12,40	88,0	0,85	71,46	7,5	2,2	2,7	0,03870	67,0

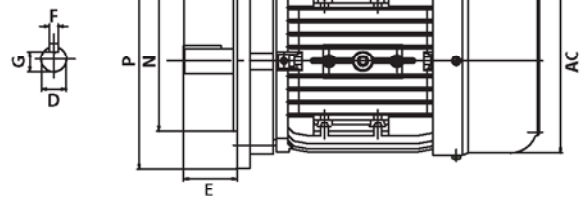
* Motorer med forhøjet effekt ** Motors with high power / Small frame*

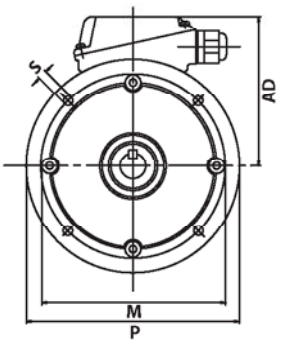
B3



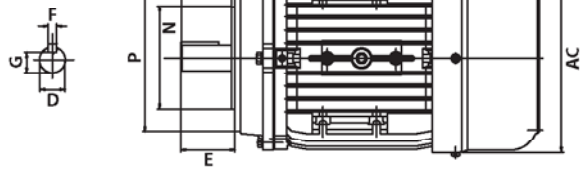


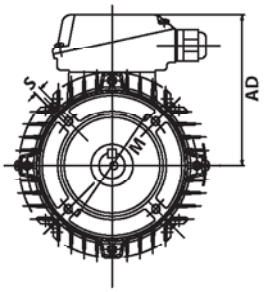
B5





B14





Bygge-størrelse / Motor size	Dimensions (mm)																						Frame Dimensions			
	Generel Data									B14					B5											
	A	B	C	D	E	F	G	H	K	M	N	P	S	T	M	N	P	S	T	AB	AC	AD	L			
	mm																									
56	90	71	36	9j6	20	3	7,2	56	5,8	65	50	80	M5	2,5	98	80	120	7	3,0	110	120	110	195			
63	100	80	40	11j6	23	4	8,5	63	7,0	75	60	90	M5	2,5	115	95	140	10	3,0	130	130	115	230			
71	112	90	45	14j6	30	5	11	71	7,0	85	70	105	M6	2,5	130	110	160	10	3,5	145	145	125	255			
80	125	100	50	19j6	40	6	15,5	80	10	100	80	120	M6	3,0	165	130	200	12	3,5	160	165	135	295			
90S	140	100	56	24j6	50	8	20	90	10	115	95	140	M8	3,0	165	130	200	12	3,5	180	185	145	335			
90L	140	125	56	24j6	50	8	20	90	10	115	95	140	M8	3,0	165	130	200	12	3,5	180	185	145	360			
100L	160	140	63	28j6	60	8	24	100	12	130	110	160	M8	3,5	215	180	250	12	4,0	205	215	170	380			
112M	190	140	70	28j6	60	8	24	112	12	130	110	160	M8	3,5	215	180	250	15	4,0	245	240	180	400			
132S	216	140	89	38k6	80	10	33	132	12	165	130	200	M10	4,0	265	230	300	15	4,0	280	275	195	475			
132M	216	178	89	38k6	80	10	33	132	12	165	130	200	M10	4,0	265	230	300	15	4,0	280	275	195	515			

Type:

- Pressure switch
- KPS 37

Application:

The units are pressure-controlled switches. The pressure controls are suitable for use in alarm and regulation system.

Enclosure:

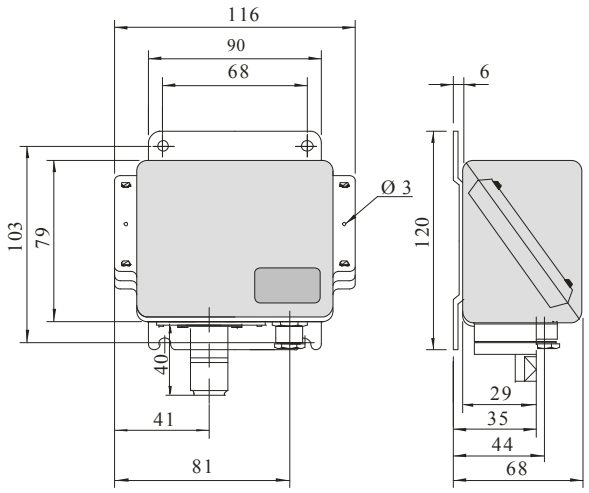
- IP 67 to IEC 529 and DIN 40050.
- The pressure control housing is enamelled pressure die cast aluminium (GD-AlSi 12). The cover is fastened by four screws which are anchored to prevent loss.
  The enclosure can be sealed with fuse wire.

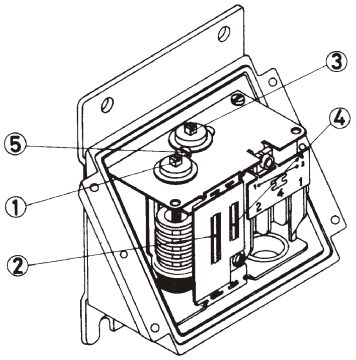
Adjustment:

- When the pressure control cover is removed, and the locking screw (5) is loosened, the range can be set with the spindle (1) while at the same time the scale (2) is being read. In units having an adjustable differential, the spindle (3) must be used to make the adjustment. The differential obtained can be read direct on the scales (4).
- To ensure that the plant functions properly, a suitable differential pressure is necessary. Too small a differential will give rise to short running periods with a risk of hunting. Too high a differential will result in large pressure oscillations.

Technical data:

Operating pressure: 6 - 18 bar
Differential: 0.75 - 2.5 bar
Test pressure: 27 bar
Pressure connection: G 3/8 -m
Cable entry: Pg 13.5 for cable diameters 5 to 14 mm.
Weight: 1 kg





1 Range spindle
2 Range scale
3 Differential spindle
4 Differential scale
5 Locking screw

Type No.: 8030 Version: B.1	**Danfoss, range 6-18 bar, connection G 3/8"-m**	**6310330**

Pressure controls, type RT

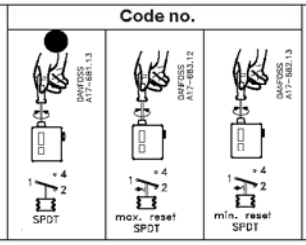
Technical data and code nos.

The designation letters mean:
A: Units suitable for the medium ammonia.
W: Units for control purposes.

B: Safety units with external reset

S: Safety units with internal reset

Pressure controls for steam plant, approved by Vd TÜV

Regulation range (p_e-effektive pressure bar	Adjustable/ fixed mechanical differential bar	Max. operating pressure PB bar	Max. test pressure p' bar	Pressure connection	Code no. 	Type
For rising pressure, approved acc. to PED						
0.1 –1.1	0.07	7	8	G ½A	**017-5282**	RT 112W
0 –2.5	0.1	7	8	G ½A	**017-5280**	RT 35W
1 –10	0.8	22	25	G ½A	**017-5187**	RT 30AW
1 –10	0.4	22	25	G ½A	**017-5188**	RT 30AB
1 –10	0.4	22	25	G ½A	**017-5189**	RT 30AS
5 –25	1.2	42	47	G ½A	**017-5181**	RT 19W
5 –25	1	42	47	G ½A	**017-5182**	RT 19B
5 –25	1	42	47	G ½A	**017-5183**	RT 19S

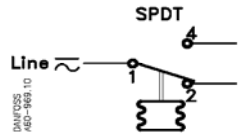
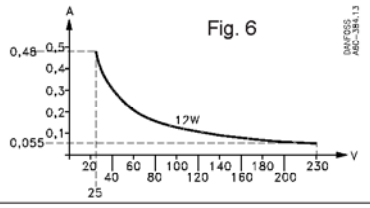
Approvals

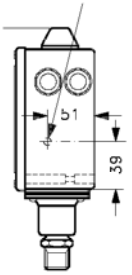
RT 1	RT1A RT 5A RT 121	RT 1AL	RT 5	RT 30AW RT 30AB RT 30AS RT 19W RT 19B RT 19S	RT 31W RT 31B RT 31S RT 32W RT 32B RT 32S	RT 33B RT 35W RT112W RT116W	RT 110	RT 112	RT 113	RT 116 RT 117 RT 200	RT 117L RT 200L	RT 260A RT 262A RT 265A RT 260AL RT 262AL RT 263AL RT 266AL	Approvals
x	x	x	x	x	x	x	x	x	x	x	x	x	DEMKO, Denmark. CE marked acc. to EN 60947-4/-5
				x	x	x		x					Vd TÜV, Germany
							x	x	x	x			Det Norske Veritas, Norway
			x				x	x		x			Lloyds Register of Shipping, UK
x			x	x			x	x		x			Germanischer Lloyd, Germany
			x				x	x	x	x			Bureau Veritas, France
x	x	x	x	x	x	x	x	x	x	x	x	x	Registro Italiano Navale, Italy
x	x		x				x	x	x	x			Polski Rejestr Statków, Poland
x	x	x	x	x	x	x	x	x	x	x	x	x	RMRS, Russian Maritime Register of Shipping,
x	x		x				x	x	x	x			Nippon Kaiji Kyokai, Japan

Note: In addition we refer to the certificates, the copies of which can be ordered from Danfoss.

All RT are
- CE marked in accordance with EN 60947-4/-5 for sale in Europe
- Further, the RT 19, RT 30, RT 35, and RT 112 series is CE marked in accordance with PED 97/23/EC, category IV, safety equipment.

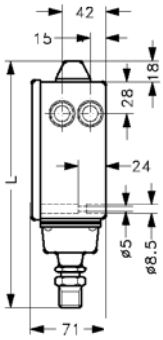
Technical data

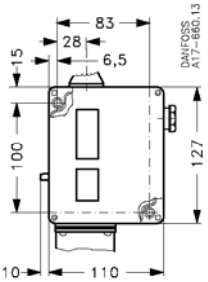
Designation	RT pressure controls
Ambient temperature	In general –50 to 70°C Vd TÜV-appoved –40 to +70°C
Contact system	 Single-pole changeover switch (SPDT)
Contact load Contact material: AgCdO	**Alternating current:** AC-1: 10A, 400 V AC-3: 4A, 400 V AC-15: 3A, 400 V **Direct current:** DC-13: 12 W, 230 V (see fig. 6)  Fig. 6
Cable entry	2 PG 13.5 for 6 - 14 mm diameter cables
Enclosure	IP66 acc. to IEC 529 and DIN 40050. Units supplied with external reset IP54. The thermostat housing is made of bakelite acc. to DIN 53470. Cover is made of polyamide.



A : External reset knob only for RT...B

RT 30 AW, -B, -S	L=225
RT 19 W, -B, -S	L=228
RT 33 B, 35W	L=221
RT 112 W	L=210
RT 116 W	L=235
RT 31 W-B,-S	L=212
RT 32 W-B, -S	L=212





Weight: approx. 1 kg

Materials in contact with the medium. Vd-TÜV approved controls

Material	Part	W.no.	DIN	RT 19W B,S	RT 30AW AB, AS	RT 31W B, S	RT 32W B, S	RT 33B 35W	RT 112 W	RT 112	RT 116W
Stainless steel 18/8	Bellows	1.4301	17440	x	x	x	x	x	x	x	x
Stainless steel 17/7	Orifice	1.4305	17440	x	x						
Steel C15	Connector	1.0401	1652	x	x						
Deep-drawn steel + Ni	Bellows ring	1.0338	1623	x	x	x	x	x	x		
Stainless steel 17/7	Bellows spring	1.4568	17224		x			x			
Stainless steel	Ring	1.4305	17440		x						
Deep-drawn steel + Ni	Housing	1.0338	1623	x	x	x	x	x	x		
Stainless steel	Bellows connect.	1.4305	17440			x					
Stainless, weldable free-cutting steel	Connector	1.4301	17440			x	x	x	x		x
Deep-drawn steel + Sn	Spring guide	1.0338	1623					x			
Brass	Housing	2.0402	17660							x	x
Brass	Bellows ring	2.0321	17660							x	x

Type:

- Pressure transmitter
- MBS 5100

Size:

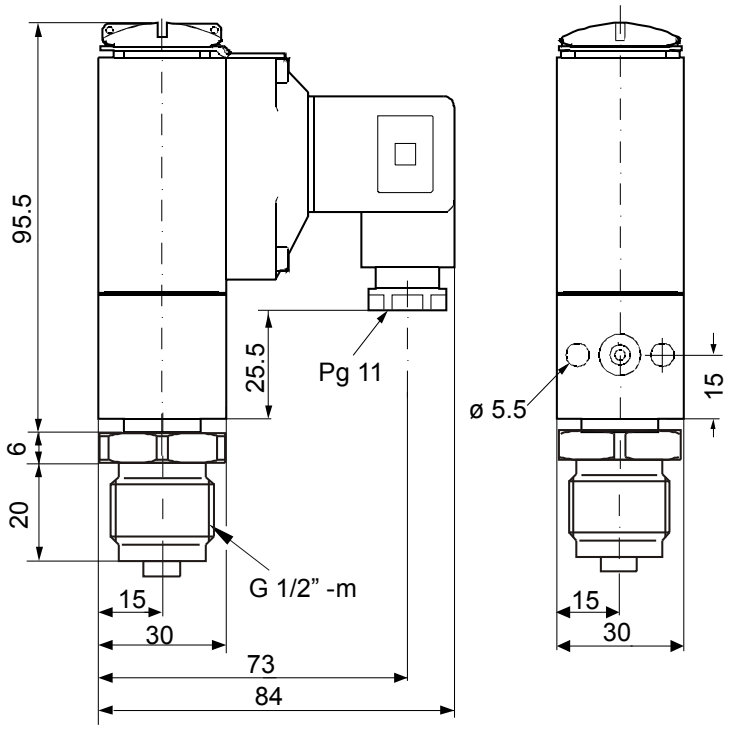
- 0 - 16 bar

Application:

- The pressure transmitter converts pressure to an electric signal. This is proportional to, and linear with, the value of the pressure to which the pressure-sensitive element is subjected by the medium. The units are supplied as two wire transmitters with an output signal of 4-20 mA. The transmitters have a zero-point displacement facility for equalizing static pressure.
  Span adjustment is also possible.

Material:

- Housing material: Anodized AlMgSiPb



Type No.: 8010 Version: A.2	**Pressure transmitter 0 - 16 bar**	**6638232**

Technical data:

Performance:

- Accuracy (incl. non-linearity, hysteresis and repeatability): ±0.1% fs (typ.) / ±0.3% FS (max.)
- Non-linearity (best fit straight line): < ±. 2% FS
- Hysteresis and repeatability: ≤ ±0.1% FS
- Thermal zero point shift: ≤ ±0.1% FS/ 10K (typ.) / ≤ ±0.2% FS/10K (max.)
- Thermal sensitivity (span) shift: ≤ ±0.01% FS/K (typ.) / ≤ ±0.02% FS/K (max.)
- Response time: < 4 rms

Electrical specification:

- Rated output signal: 4 to 20 mA
- Supply voltage, V_{supply} (polarity protected): 10 to 32 V d.c.
- Voltage dependency: < 0.01% FS/V
- Current limitation (linear output signal up to 1.5 x nom range): 28 mA (typ.)
- Max. load R_L: $R_L \leq [(Vsupply - 10V)/ 0.02A] - 10\ \Omega$

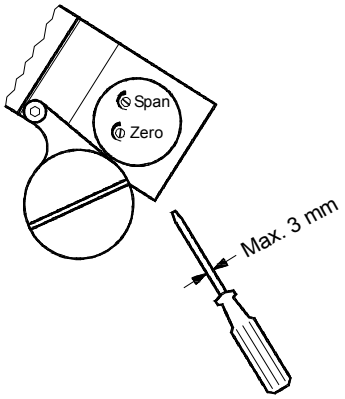
Mechanical:

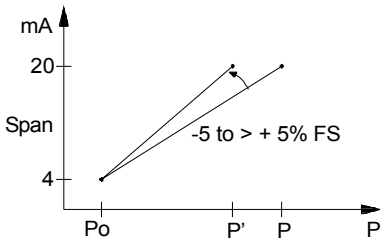
- Connection: G 1/2" –m (EN 837-1-G ½ A)
- Max. operating pressure: 50 bar
- Min. burst pressure: 100 bar
- Operating temperature range: - 40 to 85°C
- Compensated temperature range: 0 to 80°C
- Transport temperature range: - 50 to 85°C
- Cable entry: PG 11
- Enclosure: IP 65
- Weight: 0.4 kg

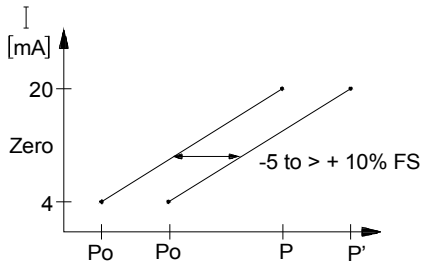
Installation:

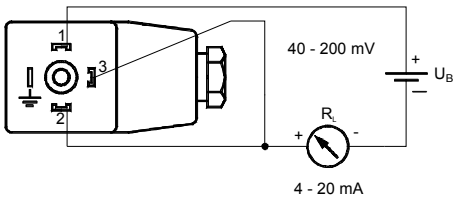
- There are facilities for adjusting zero point and span.
  Zero point adjustments is necessary to equalise pressure arising from any differences in level between the pressure transmitter and the medium being measured.

Zero point adjustment results in a parallel displacement of span.
Both zero point and span must be adjusted on the side of the unit with cover removed









1. Supply +
2. Supply -
3. Function test

⏚ Connected to MBS transmitter enclosure

Type No.: 8010 **Version: A.2**	**Pressure transmitter 0 - 16 bar**	**6638232**

Type:

- Instrument stop needle valve, straight

Size:

- 3/8" BSP
- Nominal diameter: DN 10

Application:

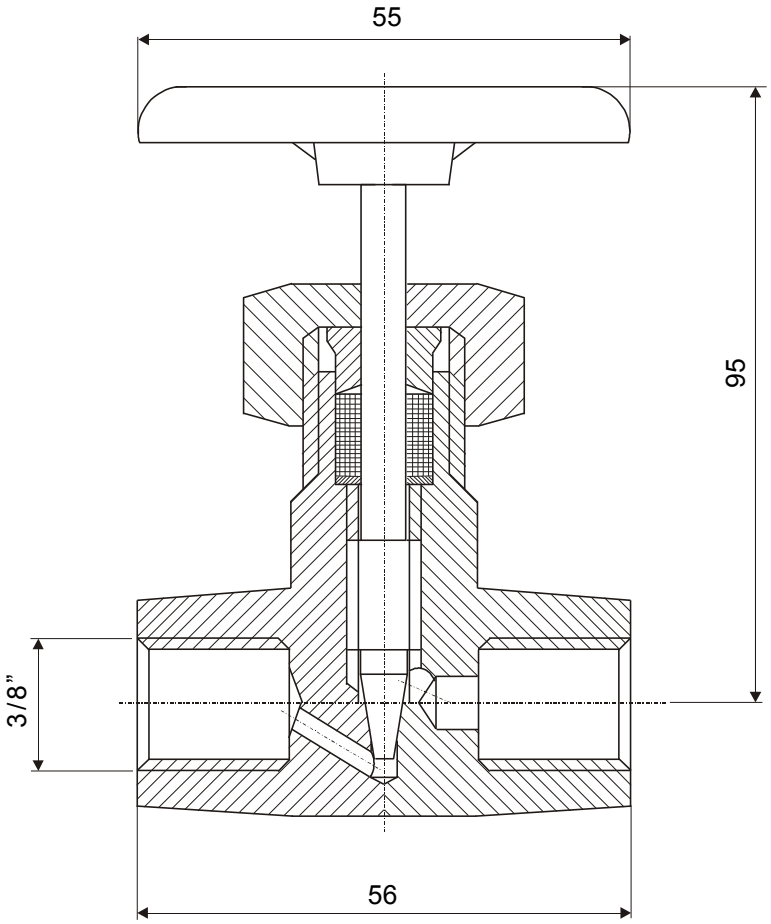
- For steam, water and/or air

Material:

- Body: brass
- Spindle: brass
- Packing: PTFE
- Hand wheel: steel

Technical data:

- Nominal pressure: PN 100
- Working pressure: 25 bar
- Weight: 0.32 kg
-



Type No.: 6220 Version: A.2	**Instrument stop valve, straight, DN 10, PN 100**	**2573307**

Type

- Filter
- 23.050

Size:

- Nominal diameter: DN 15

Application

- For mechanical cleaning of different medias in tube systems before control valves, reduction valves, pumps, steam traps and flow meters

Material:

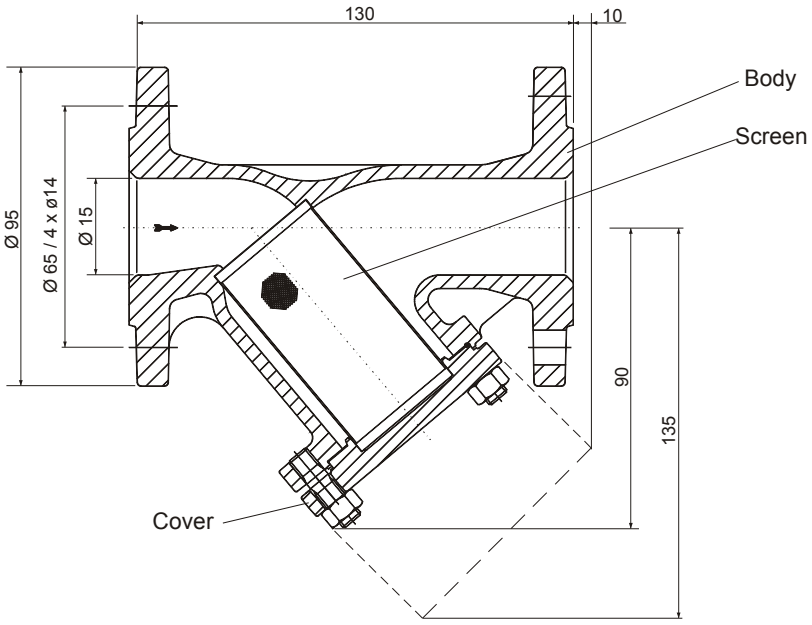
- Body: GGG-40.3
  Din-Material No. 0.07043
- Cover: GGG-40.3
  Din-Material No. 0.07043
- Screen: X 5 CrNi 18-9
  Din-Material No. 1.4301

Technical data:

- Nominal pressure: PN 25
- Filtration: 1.0
- Flange according to DIN
- Weight: 3.5 kg

Installation:

- The filter can be mounted in optional positions with the flow following the direction of the arrow.
  For steam installations the filter basket should be installed horizontally with the flow following the direction of the arrow.



Type No.: 7040 **Version: A.2**	**Filter, DN 15, PN 25**	**7040000041**

Type:

- Safety valve
- 67.963

Size:

- Nominal diameter: DN 15

Application:

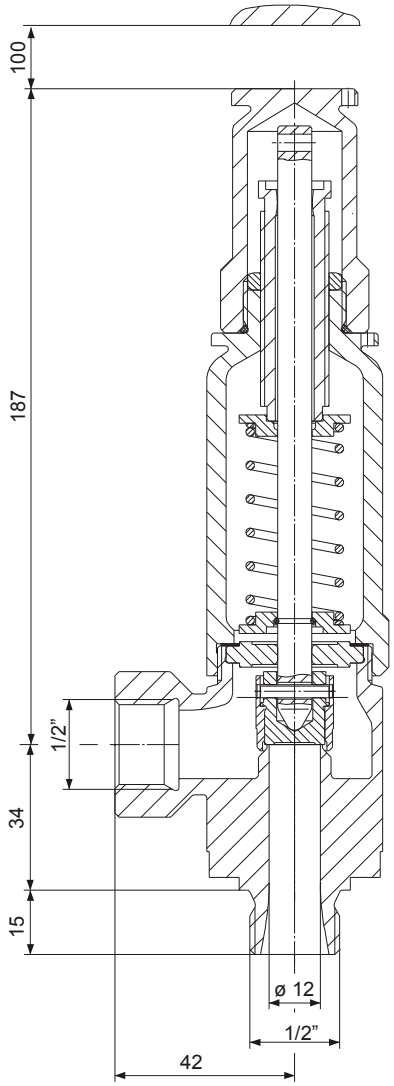
- To blow off steam, neutral gases, vapours and liquids

Material:

- Body: GGG 40.3
- DIN-material No.: 1.4581

Technical data:

- Nominal pressure: PN 100
- Thread: DIN ISO 228 part 1
- Set point:10 bar
- Weight: 1.2 kg



Type No.: 6040 **Version: A.2**	**Safety valve, DN 15, PN 100**	**87S0032**

Type:

- Stop valve, ball straight

Size:

- DN 15

Application:

- For water, compressed air and oil

Material:

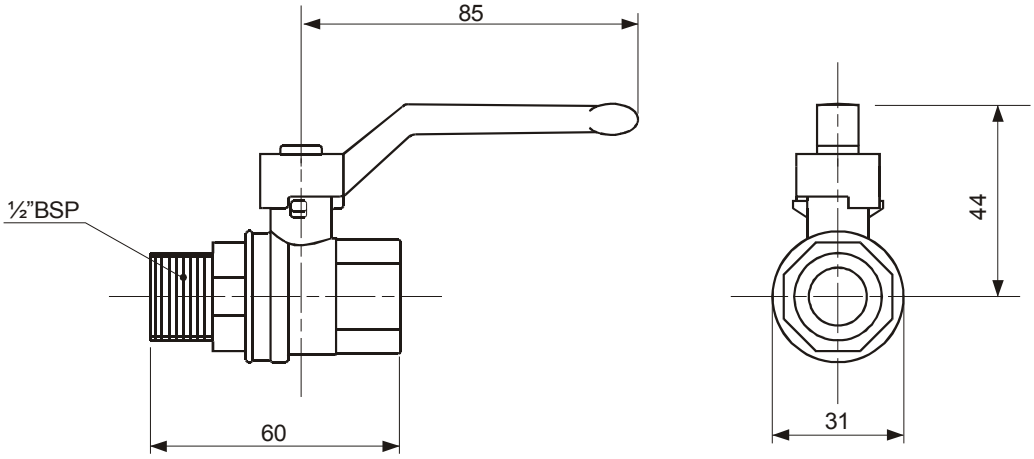
- Body: Nickel-plated brass (MS 8)
- Ball: Hard chromium plating brass (MS 8)
- Stem: Brass (MS 8)
- Stem nut: Galvanized steel
- Seat rings: Teflon (PTFE)
- Stem gasket: Teflon (PTFE)

Technical data:

Max. workingpressure at 80°C: PN 40

Max. working pressure at 150°C: PN 10

Weight: 0.18 kg



Type No.: 6010 **Version: A.2**	**Stop valve, ball straight, DN 15, PN 40**	**6666106**

Type:

- Temperature transmitter
- PT 100 element with transmitter and pocket

Size:

- Ø 4/8 x 150

Range:

- 0 – 160°C

Application:

- For measuring temperatures in gases, vapours and fluids

Material:

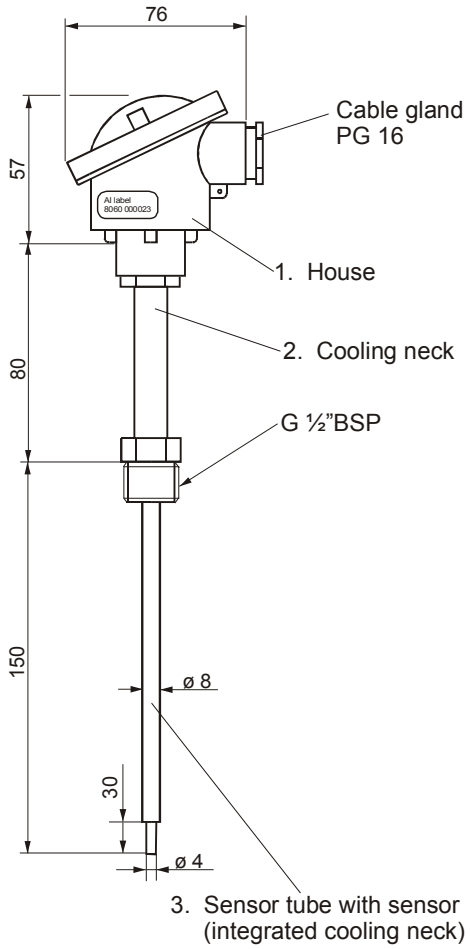
- Stainless steel

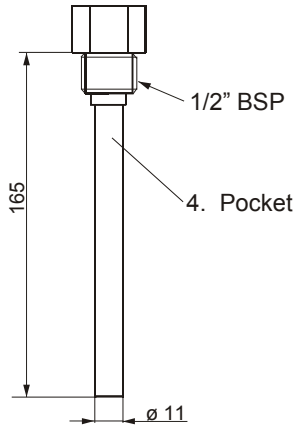
Technical data for temperature sensor:

- Housing: Form B, DIN 43729
- Connection at instrument: G 1/2" BSP
- Protection: IP65
- Cable gland: PG 16
- Response time (mean values) measured at velocities in water w. 0.4 m/s: $\tau 0.5 = 2$ sec.
- Response time (mean values) measured at velocities in air w. 3.0 m/s: $\tau 0.5 = 24$ sec.
- Recommended measuring current: max. 2 mA
- Prepared for conductors transmitter: 3
- Number of elements: 1 x PT 100
- Tolerance class, DIN C1.B: ± 0.3°C
- Resistance in · at 0°C: 100

Installation:

- The temperature transmitter is delivered with 5 g zinc compound which must be sprayed in the pocket by means of the single-use syringe.





Type No.:8060 Version: A.2	**Temperature transmitter**	**8060000023**

Technical data for transmitter:

- Type: 5333B
- Signal span: 4 – 20 mA
- Internal wiring: 3 wire sensor
- Ambient temperature: -40°C to + 85°C
- Supply voltage: 8.0 to 30 V_{DC}
- Internal consumption: 25 mW to 0.8 W
- Voltage drop: 8 V_{DC}
- Warm-up time: 5 min.
- Communications interface: Loop link
- Signal / noise ratio: Min. 60 dB
- Response time (programmable): 0.33 to 60 s
- Signal dynamics, input: 19 bit
- Signal dynamics, output: 16 bit
- Calibration temperature: 20 to 28°C
- Absolute accuracy: ≤ ±0.1% of span
- Temperature coefficient: ≤ ± 0.01% of span / °C
- Basic accuracy: ≤ ±0.3°C
- Basic temperature coefficient: ≤ ±0.01°C / °C
- EMC immunity influence: ≤ ±0.5% of span
- Effect of supply voltage variation: ≤ 0.005 % of span / V_{DC}
- Vibration: IEC 60068-2-6 test FC
- Max. standard wire size: 1 x 1.5 mm²
- Humidity: < 95% RH, (non cond.)
- Tightness (enclosure / terminal: IP68 / IP00

Input:

- Linear resistance min. value: -200°C
- Linear resistance max. value: +850°C
- Linear resistance min. span: 25°C
- Max. offset: 50% of selection max. value
- Cable resistance per wire: Max 10 Ω
- Sensor current: > 0.2 mA, < 0.4 mA
- Effect of sensor cable resistance (3-wire) < 0.002 Ω/ Ω

Current output:

- Signal range: 4 – 20 mA
- Min. signal range: 16 mA
- Updating time: 135 ms
- Load resistance: ≤ (V_{supply}- 8) / 0.023 [Ω]
- Load stability: < ±0.01% of span/100 Ω

Sensor error detection:

- Programmable: 3.5 to 23 mA
- NAMUR NE43 upscale: 23 mA
- NAMUR NE43 downscale: 3.5 mA

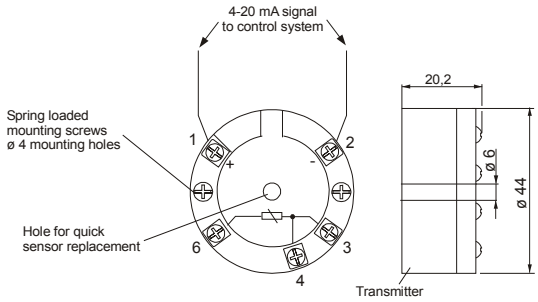
Ex/I.S. data:

- Signal output / supply, terminal 1 and 2
  U_i: 30 V_{DC}
  I_i: 120 mA_{DC}
  P_i: 0.84 W
  L_i: 10 µH
  C_i: 1.0 nF

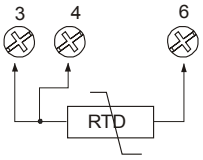
EEx / I.S. approval:

- KEMA 03ATEX1535X: Ex II 1 GD, T80°C to T105°C
  EEx ia IIC T6 /T4
- Max. ambient temperature for T1 to T4: 85°C
- Max. ambient temperature for T5 and T6: 60°C
- ATEX, applicable in zone: 0, 1,2, 20, 21 or 22
- FM,application in: IS, CI, I, DIV. 1, Gr. A, B, C, D
  IS, CI, I Zone 0, AEx ia IIC

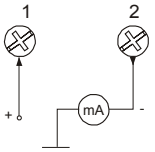
Type No.:8060 **Version: A.2**	**Temperature transmitter**	**8060000023**



Input:
RTD, 3-wire



Output:
2-wire installation



Type No.:8060 **Version: A.2**	**Temperature transmitter**	**8060000023**

AALBORG INDUSTRIES

DATA SHEET

Type:

- Three-way valve, ball
- LB 283 BW, reduced bore

Size:

- DN 32

Application:

- For air, steam, or oil flow

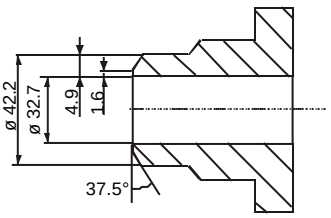
Material

- Body: ASTM A105
- End connections: ASTM A105

Technical data:

- Min./max. temperature at 30 bar:
  - 29°C to + 230°C
- End connections: Butt weld according to ASME/ANSI B16.25 - XS-80
- Pipe size: DN 32
- Weight: 7 kg

Detail A



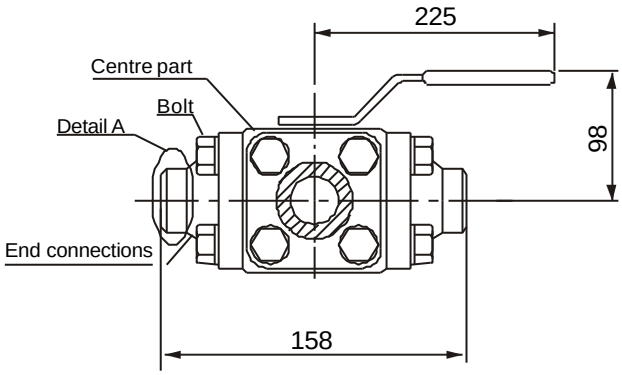
Installation:

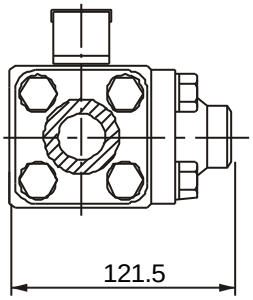
Information and caution before installation of the valve:

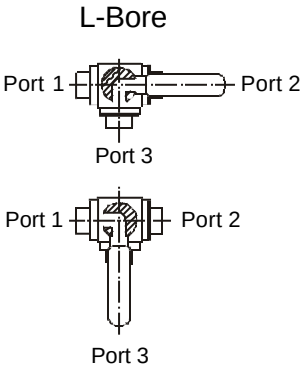
- Pipe must be free of tension.
- Pipe must be flushed to clean the dirt, burrs calamines, welding residues etc. which would damage the ball and seat.
- The valve must be kept in open position during installation. Protective plastic covers must not be removed before the installation work commences.
- At the moment of the shipment the ball is lubricated with a pure vaseline oil, which can be easily removed with a solvent, if required.
- Ball valves normally have a space between ball and inside cavity of the body, which could trap the product, care should be taken to drain the cavity.

Instruction for welding the valve on the pipe line:

- Tack weld in four points on both end-connections.
- Lift out the centre part to protect the gaskets against damage and complete the welding.
- Insert the centre part and ensure easy operation.







Type No.: 6070 **Version: A**	**Three-way valve, ball DN 32**	**87D3073**

EGO SWITCHBOX
TYPE M

Description:

EGO switchbox with integrated mikroswitches to be used for remote as well as visual indication of valve position The switchbox include bracket for mounting on a pneumatic actuator. With use of a special bracket the box can be mounted on a gearbox or directly on a valve.



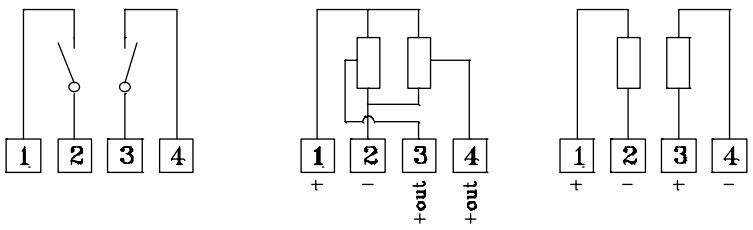


Specifikations	
Bus	Polycarbonat
Aksel	POM
Kamskive	Nylon
Bundplade	Pertimax
Kamhoved	Messing
Tætningsgrad	IP 65
Indikator	POM
O-rings tætning	Viton

EGO SWITCHBOX
TYPE M

Teknisk data:			
	EGO BOX M	EGO BOX I	EGO BOX N
Kontakt antal	1 + 1	1 + 1	1 + 1
Kontakttype	Mikroswitch	PNP induktiv	Namur
Fabrikat	Honeywell	Honeywell	Pepperl + Fuchs
Type	V5C010TB1C	992FS2-A9PV3-L	NJ2-V3-N-V5
Spænding	max. 250 VAC	9,6 - 50 VDC	8 VDC
Forbrug	-	≤ 10 mA	-
Max. belastning	10 (3) A	200 mA	-
Max. frekvens	-	2 KHz	1 KHz
Ambient temperatur	÷ 55°C til +85°C	÷ 25°C til +75°C	÷ 25°C til +100°C
Dimensioner LxBxH	82x80x67	82x80x67	82x80x67

CONNECTION DIAGRAM



Microswitch Inductiv Namur

EGO Box		DWG NO: 04.98.06-EGO BOX	
DRAWING BY	DRAWING DATE 06-04-1998	APPROVED BY	APPROVED DATE

Type:

- Safety valve
- 67.963

Size:

- Nominal diameter: DN 15

Application:

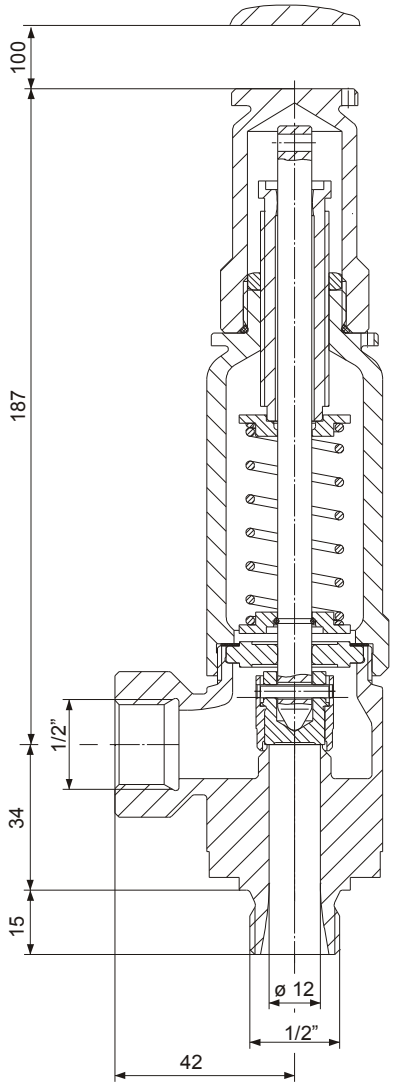
- To blow off steam, neutral gases, vapours and liquids

Material:

- Body: GGG 40.3
- DIN-material No.: 1.4581

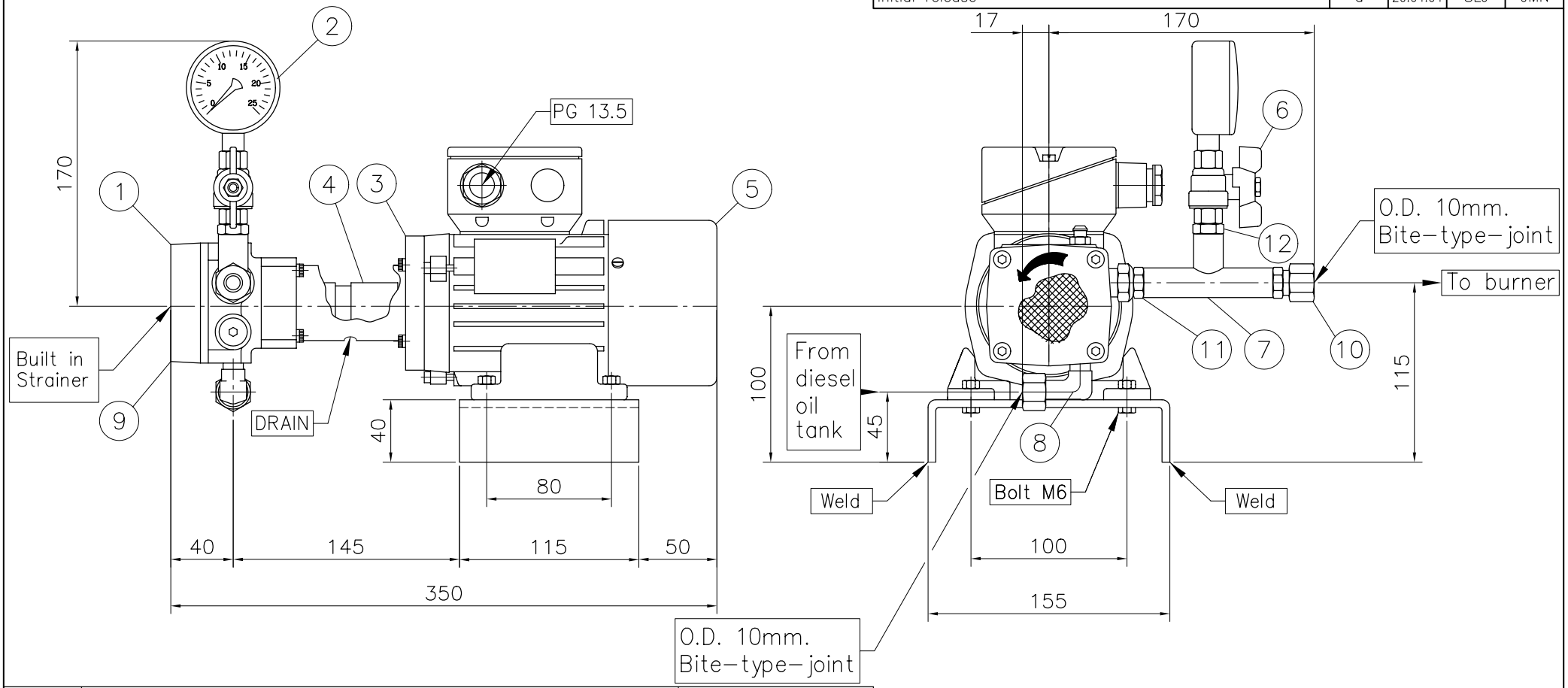
Technical data:

- Nominal pressure: PN 100
- Thread: DIN ISO 228 part 1
- Set point:16 bar
- Weight: 1.2 kg



Type No.: 6040 **Version: A.2**	**Safety valve, DN 15, PN 100**	**87S0031**

Description	Index	Date	Drawn	Appr.
Initial release	a	20.04.04	SLJ	JMN



ITEM	OBJECT	PART NO.
12	HEXAGON NIPPLE	6638104
11	HEXAGON NIPPLE	6638136
10	STRAIGHT MALE 10mm x 1/4"	6641089
9	STRAINER (INTERNAL)	
8	BEND – 10mm x 1/4"	6641069
7	TEE-PIECE	6638134
6	BALL VALVE	6666006
5	MOTOR 400/460 V – 50/60 Hz	6638133
4	COUPLING	6638132
3	CONNECTION	6638131
2	MANOMETER 0–25 Bar \ Kg/cm2 \ 0–2,5 MPa	6633121
1	PUMP	6638130

Part no. 4800000063

Final colour : Munsell 7.5 BG 7/2

AALBORG INDUSTRIES

Plot Date:

Title:
FUEL OIL SUPPLY SYSTEM
STANDARD

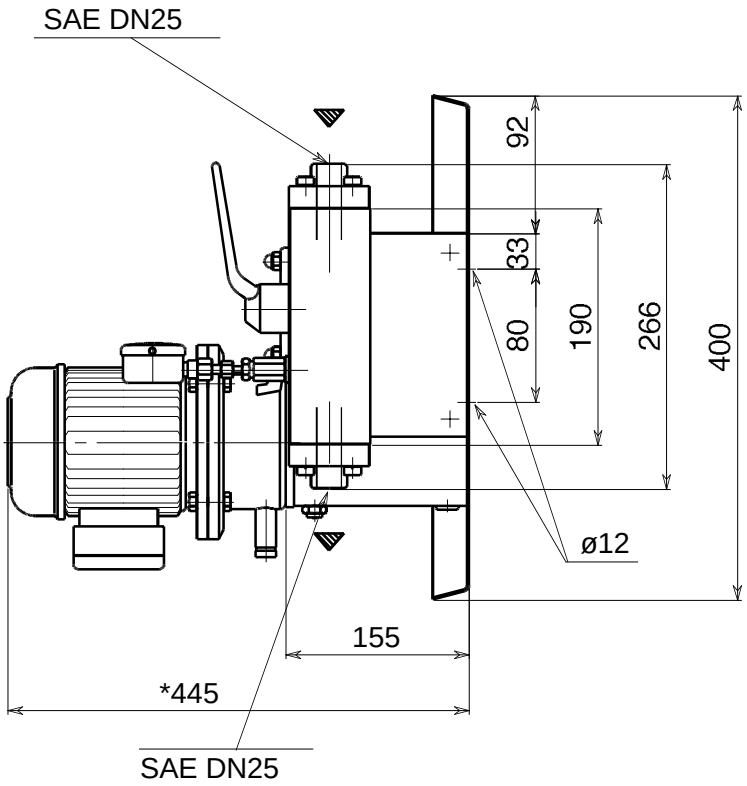
IGNITION OIL PUMP (G145)

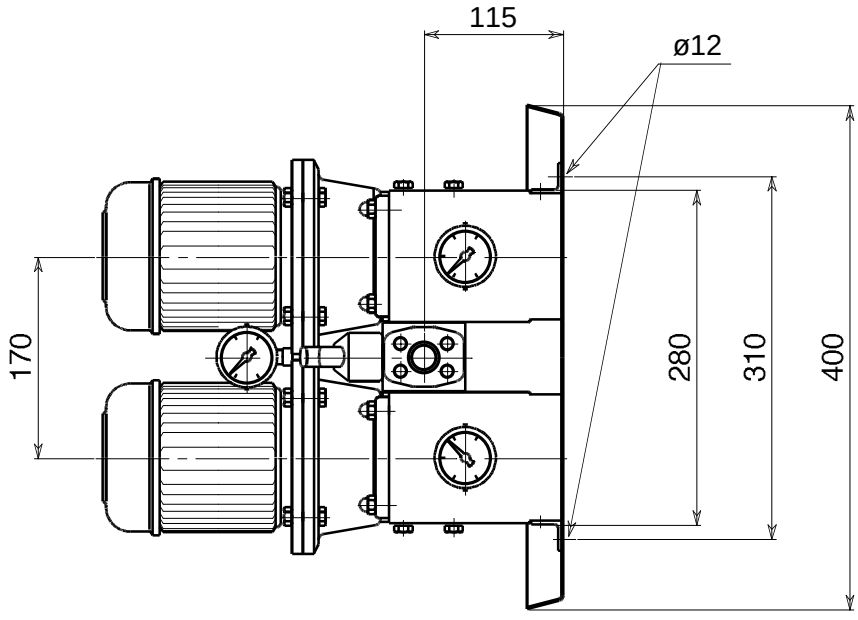
THIS DRAWING AND DESIGN SHOWN HEREIN IS THE PROPERTY OF AALBORG INDUSTRIES AND MUST NOT BE USED BY OR REPRODUCED FOR THIRD PARTY

Drawn	Date
SLJ	20.04.2004
Appr. JMN	Date 20.04.2004
Weight	Scale: 1:2.5 / Size A3
Article/Drawing No: 71Z:031258	Index a

	Schraubenspindelpumpe Screw-pump	Data sheets 5750 000724
		erstellt / made 07.03.03

Gewicht: ca.40kg





* depending on motor manufacturer

Type:

- Remote start/stop box

Application:

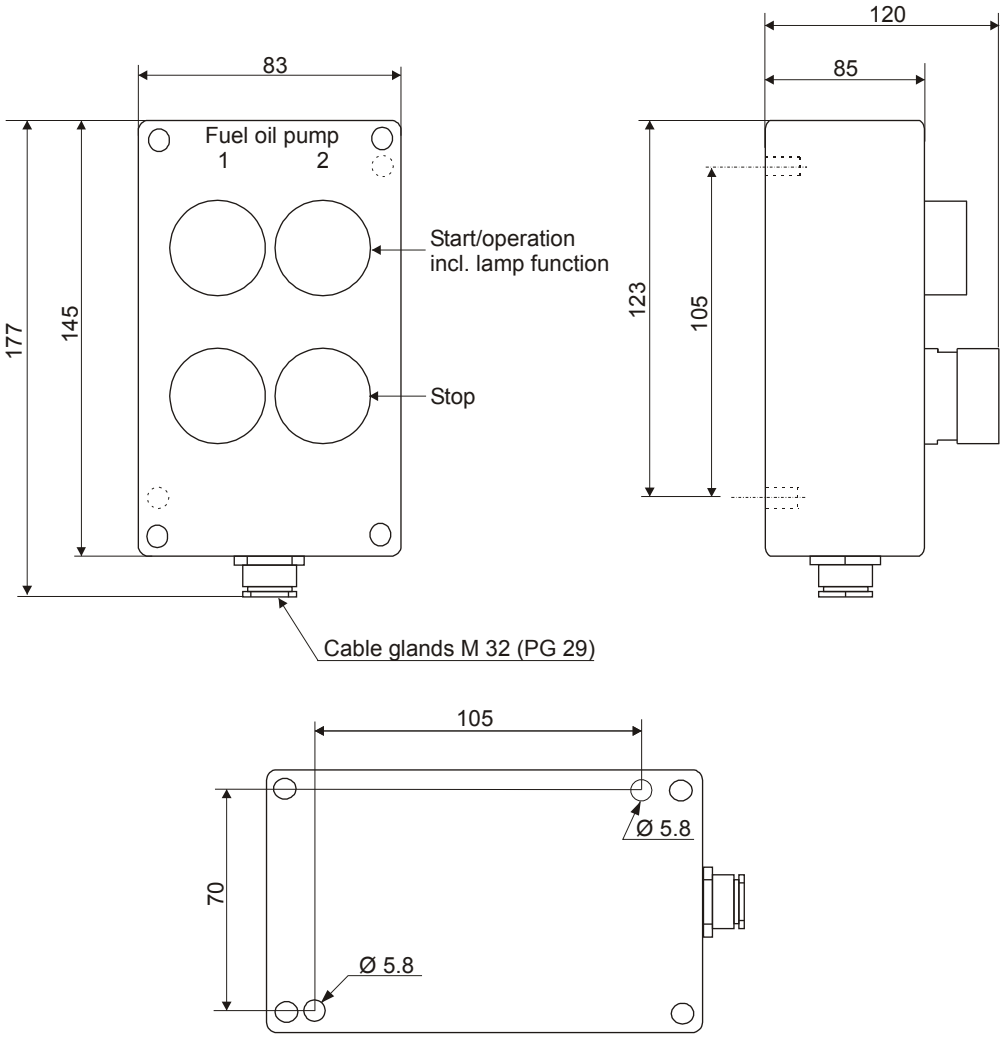
- For start/operation and stop of fuel oil pumps
-

Material:

- House: Polycarbonate
- Colour: Grey

Technical data:

- Nominal operating condition:
  U = 600 V and I = 1.2 A or
  U = 240 V and I = 3 A or
  U = 120 V and I = 6 A
- Protection: IP 65
- Temperature: -25°C to +70°C



Type No.: 8001 Version: B.1	Remote start/stop box	8001002002

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Proformance curves

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AALBORG INDUSTRIES

Performance Calculation

MISSION™ OS

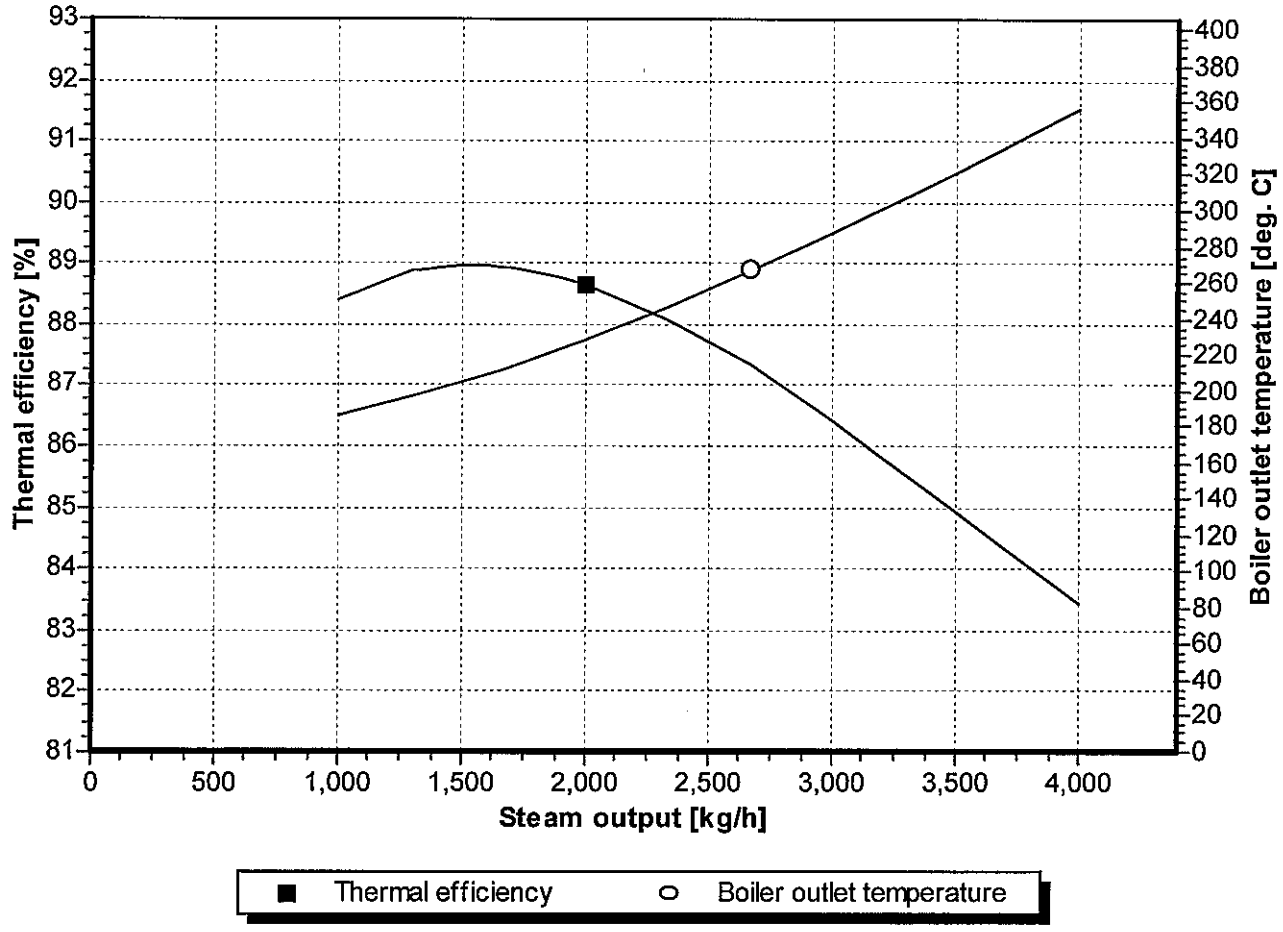
Standard Size: 4000 kg/h

Date: 12/09/2006

User Initials: slj

Project Name: Jiangnan Shipyard **Project no:** 051868

Fuel type	:	Heavy Fuel Oil	
Calorific value	:	40200	kJ/kg
Working pressure	:	7.0	bar g
Feed water temperature	:	60	deg. C



AALBORG INDUSTRIES

Performance Calculation

MISSION™ OS

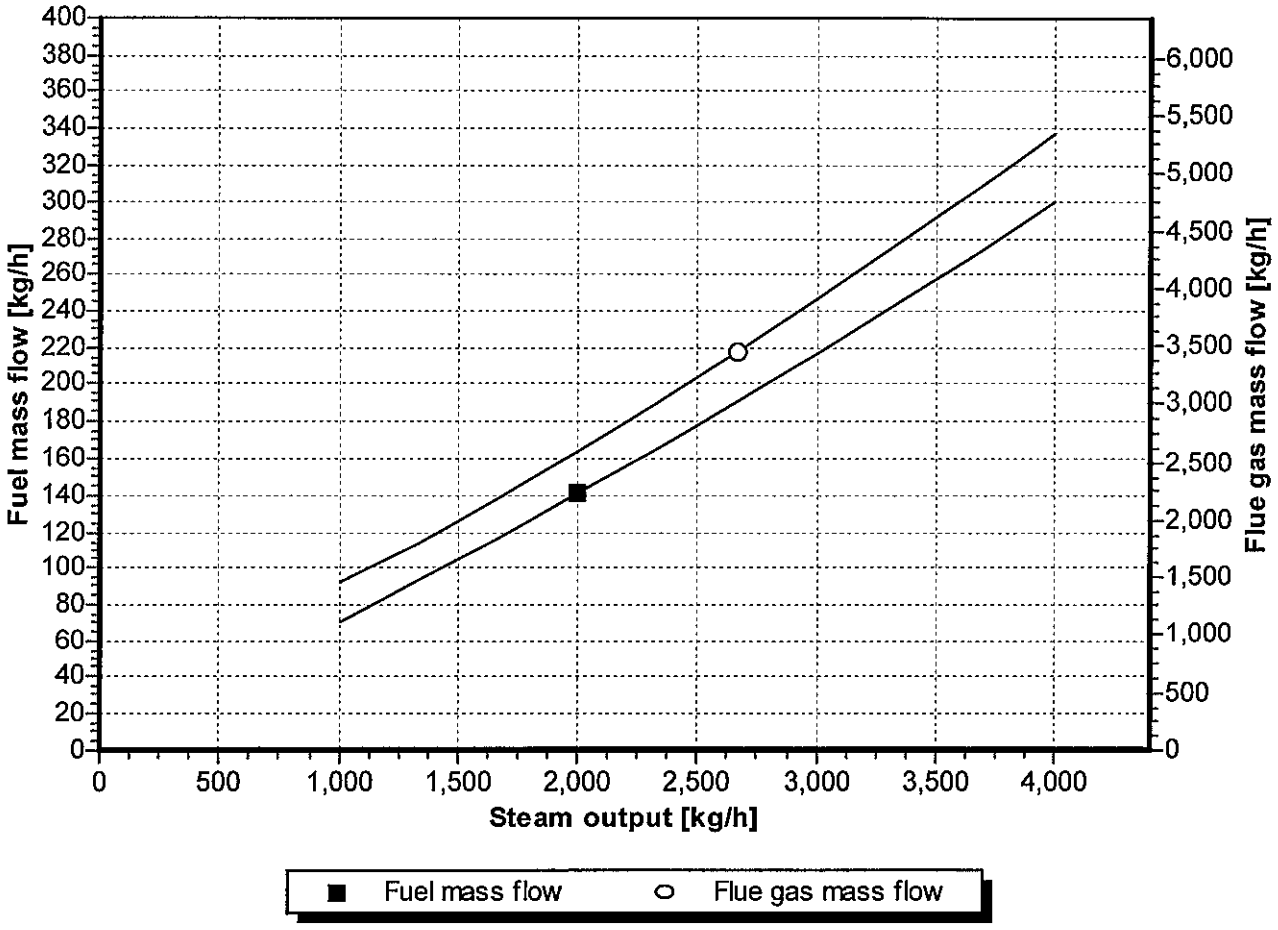
Standard Size: 4000 kg/h

Date: 12/09/2006

User Initials: slj

Project Name: Jiangnan Shipyard **Project no:** 051868

Fuel type	:	Heavy Fuel Oil	
Calorific value	:	40200	kJ/kg
Working pressure	:	7.0	bar g
Feed water temperature	:	60	deg. C



Version no.: 3.1

AALBORG INDUSTRIES

Performance Calculation

MISSION™ OS

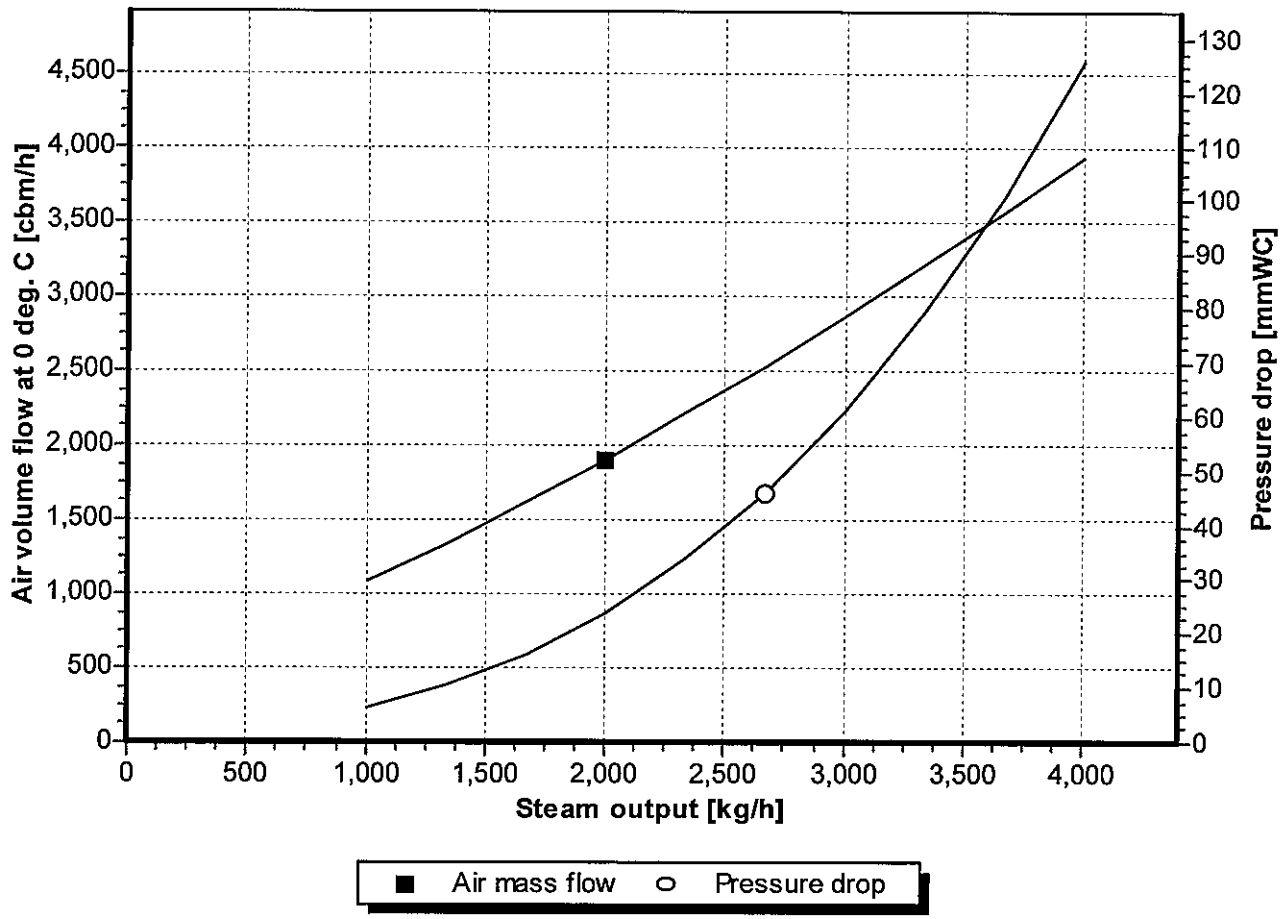
Standard Size: 4000 kg/h

Date: 12/09/2006

User Initials: slj

Project Name: Jiangnan Shipyard **Project no:** 051868

Fuel type	:	Heavy Fuel Oil	
Calorific value	:	40200	kJ/kg
Working pressure	:	7.0	bar g
Feed water temperature	:	60	deg. C



Performance Calculation

MISSION™ OS

Standard Size: 4000 kg/h

Date: 12/09/2006

User Initials: slj

Project Name: Jiangnan Shipyard **Project no:** 051868

Fuel type	:	Heavy Fuel Oil	
Calorific value	:	40200	kJ/kg
Working pressure	:	7.0	bar g
Feed water temperature	:	60	deg. C

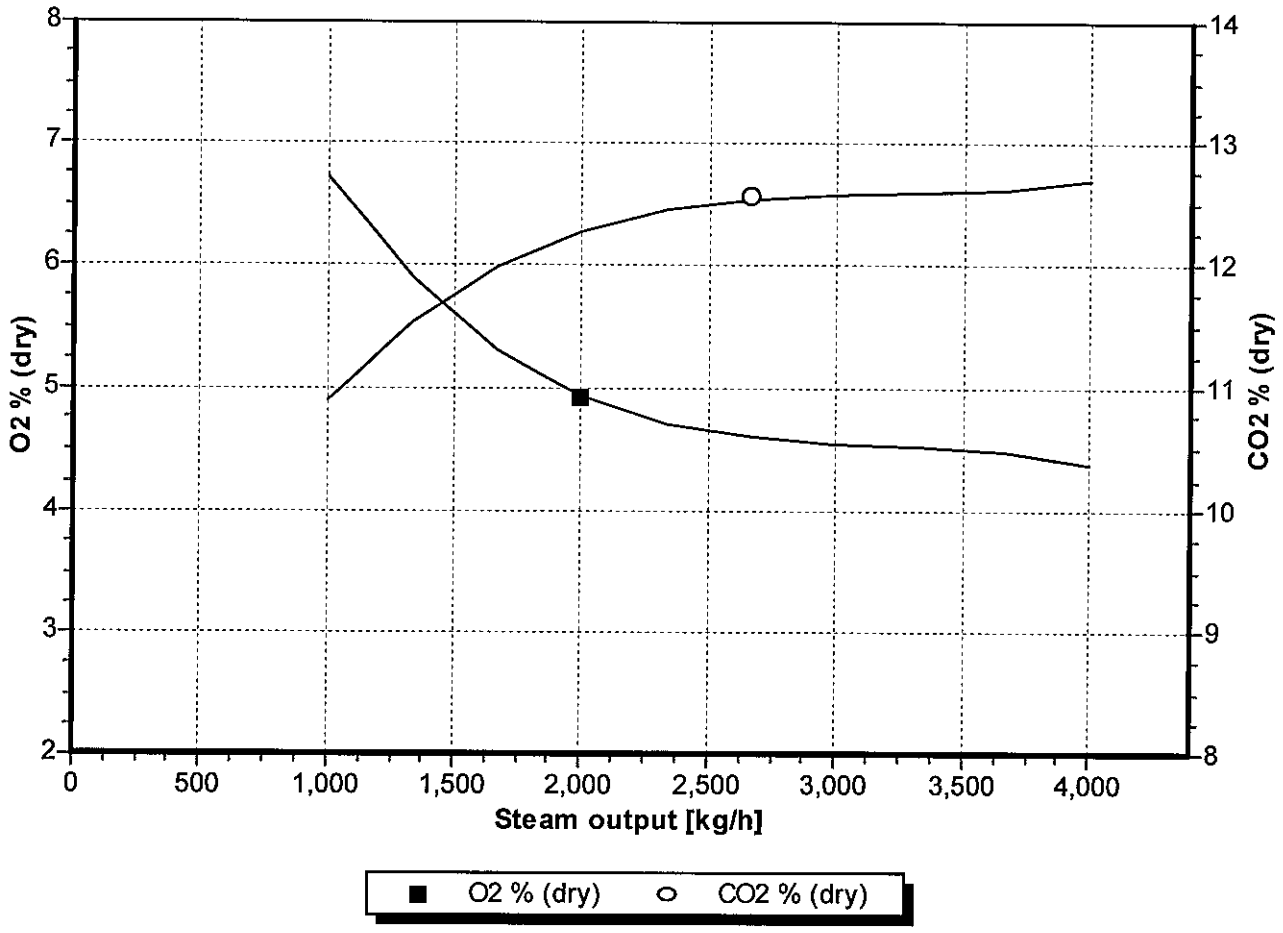


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MISSION™ XS-7V boiler

1 Description

The MISSION™ XS-7V boiler is a smoke tube exhaust gas boiler with forced water circulationused for heat recovery from engine exhaust gas. An illustration of the boiler is shown in Figure 1.The boiler is used in connection with one or more oil fired boilers which act as steam/water space. Water at saturation temperature is pumped from the oil fired boiler(s) into the exhaust gas boiler by the circulation pumps. In the boiler tubes, heat from the engine exhaust gas is transferred to the water side by convection. On the water side, the heat is transferred by evaporation of the saturated water adjacent to the tubes where steam bubbles are formed. The generated steam/water mixture is then discharged into the steam space of the oil fired boiler(s) where the heavier water particles separate from the steam.

The boiler is designed as a vertical boiler with a cylindrical shell surrounding the boiler tubes and water drum. The tubes consist of a large number of smoke tubes and a small number of stay tubes. The stay tubes with an increased diameter act as support for the boiler. Both types are welded onto the lower and upper tube plates.As the pressure part is made of mild carbon steel with elevated temperature properties stress concentrations in corner welding are minimised. In emergency mode the boiler can therefore be operated with low water level and even without water with the full exhaust gas flow through the boiler tubes, provided the boiler is operated depressurised and the inside temperature does not exceed 400˚C.

Illustration of the MISSION™ XS-7V boiler

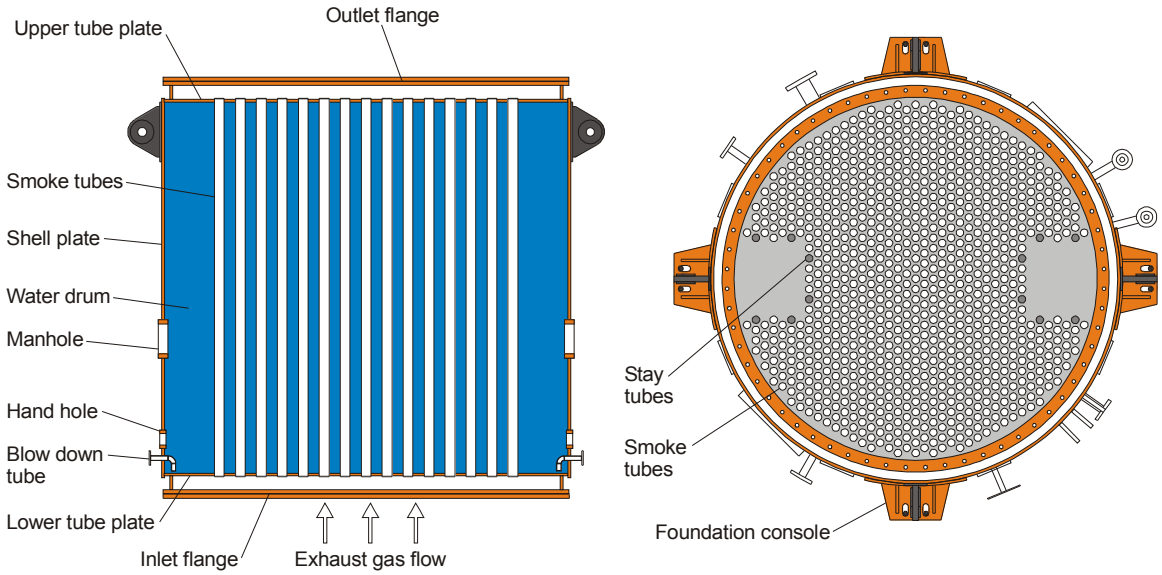


Figure 1 **sd9210_14_aqx0063800en.wmf**

For inside inspection, the MISSION™ XS-7V boiler is arranged with both hand holes and manholes. Two manholes are arranged at the lower end of the boiler shell for convenient access into the water drum. For visual check of the smoke tubes, a number of hand holes are arranged in a suitable distance at the bottom end of the boiler shell.

The boiler foundation consists of four foundation consoles giving the necessary support and absorption of the thermal expansion.

Finally, the heating surface dimensions of the boiler are designed to maintain a sufficient exhaust gas velocity giving the best self-cleaning effect within the design limits.However, after long term operation soot deposits can be accumulated inside the boiler tubes. The heating surface of the MISSION™ XS-7V boiler can be cleaned easily by means of water washing or by adding soot remover into the exhaust gas flow using compressed air.

Forced circulation system

The MISSION™ XS-7V boiler is designed for continuous forced circulation of water through the boiler. The forced circulation must be provided by at least two circulating pumps. One of the pumps must be kept in continuous operation (also in port) and the other pumps in automatic stand-by operation mode.

A circulation flow measurement control system must be installed to ensure a continuous water circulation. The system should in general consist of an orifice, differential pressure indicator switch, and reducing valve.The reducing valve and the orifice will protect the system by reducing the pump discharge flow variations resulting from different working conditions. The differential pressure indicator switch provides low circulating flow alarm and start of the stand-by pump.

Boiler mountings

1 Mountings

The following is a brief description of the most important items of the boiler mountings. The components mentioned in this section are referring to the general arrangement drawing of the boiler.

Safety valves

One or two safety valves are fitted to the pressure vessel of the boiler. They are installed for security reasons, and designed to prevent the boiler pressure from rising above the design value. The safety valves must be supplied with waste steam pipes and either expansion devices, or bellows.

Circulation valves

The circulation inlet and outlet valves are shut off valves. When closed, they isolate the boiler from the circulation pumps and steam space of the oil fired boiler(s) respectively.

Blow-down valves

Two blow-down valves are mounted at the bottom of the boiler body. If connected to a separate drainage system the valves are of the ball type. When connected to a common drainage system two valves are provided in each group, one shut-off valve and one shut-off/non-return valve. The shut-off function is for security and the non-return function prevents steam/water from flowing into an empty boiler by mistake.

Air valve

The air/ventilation valve located at top of the boiler body is a shut-off valve. It is normally closed except when the boiler is being filled or completely drained. The end of the drain pipe from the air valve must be visible in order to determine when air or steam is coming out.

Gauge board valve(s)

One or two gauge board valves are located on the boiler body and are of the shut-off type. The valves must always be opened during boiler operation.

Sample valve

A sample valve is installed enabling connection to a sample cooler for taking test samples to perform boiler water analyses.

Manholes

Two manholes are arranged on the boiler shell which allow inside inspection of the pressure vessel.

Hand holes

A number of hand holes are distributed regularly around the circumference of the boiler at the bottom end for visual check of the smoke tubes.

Inspection doors

The boiler is or must be provided with an inspection door in both the exhaust gas inlet and outlet boxes to enable inspection and cleaning of the heating surface.

Gauge board

1 Description

The function of the gauge board is for monitoring of the boiler parameters.

- A pressure gauge is fitted for analogous reading of the actual steam pressure in the boiler.
- A pressure transmitter can be fitted. It converts the actual steam pressure into corresponding electric signals which are used for remote steam pressure indication.
- Two temperature gauges can be fitted for analogous reading of the inlet and outlet exhaust gas temperatures respectively.
- A U-tube differential pressure indicator can be fitted. It indicates the differential pressure between the inlet and outlet exhaust gas boxes.
- A differential pressure transmitter can be fitted. It converts the actual differential pressure between the inlet and outlet exhaust gas boxes into corresponding electric signals which are used for remote indication.

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Start/stop of the boiler

1 General

The following chapters of the instruction manual describe the commissioning, operation, and maintenance of the exhaust gas boiler. As this is only a part of the complete boiler plant, it is important to study the remaining chapters in this manual very thoroughly. It is especially important that the operator of the boiler plant becomes familiar with the operation instructions of the forced circulation system, oil fired boiler(s), steam dump equipment, control system, etc.

Note: To ensure a safe and reliable operation of the boiler plant, all operation and/or maintenance of the boiler should be carried out only by skilled personnel.

2 Commissioning

In connection with the boiler plant installation the entire system must be thoroughly cleaned in order to remove all welding beads, grease, dirt, etc. It must be ensured that all pipelines are ready for operation and that possible blind flanges used during pressure tests have been removed.

Before putting the boiler into operation for the first time or after repair works, it should be boiled out to remove all protecting remedies and impurities on the boiler waterside. The exhaust gas boiler must be boiled out in connection with boiling out of the oil fired boiler(s). The circulation pumps should be protected temporarily by a suction filter which is removed again when the boiling out procedure has been completed. It must be assured that the chemicals used for boiling out are not harmful to the circulation pumps. If so, a separate pump must be used for boiling out.

Caution: Extreme care should be taken while handling the chemicals. The person handling the chemicals/solution should be properly dressed and protected.

When the exhaust gas boiler and forced circulation system are commissioned the following work procedures should be carried out:

2.1 Initial commissioning

Step A: Check that the water level in the oil fired boiler(s) is within the permitted limits and that feed water pumps as well as water level control equipment are operational.

Step B: Open the inlet and outlet stop valves for the circulation pumps.

Step C: Open the instrument stop valves for the differential pressure indicator switch.

Step D: Open the inlet and outlet circulation valves for the exhaust gas boiler.

Step E: Open the air escape valve and gauge board valve.

Step F: Check that the blow-down valves and sample valve are closed.

Step G: Close the reducing valve for the circulation flow measurement equipment.

Step H: Open the circulation outlet valve on the oil fired boiler(s). If the oil fired boiler(s) is already pressurised and heated the valve must be opened very carefully in order to avoid thermal stresses in the piping and pumps.

Step I: Fill the circulation system as far as possible with boiler water via outlet circulation valve of the oil fired boiler(s).

Step J: Make sure that the circulation pumps are properly filled and vented.

Step K: Ensure that the impulse legs for the differential pressure indicator switch are completely filled with water and adjust the zero-point as well as the alarm switches (low flow and start of stand-by pump) to the specified settings.

Step L: Open the circulation inlet valve of the oil fired boiler(s). If the oil fired boiler(s) is already pressurised and heated the valve must be opened very carefully in order to avoid thermal stresses in the piping and exhaust gas boiler. As soon as steam blows out the air escape valve should be closed.

Step M: Open the reducing valve approximately one turn on the hand wheel.

Step N: Start one of the circulation pumps in accordance with instructions. Check the complete system for leaks.

Step O: In case of depressurised and cold oil fired boiler(s) carefully fill boiler water in the forced circulation system and exhaust gas boiler until the system is completely filled. As soon as water comes out the air escape valve should be closed.

Step P: In case of pressurised and heated oil fired boiler(s) carefully circulate boiler water through the forced circulation system and exhaust gas boiler until the system is heated to approximately the same temperature as the boiler water.

Step Q: Adjust the stroke of the reducing valve to obtain the specified design pressure drop across the orifice.

Step R: Check that the operating circulation pump is running within the permissible range.

Step S: Engage the automatic stand-by position of the other circulation pump.

Step T: Check the adjustment of the low flow alarm switch and the switch for stand-by pump start by throttling the reducing valve. Adjust the switches, if necessary.

Step U: Re-adjust the reducing valve after testing and lock the valve temporarily by means of the counter nut. Final adjustment should be performed at steady boiler load (design load).

2.2 Boiling out

Step A: Follow the boiling out procedure of the oil fired boiler(s) with one of the circulation pumps running.

Step B: Stop the circulating pumps before the oil fired boiler(s) are drained after completing the boiling out procedure.

Step C: Drain the exhaust gas boiler and entire forced circulation system. Remove the temporarily inserted suction filter for the circulation pumps.

Step D: Dismantle the bottom blow-down valves for cleaning and inspection. Deposits and foreign substances will usually be accumulated in these valves and cause leaking if not cleaned.

Step E: Inspect the boiler and remove any remaining deposits and foreign substances.

Step F: Finally, new gaskets should be fitted in all hand holes and manholes before refilling the boiler with circulation water.

Note: During the first two weeks in operation Aalborg Industries recommend to carry out frequent bottom blow-downs to remove impurities entering the boiler from the pipe system.

2.3 Re-start of the system

Step A: Check that the water level in the oil fired boiler(s) is within the permitted limits and that feed water pumps as well as water level control equipment are operational.

Step B: Check that the valves are open for the circulation pumps, exhaust gas boiler, and differential pressure indicator switch.

Step C: Open the air escape valve and gauge board valve.

Step D: Check that the blow-down valves and sample valve are closed.

Step E: Open the circulation outlet valve on the oil fired boiler(s). If the oil fired boiler(s) is already pressurised and heated the valve must be opened very carefully in order to avoid thermal stresses in the piping and pumps.

Step F: Fill the circulation system as far as possible with boiler water via outlet circulation valve of the oil fired boiler(s).

Step G: Make sure that the circulation pumps are properly filled and vented.

Step H: Ensure that the impulse legs for the differential pressure indicator switch are completely filled with water.

Step I: Open the circulation inlet valve of the oil fired boiler(s). If the oil fired boiler(s) is already pressurised and heated the valve must be opened very carefully in order to avoid thermal stresses in the piping and exhaust gas boiler. As soon as steam blows out the air escape valve should be closed.

Step J: Throttle the outlet valve for the circulation pump which should be set into operation and then start the circulation pump.

Step K: In case of depressurised and cold oil fired boiler(s) carefully fill boiler water in the forced circulation system and exhaust gas boiler until the system is completely filled. As soon as water comes out the air escape valve should be closed.

Step L: In case of pressurised and heated oil fired boiler(s) carefully circulate boiler water through the forced circulation system and exhaust gas boiler until the system is heated to approximately the same temperature as the boiler water.

Step M: Open the outlet valve for the operational circulation pump completely.

Step N: Engage the automatic stand-by position of the other circulation pump.

Step O: Re-tighten all covers such as manholes, hand holes, inspection doors, flanges, etc. during the pressure rising period. If required, check all flange joints on the plant.

2.4 Final commissioning

When both the oil fired boiler(s) as well as the exhaust gas boiler are operational and the main engine is running at steady load (design load) the following work procedures should be performed:

Step A: Adjust the reducing valve to obtain the specified pressure drop across the orifice.

Step B: Lock the valve by firmly fastening the counter nut on the valve spindle. Remove the hand wheel in order to avoid any unintentional operation of the valve.

Note: The system behaviour should be observed during the first period of operation, especially at full load, no load, and large load variations. In case the low flow alarm is observed at full load, the reducing valve should be re-adjusted to a higher flow rate for this operating condition.

Step C: Check the opening pressure of the safety valves for the exhaust gas boiler by throttling the circulation outlet valve until the pressure increases to the set point, adjust if necessary.

3 Boiler operation

3.1 Boiler operation mode

The exhaust gas boiler is operated in connection with one or more oil fired boilers. The combination between an exhaust gas boiler and oil fired boiler(s) makes it possible to operate the boiler plant in different modes. The different modes are:

- Operation only on the oil fired boiler(s)
- Operation only on the exhaust gas boiler
- Operation on both the oil fired boiler(s) and exhaust gas boiler.

Oil fired boiler operation mode

When the main engine is stopped, the only heat source is the burner(s) of the oil fired boiler(s). The burner is operated by means of signals from the boiler gauge board and the steam pressure is kept within the set point limits. As the circulation pumps are operational, hot boiler water is pumped through the circulating system and the exhaust gas boiler is kept heated and pressurised.

Exhaust gas boiler operation mode

When the exhaust gas flow through the boiler, produced by the main engine, is sufficient to maintain the steam pressure, the burner(s) of the oil fired boiler(s) will not be in operation. If the exhaust gas flow is above the required flow to maintain the steam pressure at a given steam output, the pressure increases. At a pre-selected set point the

steam dump equipment, located elsewhere in the steam system, opens the dump valve and regulates the steam line pressure.

If, however, the circulation outlet valve has been closed the boiler pressure may rise above the maximum allowable working pressure. At this point, the safety valves open and ensure any further increase of the steam pressure.

Combined operation mode

The steam production is controlled by the amount of exhaust gas from the main engine and the gauge board of the oil fired boiler(s) which controls the burner(s). If the main engine produces an insufficient amount of exhaust gas to maintain the steam pressure, the boiler gauge board initiates start of the burner. The burner operates as long as the steam pressure does not exceed the set point for stop. If the steam pressure increases above this set point, the boiler gauge board initiates stop of the burner.

3.2 Shrink and swell phenomenon

This phenomenon is particularly related to exhaust gas boilers with forced circulation.The circulation system is totally filled with water when no steam is generated in the exhaust gas boiler.

As the steam production starts in the exhaust gas boiler, some of the water contents in the boiler and circulation pipes will be replaced by steam and pushed into the oil fired boiler(s). This creates a considerable and rapid water level rise (swell).

The opposite happens when the steam production stops in the exhaust gas boiler. The boiler will again be completely filled with water by means of the circulating pumps causing a water level fall (shrink) in the oil fired boiler(s).

Rapid and large steam consumption changes will create similar shrink and swell conditions in the oil fired boiler(s) and should be avoided by smooth operation of the steam consumers.

This phenomenon is not only restricted to the boilers. The shrink and swell volumes will also be transferred to the condensate system. When the water level is above normal in the oil fired boiler(s), e.g. after start of the exhaust gas boiler, the feed water supply is temporarily stopped and condensate will accumulate in the condensate system (hotwell tank) until the water level is back to normal. When the water level is below normal in the oil fired boiler(s), e.g. after stop of an exhaust gas boiler, the feed water is supplied at a faster rate than condensate is returned, and the levels will shrink in the condensate system.

3.3 Normal operation

When an exhaust gas boiler has been put into service it requires only little attendance. However, the following items must be ensured:

- The circulation valves on both the exhaust gas boiler and oil fired boiler(s) must be opened.
- One of the circulation pumps must be operating continuously (also in port) while the other pump is in automatic stand-by start mode.
- The flow measurement system must be operational.
- Open the air escape valve once in a while to remove air pockets in the boiler. This specially applies if the boiler has been out of operation for some time.
- All alarms, especially circulation failure/start of stand-by pump, must be attended to immediately and the cause must be established and rectified as soon as possible.
- The routine maintenance must be followed according to the recommendations. Please see the sections for “Boiler maintenance” and “Cleaning smoke tubes”.

When the above mentioned items are followed the exhaust gas boiler operation (generating steam or stand-by) automatically follow the operation pattern of the main engine.

It is strongly recommended to continuously maintain circulation in order to keep the system heated and pressurised. This reduces thermal stresses during the heat-up period, and the system will be protected from ingress of oxygen which would cause undesirable corrosion in the system. Furthermore, it also reduces the risk of a soot fire during port periods.

3.4 Dry running

Continuous water circulation must always be maintained through the exhaust gas boiler while the main engine is running. However, the design of the boiler allows operation without water with the full exhaust gas flow through the smoke tubes, provided the boiler is operated depressurised. Although the boiler materials are selected to accept unlimited dry running, there is always the risk of a soot fire and every effort tore-establish the water circulation should be made in order to reduce the dry running period to a minimum. Furthermore, operation of the boiler without water eventually dries out the gaskets, and a replacement of the gaskets is necessary.

Attention: Dry running must be limited as far as possible and only allowed in case of emergencyif no other operation alternatives are present. Before start of the boiler it must be drained and the manhole cover should be dismounted to ensure that it is operated completely depressurised. Please note that the temperature inside the boiler must not exceed 400ºC.

When the boiler operates without water, it will gradually be heated to the same temperature as the exhaust gas. It is therefore important to allow the boiler to cool before restarting the boiler water circulation, thereby avoiding excessive thermal shock stresses which, if repeated, would result in damage.

4 Boiler stop

4.1 Stop to normal stand-by condition

The main engine can be stopped at any time without special preparations regarding the boiler plant. A slow engine turn-down/stop sequence is obviously preferable, as this will reduce the thermal stresses to the equipment. The circulation of water through the exhaust gas boiler must be maintained after stop of the main engine for the following reasons:

- The boiler is kept heated by the oil fired boiler(s) and therefore ready for start of the main engine. Further, the risk of stand-by corrosion, caused by oxygen penetrating into the boiler, is reduced.
- A soot fire may develop even after stop of the main engine, and if the tubes are not properly cooled, this may result in severe damage to the boiler.
- External corrosion of the boiler tubes due to sulphuric acid is reduced.

4.2 Stop to cold condition

Stop to cold condition is generally the same procedure as stop to normal stand-by condition. If required, the circulation pumps can be stopped during prolonged stays in port. However, not earlier than 12 hours after the main engine has been stopped and provided that no abnormal conditions have occurred during the cooling period, e.g. small soot fires. The boiler water circulation must be re-established prior to the next start of the main engine.

If an exhaust gas boiler with contents of steam and /or hot water is totally isolated from the system, the air escape valve must be opened to avoid vacuum in the boiler as the steam/water volume shrinks when cooled. However, air gets into the boiler in this way and to avoid this, it is recommended only to close one of the inlet/outlet valves and leave the other line valves open in the circulation system.

Note: The boiler plant should not be left cold for more than a few days without taking appropriate preservation initiatives to prevent corrosion (please see instructions for preservation of oil fired boilers).

4.3 Emergency stop

The boiler must be taken out of service immediately if:

- A substantial loss of water is noted.
- The safety valve cannot function.
- Oil in the boiler water is detected.
- Too high salinity level is detected.

4.4 Stop for repair or inspection

The exhaust gas boiler should be stopped as described in section 4.2. The complete boiler plant should be drained while still warm when the exhaust gas system and boiler has cooled properly down after stop of the main engine.

- Check the fouling factor of the smoke tubes and water wash if necessary.
- Inspect the exhaust gas side as well as the water side.
- Check and clean the outer fittings. Change gaskets where required.
- Check that the necessary spare parts are available. Order complementary parts in time.

Boiler maintenance

1 Boiler maintenance

The boiler maintenance should always be executed with skill and in accordance with valid rules and regulations from the authorities. Below some recommendations are given for periodical inspections and maintenance.

1.1 Daily operation

During normal operation of the boiler, some work and check procedures have to be considered every day.

Step A: Check the boiler water condition and make necessary counter measures with regard to the feed and boiler water treatment. If necessary, blow-down the boiler.

Step B: Check that the circulation pumps are running smoothly without vibration or noise.

Step C: Check and record the exhaust gas inlet and outlet temperatures as well as the exhaust gas pressure loss across the boiler at the actual main engine loads. An outlet temperature or a pressure loss higher than expected indicate that the heating surface may be fouled and need to be cleaned.

1.2 Weekly routine checks

Step A: Depending on the boiler water tests blow-down the boiler. Open the blow-down valves quickly for a few seconds and then close and open again for about five to ten seconds. Repeat this operation when required according to the boiler water tests.

1.3 Monthly routine checks

Step A: Test the function for automatic stand-by start of the non operational circulation pump by throttling the outlet valve of the operational pump.

Step B: Check all boiler mountings for damage or leaks and repair/replace if necessary.

2 Inspection of the boiler

2.1 Inspection of boiler exhaust gas side

The exhaust gas section should be inspected at least once a year. During this inspection, the following issues should be taken into consideration:

- Check the welding in the exhaust gas section. A careful examination should be carried out with respect to any possible corrosion or crack formation.
- Check that the smoke tubes and stay tubes are intact and that soot deposits are within normal limits.
- Check that the inlet box and outlet box are intact and that soot deposits are within normal limits.

2.2 Inspection of boiler steam/water side

The boiler water side (interior) must be carefully inspected at least once a year. This inspection is of great importance since it has a direct influence on the boiler longevity and on the security.

At these inspections, hard deposits, corrosion, and circulation disturbances can be found at an early stage and preventive measures must be taken to avoid unexpected material damage and boiler breakdown. The presence of hard deposits at the boiler tubes reduce their heat transfer properties and decrease the capacity of the boiler. Further, it can be established whether the feed water treatment is satisfactory, and whether the blow-down is carried out sufficiently. Insufficient blow-down will cause accumulation of sludge in the bottom of the boiler. Incorrect feed water treatment is commonly causing hard deposits or corrosion. If hard deposits are not removed, it may lead to overheating. Incorrect feed water treatment does, however, not always lead to hard deposits. For example, a too low or too high pH-value may give an electrolytic reaction, causing corrosion in the boiler.

When the boiler interior is inspected, examine all parts carefully and be attentive to deposits, corrosion, and cracks. It is advisable to pay special attention to this inspection. If any unusual signs are found, contact Aalborg Industries at once for advice.

2.3 Procedure and remarks for inspection

Step A: Stop the boiler and allow it to cool.

Step B: Ensure that the boiler is depressurised and that all valves are closed.

Step C: Access for inspection is achieved through the manholes, hand holes and inspection doors. The boiler can be entered when it is sufficiently cold.

Step D: Check the welding in the boiler. A careful examination should be carried out with respect to any possible corrosion or crack formation.

Step E: If deposits are forming at the boiler tubes, the boiler should be chemically cleaned. It is advisable to consult a company of cleaning specialists who will examine the boiler deposits and treat the boiler accordingly.

Step F: After chemical treatment the boiler should be blown-down at least twice a day for approximately one week. This will ensure that excessive sludge deposits due to chemical treatment do not collect in the bottom of the pressure vessel.

2.4 Contamination

If the steam/water side of the boiler is contaminated with foreign substances like oil, chemicals, corrosion products etc., it is very important to act immediately to avoid damage of the boiler. Layers of thin oil films, mud, etc. exposed to the heating surfaces cause poor heat transfer in the boiler, leading to overheating followed by burned out pressure parts. In order to remove such contamination, a boiling out or acid cleaning should be performed immediately.

Note: Corrosion products from the pipe system or insufficient boiler water treatment may result in corrosion in the boiler itself. It is therefore important to observe that such circumstances do not occur in the system.

Cleaning smoke tubes

1 General

The heating surface dimensions of the boiler are designed to maintain a sufficient exhaust gas velocity giving the best self-cleaning effect within the design limits. However, after long term operation soot deposits can be accumulated inside the smoke tubes. The main engine exhaust gas contains carbon particles and un-burnt residues (soot, etc.) and the amount is strongly dependent on the state of the engine and the supply of scavenging air. These soot/un-burnt residues will accumulate on the boiler heating surface if not removed by cleaning.Furthermore, the combustion quality of the engine is changing together with the load, where the best combustion is in the high load range and the lower range is giving a more “contaminated” (black/coloured) exhaust gas. And the more contaminated the exhaust gas is, the more fouling will appear in the exhaust gas boiler.Therefore, it is impossible to specify exact time intervals in which the smoke tubes should be soot cleaned. However, some general guidelines are given below:

- Inside inspection.
- Check of the exhaust gas temperature on the outlet side of the boiler. The boiler should be cleaned if the outlet exhaust gas temperature lies approx. 20°C above the temperature in a clean boiler at a specified engine load.
- Check of the pressure loss. The boiler should be cleaned if the pressure loss lies approx. 20 mm WC above the pressure loss in a clean boiler.

It is recommended to keep a consecutive record of the exhaust gas temperature and pressure loss related to different engine loads in a clean boiler. These original data should be used for comparison, and plotted into a measurement chart like the one shown in Figure 1. In this way it is possible to monitor the fouling condition of the smoke tubes and determine when they need to be cleaned.

Check scheme for exhaust gas measurements

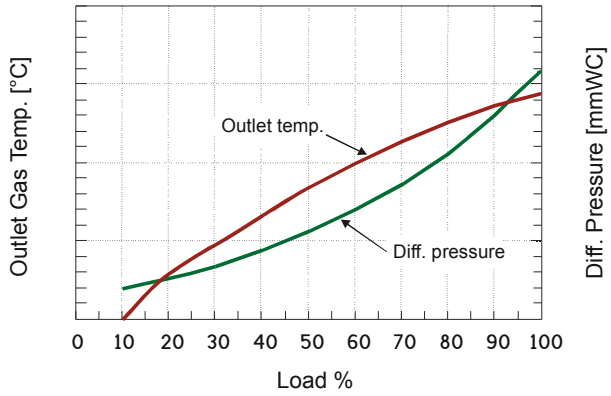


Figure 1 **om9210_41_dp_tubx0059920en.wmf**

2 Water washing procedure

The most effective way of soot cleaning is water washing, as most of the deposits consist mainly of non-soluble particles held together by a water soluble bonding material. Water washing will have the following benefits:

- Dissolves the bonding material.
- Washes the loosened insoluble deposits away.

Water washing must be carried out when the main engine is stopped and the boiler has been cooled down. However, the boiler should be warm enough for the water to evaporate so that the tubes will not remain moist after washing.

Both fresh and sea water can be used. However if sea water is used, the boiler must be thoroughly washed afterwards with fresh water in order to remove all salt deposits. Where deposits are highly corrosive or bonded, a soaking spray with a 10% soda ash solution is advisable before washing.

Step A: Ensure that the main engine is stopped or by-pass the exhaust gas flow, if possible.

Step B: Wait a minimum of time allowing the boiler to cool.

Step C: Open the inspection doors above and below the boiler.

Step D: Open the drain at the bottom of the inlet box to the soot collecting system, and make sure that there is free passage.

Step E: Open drains at the turbo chargers and make sure that there is free passage.

Step F: If there is a risk that the washing water will run into the exhaust gas pipe and down to the turbo chargers, the exhaust gas pipe must be covered. This can be done by e.g. covering the exhaust gas inlet pipe with a waterproof tarpaulin as indicated in Figure 2.

Step G: Start water washing using a hand water lance or fire hose inserted through the inspection door of the outlet box and direct the jet of water directly at the smoke tubes. In the beginning the water supply should only be slightly opened, just enough to have a small amount of water to ensure that the drainsare working properly.

Step H: When it has been ensured that the washing water is running freely down through the drain system into the soot collecting system, the water amount can slowly be increased, until a flow of approximately 50 l/minat a water pressure between4 to 6 bar is obtained.

Warning: When the smoke tubes are water washed, there is a risk of generating steam. It is therefore very important that all of your body is outside the outlet box in order not to get your skin burned by the steam.

Step I: It is important to check that the drain and soot collecting system are working properly during the whole water washing procedure.

Step J: When the water washing has begun, it must be completed until the heating surface is thoroughly washed and all deposits are removed. This is due to the fact that some types of coatings harden and accordingly get very difficult to loosen when they have been saturated and then dry out.

Water washing of the smoke tubes

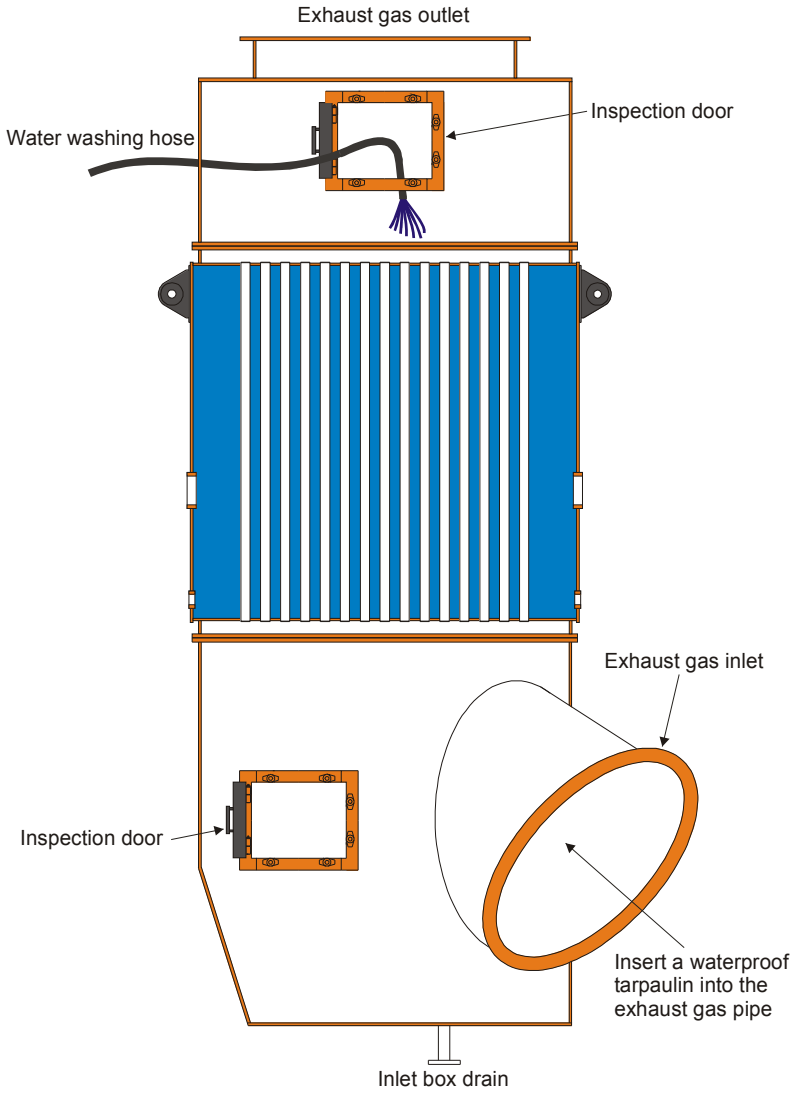


Figure 2 **om9210_41_aqx0059910en.wmf**

Step K: When the water washing has been completed, it must be ensure that all the washing water is drained awayby looking into the inlet box from the inspection door. The bottom of the inlet box must be cleaned with alkaline water because the washing water is very corrosive.

Step L: The boiler must be dried out immediately after water washingby having a natural air circulation through the boiler or by heating it up with feed water. This is because soot formations produced by the combustion process in the engine contain sulphur compounds. Any residual soot and water will therefore react chemically to form a highly corrosive sulphuric acid.

Step M: Remove the waterproof tarpaulin from the exhaust gas inlet pipe, if inserted, and close drains as well as inspection doors.

Step N: The boiler can now be brought back into normal service.

Boiler repair

1 Plugging of tubes

In case of a leakage tube, the boiler must be stopped and the pressure lowered to atmospheric pressure. If the leaking tube cannot be located immediately via the inspection doors, the boiler should be set on pressure by means of the circulation pumps so that the leakage indicates the damaged tube.

Step A: The main engine must be stopped during the repair work.

Step B: Open and, if necessary, remove the inspection doors in the exhaust gas inlet box and outlet box.

Step C: When the damaged tube has been located, clean the inside of the tube ends with a steel brush so that no deposits are present in the tube.

Step D: Plug and seal weld both tube ends with a conical plug, see Figure 1.

Note: Tube plugging results in reduced efficient heating surface, and accordingly the boiler efficiency will decrease.

Attention: The classification society should be notified about the repair work and a schedule must be made for exchange of the damaged tubes.

2 Exchange of tubes

From an operational point of view up to 10% to 15% of all tubes can be plugged with a conical plug, but if more tubes are damaged, an exchange of tubes is necessary.It is possible to replace the tubes from the outside of the boiler. After location of the damaged tubes, they must be replaced according to the following procedure:

Step A: The main engine must be stopped during the repair work.

Step B: Ensure that the boiler pressure is lowered to atmospheric pressure and that it is completely drained of water.

Step C: Open and remove the inspection doors in the exhaust gas inlet box and outlet box. If necessary remove the inlet box and/or outlet box.

Step D: The damaged tubes must be cut right below and above the tube plates.

Step E: Remove the damaged tubes.

Step F: Scraps of metal and welding material in the tube holes as well as the tube plates must be grinded off.

Step G: The new tubes should be placed in the tube holes one by one and seal welded onto the tube plates as shown in Figure 1.

Note: Only skilled personnel with knowledge and qualifications to perform certified welding should perform repair work.

Step H: The tubes should be rolled after the welding work has been completed.

Step I: After completion of the repair work, clean the working area.

Step J: Refill the boiler with water and check for leaks through the inspection doors before starting up.

Step K: Mount and close the inspection doors again.

Illustration of how to plug and exchange tubes

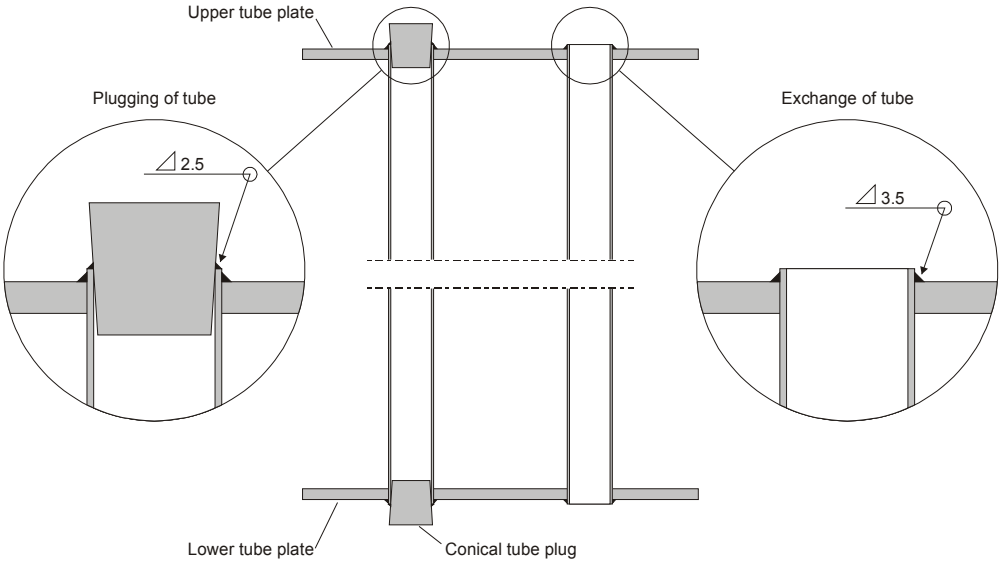


Figure 1 **om9210_26_aqx0059790en.wmf**

Manhole gaskets and hand hole gaskets

1 Gaskets

The gaskets are of a high-tech, compressed fibre material which makes them ideal for steam.

1.1 Storage and handling

The gaskets should always be stored horizontally to avoid tensions. Also, they should be stored in clean condition and in a dark storage room.

Ideal temperature: < 25˚C.
Ideal air humidity: 50-60%.

Never bend the gaskets or damage their surfaces.

1.2 Installation

Note: For safety reasons, never re-use a gasket.

Make sure that all sealing surfaces are clean and dry. Be sure not to damage/scratch sealing surfaces while cleaning. Also check that sealing surfaces are parallel and free of damages and cracks.
All gaskets should be installed clean and dry. No form of gasket compounds can be used for installation. These might damage the gaskets and result in possible blowouts of the gaskets. The gaskets are coated with a non-sticking film.
Ensure that bolts and nuts are clean and free of corrosion and apply lubricant on the threads.The lubricant must not contaminate gaskets or sealing surfaces. Insert the gaskets carefully in the covers and place the covers with the new gaskets in the manholes/ hand holes. Ensure that the coversare centralized in the manholes/hand holes.

Make at least 4 stages to the required torque.
- Finger-tighten the bolts.
- Use 30% of the required torque.
- Use 60% of the required torque.
- Use the required torque.

1.3 Recommended torque

- Manhole : 250 Nm.
- Hand hole: 500 Nm.

1.4 Re-tightening

Re-tightening must be done in hot condition during the first 24 hours of the starting-up of the plant. Re-tightening of high-tech, compressed fibre gaskets under pressure and after a long period of operation might lead to leaking gaskets and possible blow-outs.

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Feed and boiler water

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Feed and boiler water

1 General

Note: The recommended feed and boiler water characteristics are only valid for boilers with a working pressure below 20 barg.

There is a number of ways to produce good quality feed water for boiler plants. Methods such as e.g. reverse osmosis plants or ion exchange plants produce good quality distillate. Also evaporators generally produce good distillate. The important thing is that the distillate used should be clean and without foreign salt contamination.

In practice most distillates used contain minor parts of various salt combinations which can and must be chemically treated away. Furthermore, the distillate may contain dissolved gases like for example oxygen (O_2) and carbon dioxide (CO_2) which may lead to corrosion in the boiler, steam, and condensate system.

Important: Boiler and feed water must be chemically treated in order to avoid corrosion and scaling in the boiler.

2 Layout of the treatment system

The condition of the feed and boiler water is an essential part of the boiler operation and operation philosophy. The design and construction of the treatment system should therefore be considered carefully during layout of the plant. Aalborg Industries gives some general requirements and recommendations regarding the conditions of the feed and boiler water. However, there is several ways to obtain this results, or similar, by using different treatment systems. The following should therefore be considered already at the layout stage:

- Choose the treatment system that should be used.
- Present the condensate and feed water system to the supplier of the treatment system and inform about the operation philosophy of the plant.
- Let the supplier indicate where the injection points should be located and also inform if special equipment is required.
- Let the supplier inform about which test facilities is needed.
- Purchase the recommended equipment and install it in the correct way.
- Use the treatment system as soon as the boiler is taken into operation.

3 Feed and boiler water characteristics

The following text regarding feed and boiler water treatment is the normal recommendations given by Aalborg Industries. These recommendations should be followed strictly in order to have the best working conditions for the boiler plant and to extend the working life of the plant. The requirements/recommendations of the various values for feed and boiler water are listed in Table 3 below.

Requirements for feed and boiler water			
	Unit	**Feed water**	**Boiler water**
Appearance	-	Clear and free of mud	Clear and free of mud
Hardness	ppm $CaCO_3$	0 - 5	-
Chloride content	ppm Cl^-	<15	<100
"P" alkalinity	ppm $CaCO_3$	-	100 - 150
Total (T) alkalinity	ppm $CaCO_3$	-	<2 x "P" - Alkalinity
PH-value at 25°C	-	8.5 - 9.5	10.5 - 11.5
Hydrazine excess	ppm N_2H_4	-	0.1 - 0.2
Phosphate excess	ppm PO_4	-	20 - 50
Specific density at 20°C	Kg/m^3	-	<1.003
Conductivity at 25°C	µS/cm	-	<2000
Oil content	-	NIL	NIL

Table 1

If hydrazine (N_2H_4) is not used, sodium sulphate (Na_2SO_3) can be used instead, and the excess should be 30 - 60 ppm.

In cases where other kinds of oxygen binding agents are used, it is recommended that an excess of oxygen binding agents can be measured and indicates that no oxygen has been dissolved in the boiler water.

If it is requested to measure the content of dissolved oxygen directly, it is recommended to keep the value < 0.02 ppm.

In addition to the above values, the various water treatment companies will add further demands, depending on the method used for treatment of feed and boiler water.

However, the most important point is that the above values or their equivalents are observed and that a regular (daily) test of feed and boiler water is carried out.

3.1 Units of measurement

Concentrations are usually expressed in "ppm" i.e. parts solute per million. Concentrations for parts solution by weight are the same as "mg/litre".

3.1.1 Specific gravity

As guidance the following conversion can be used:

- 1 Be° = 10.000 mg/l total dissolved solids (TDS)
- 1 mg/l total dissolved solids = 2 µS/cm
- 1 µS/cm = 1 µmho

4 Feed and boiler water maintenance

The following are recommended water maintenance instructions. More exact details concerning analyses and blow downs should be set up together with the supplier of chemicals for water treatment.

4.1

4.1.1 Daily

Step A: Analyses of feed and boiler water.

4.1.2 Weekly

Step A: Skimming (surface blow down) according to analyses, but at least once per week (2 minutes with fully open valve).

Step B: Blow down (bottom blow down) according to analyses, but at least once per week (each blow down valve 1 minute in low load condition).

4.1.3 Monthly

Step A: Check the functions for salinity and oil detection systems.

4.1.4 Every six months

Step A: The boiler water side (interior) must be carefully inspected at least twice a year.

4.1.5 Yearly

Step A: Check of the water side of the boiler and hotwell/deaerator for corrosion and scaling.

Step B: Check the chemical pump unit.

5 Treatment systems / injection points

In the following tables and illustrations a number of different feed and boiler water treatment systems are shown together with the recommended location for the injection point of the individual chemicals as stated by the manufacturer. The general information regarding the injection point principle can be used as guidelines for the most common systems. But should there be any doubt for a specific system the manufacturer/ supplier should be consulted in order to obtain the correct result.

Notes for tables/illustrations:

- Note No. 1: the preferred injection point of chemicals stated by the manufacturer/ supplier.
- Note No. 2: the alternate injection point of chemicals stated by the manufacturer/ supplier.
- Note No. 3: Valid for modulating feed water systems.
- Note No. 4: valid for on/off operating feed water systems. The chemical pump starts/stops together with the feed water pump.
- Note No. 5: valid for two boiler installation. Control of the chemicals in question work properly at an equal load condition (feed water flow) on the two boilers.

How to use the tables:

The tables can be used in different ways but the main idea is to do following:

Step A: Discover which manufacturer and type of chemicals that should be used for the actual boiler plant.

Step B: Use the name of the manufacturer and type of chemicals to select which tables that can be used.

Step C: Check the flow diagrams (Figure 4, Figure 4, or Figure 4) to find a diagram that matches the actual boiler plant.

Step D: Find in the selected tables the table which includes the matching diagram.

Step E: If more than one table is found to match the actual boiler plant in question it is recommended to use the method/table which includes note No. 1.

Step F: If no table is found to match the actual boiler plant in question it is recommended to seek assistance by the chemical manufacturer/supplier.

Chemical injection points

Manufacturer / supplier:		Ashland Chemical / Drew Marine Division			Table No. 1
Product name / method:		**Standard with Drewplex OX**			
Chemical name	**Injection point No.**	**Continuous**	**Batch**	**Note No.**	**Valid flow diagram No.**
Adjunct B	3, 3a, 3b		X	1	1, 2, 3
GC	3, 3a, 3b		X	1	
SLCC-A	3, 3a, 3b		X	1	
Drewplex OX	2, 2a, 2b	X		1, 3, 4	

Chemical injection points (continued)

Manufacturer / supplier:		Ashland Chemical / Drew Marine Division			Table No. 2
Product name / method:		**Standard with Amerzine**			
Chemical name	**Injection point No.**	**Continuous**	**Batch**	**Note No.**	**Valid flow diagram No.**
Adjunct B	3, 3a, 3b		X	1	1, 2, 3
GC	3, 3a, 3b		X	1	
SLCC-A	3, 3a, 3b		X	1	
Amerzine	2, 2a, 2b	X		1, 3, 4	

Chemical injection points (continued)

Manufacturer / supplier:		Ashland Chemical / Drew Marine Division			Table No. 3
Product name / method:		**Standard with Amerzine**			
Chemical name	**Injection point No.**	**Continuous**	**Batch**	**Note No.**	**Valid flow diagram No.**
Adjunct B	3		X		1
GC	3		X		
SLCC-A	3		X		
Amerzine	1	X		2, 3, 4	

Chemical injection points (continued)

Manufacturer / supplier:		Ashland Chemical / Drew Marine Division			Table No. 4
Product name / method:		**Standard with Amerzine**			
Chemical name	**Injection point No.**	**Continuous**	**Batch**	**Note No.**	**Valid flow diagram No.**
Adjunct B	3a, 3b		X		2, 3
GC	3a, 3b		X		
SLCC-A	3a, 3b		X		
Amerzine	1	X		2, 3, 4, 5	

Chemical injection points (continued)

Manufacturer / supplier:		Ashland Chemical / Drew Marine Division			Table No. 5
Product name / method:		**Drewplex AT / OX**			
Chemical name	**Injection point No.**	**Continuous**	**Batch**	**Note No.**	**Valid flow diagram No.**
Drewplex AT	3, 3a, 3b	X		1	1, 2, 3
Drewplex OX	2, 2a, 2b	X		1, 3, 4	

Chemical injection points (continued)

Manufacturer / supplier:	Ashland Chemical / Drew Marine Division			Table No. 6	
Product name / method:	**Drewplex AT / OX**				
Chemical name	**Injection point No.**	**Continuous**	**Batch**	**Note No.**	**Valid flow diagram No.**
Drewplex AT	2, 2a, 2b	X		2, 3, 4	1, 2, 3
Drewplex OX	2, 2a, 2b	X		3, 4	

Chemical injection points (continued)

Manufacturer / supplier:	Ashland Chemical / Drew Marine Division			Table No. 7	
Product name / method:	**Drewplex AT with Amerzine**				
Chemical name	**Injection point No.**	**Continuous**	**Batch**	**Note No.**	**Valid flow diagram No.**
Drewplex AT	3, 3a, 3b	X		1, 3, 4	1, 2, 3
Amerzine	2, 2a, 2b	X		1, 3, 4	

Chemical injection points (continued)

Manufacturer / supplier:	Ashland Chemical / Drew Marine Division			Table No. 8	
Product name / method:	**Drewplex AT with Amerzine**				
Chemical name	**Injection point No.**	**Continuous**	**Batch**	**Note No.**	**Valid flow diagram No.**
Drewplex AT	2, 2a, 2b	X		2, 3, 4	1, 2, 3
Amerzine	2, 2a, 2b	X		3, 4	

Chemical injection points (continued)

Manufacturer / supplier:	Ashland Chemical / Drew Marine Division			Table No. 9	
Product name / method:	**Drewplex AT with Amerzine**				
Chemical name	**Injection point No.**	**Continuous**	**Batch**	**Note No.**	**Valid flow diagram No.**
Drewplex AT	2, 2a, 2b	X		2, 3, 4	1, 2, 3
Amerzine	1	X		2, 3, 4, 5	

Chemical injection points (continued)

Manufacturer / supplier:	Ashland Chemical / Drew Marine Division			Table No. 10	
Product name / method:	**AGK-100 with Amerzine**				
Chemical name	**Injection point No.**	**Continuous**	**Batch**	**Note No.**	**Valid flow diagram No.**
AGK-100	2, 2a, 2b	X		1, 3, 4	1, 2, 3
Amerzine	2, 2a, 2b	X		1, 3, 4	

Chemical injection points (continued)

Manufacturer / supplier:	Ashland Chemical / Drew Marine Division				Table No. 11
Product name / method:	**AGK-100 with Amerzine**				
Chemical name	**Injection point No.**	**Continuous**	**Batch**	**Note No.**	**Valid flow diagram No.**
AGK-100	2, 2a, 2b	X		3, 4	1, 2, 3
Amerzine	1	X		2, 3, 4, 5	

Chemical injection points (continued)

Manufacturer / supplier:	Ashland Chemical / Drew Marine Division				Table No. 12
Product name / method:	**AGK-100 with Amerzine**				
Chemical name	**Injection point No.**	**Continuous**	**Batch**	**Note No.**	**Valid flow diagram No.**
AGK-100	1	X		2, 3, 4, 5	1, 2, 3
Amerzine	1	X		2, 3, 4, 5	

Chemical injection points (continued)

Manufacturer / supplier:	Marichem				Table No. 13
Product name / method:	**Standard**				
Chemical name	**Injection point No.**	**Continuous**	**Batch**	**Note No.**	**Valid flow diagram No.**
Alkalinity control	3, 3a, 3b		X	1, 3, 4	1, 2, 3
Phosphate	3, 3a, 3b		X	1, 3, 4	
Oxycontrol	2, 2a, 2b	X		1, 3, 4	
Marichem CCI	2, 2a, 2b	X		1, 3, 4	

Chemical injection points (continued)

Manufacturer / supplier:	Marichem				Table No. 14
Product name / method:	**Standard**				
Chemical name	**Injection point No.**	**Continuous**	**Batch**	**Note No.**	**Valid flow diagram No.**
Alkalinity control	1		X	2, 3, 4	1
Phosphate	1		X	2, 3, 4	
Oxycontrol	2	X		3, 4	
Marichem CCI	2	X		3, 4	

Chemical injection points (continued)

Manufacturer / supplier:	Marichem				Table No. 15
Product name / method:	**BWT new formula**				
Chemical name	**Injection point No.**	**Continuous**	**Batch**	**Note No.**	**Valid flow diagram No.**
BWT new formula	2, 2a, 2b	X		1, 3, 4	1, 2, 3
Marichem CCI	2, 2a, 2b	X		1, 3, 4	

Chemical injection points (continued)

Manufacturer / supplier:	Marichem	Table No. 16
Product name / method:	BWT new formula	

Chemical name	Injection point No.	Continuous	Batch	Note No.	Valid flow diagram No.
BWT new formula	1		X	2, 3, 4, 5	1, 2, 3
Marichem CCI	2, 2a, 2b	X		3, 4	

Chemical injection points (continued)

Manufacturer / supplier:	Marichem	Table No. 17
Product name / method:	BWT	

Chemical name	Injection point No.	Continuous	Batch	Note No.	Valid flow diagram No.
BWT powder	2, 2a, 2b	X		1, 3, 4	1, 2, 3
Marichem CCI	2, 2a, 2b	X		1, 3, 4	

Chemical injection points (continued)

Manufacturer / supplier:	Marichem	Table No. 18
Product name / method:	BWT	

Chemical name	Injection point No.	Continuous	Batch	Note No.	Valid flow diagram No.
BWT powder	1		X	2, 3, 4, 5	1, 2, 3
Marichem CCI	2, 2a, 2b	X		3, 4	

Chemical injection points (continued)

Manufacturer / supplier:	Ashland Chemical / Drew Marine Division	Table No. 19
Product name / method:	I	

Chemical name	Injection point No.	Continuous	Batch	Note No.	Valid flow diagram No.
Hardness control	3, 3a, 3b		X	1	1, 2, 3
Alkalinity control	3, 3a, 3b		X	1	
Oxygen control	2, 2a, 2b	X		1, 3, 4	
Condensate control	2, 2a, 2b	X		1, 3, 4	

Chemical injection points (continued)

Manufacturer / supplier:	Unitor Chemicals	Table No. 20
Product name / method:	I	

Chemical name	Injection point No.	Continuous	Batch	Note No.	Valid flow diagram No.
Hardness control	1		X	2	1
Alkalinity control	1		X	2	
Oxygen control	2	X		3, 4	
Condensate control	2	X		3, 4	

Chemical injection points (continued)

Manufacturer / supplier:	Unitor Chemicals	Table No. 21
Product name / method:	II	

Chemical name	Injection point No.	Continuous	Batch	Note No.	Valid flow diagram No.
Hardness control	3, 3a, 3b		X	1	1, 2, 3
Alkalinity control	3, 3a, 3b		X	1	
Cat sulphite L (CSL)	2, 2a, 2b	X		1, 3, 4	
Condensate control	2, 2a, 2b	X		1, 3, 4	

Chemical injection points (continued)

Manufacturer / supplier:	Unitor Chemicals	Table No. 22
Product name / method:	II	

Chemical name	Injection point No.	Continuous	Batch	Note No.	Valid flow diagram No.
Hardness control	1		X	2	1
Alkalinity control	1		X	2	
Cat sulphite L (CSL)	2	X		3, 4	
Condensate control	2	X		3, 4	

Chemical injection points (continued)

Manufacturer / supplier:	Unitor Chemicals	Table No. 23
Product name / method:	Liquitreat	

Chemical name	Injection point No.	Continuous	Batch	Note No.	Valid flow diagram No.
Liquitreat	3, 3a, 3b		X	1	1, 2, 3
Condensate control	2, 2a, 2b	X		1, 3, 4	
(Oxygen control)	2, 2a, 2b	X		1, 3, 4	

Chemical injection points (continued)

Manufacturer / supplier:	Unitor Chemicals	Table No. 24
Product name / method:	Liquitreat	

Chemical name	Injection point No.	Continuous	Batch	Note No.	Valid flow diagram No.
Liquitreat	1		X	2	1
Condensate control	2, 2a, 2b	X		3, 4	
(Oxygen control)	2, 2a, 2b	X		3, 4	

Chemical injection points (continued)

Manufacturer / supplier:	Unitor Chemicals	Table No. 25
Product name / method:	Combitreat	

Chemical name	Injection point No.	Continuous	Batch	Note No.	Valid flow diagram No.
Combitreat	3, 3a, 3b		X	1	1, 2, 3
Condensate control	2, 2a, 2b	X		1, 3, 4	
Oxygen control	2, 2a, 2b	X		1, 3, 4	

Chemical injection points (continued)

Manufacturer / supplier:	Unitor Chemicals				Table No. 26
Product name / method:	**Combitreat**				
Chemical name	**Injection point No.**	**Continuous**	**Batch**	**Note No.**	**Valid flow diagram No.**
Combitreat	1		X	2	1
Condensate control	2	X		3, 4	
Oxygen control	2	X		3, 4	

Chemical injection points (continued)

Manufacturer / supplier:	Unitor Chemicals				Table No. 27
Product name / method:	**I**				
Chemical name	**Injection point No.**	**Continuous**	**Batch**	**Note No.**	**Valid flow diagram No.**
Hardness control	3, 3a, 3b		X	1	1, 2, 3
Alkalinity control	3, 3a, 3b		X	1	
Hydrazine	2, 2a, 2b	X		1, 3, 4	
Condensate control	2, 2a, 2b	X		1, 3, 4	

Chemical injection points (continued)

Manufacturer / supplier:	Uniservice Group				Table No. 28
Product name / method:	**I**				
Chemical name	**Injection point No.**	**Continuous**	**Batch**	**Note No.**	**Valid flow diagram No.**
Hardness control	1		X	2	1
Alkalinity control	1		X	2	
Hydrazine	2	X		3, 4	
Condensate control	2	X		3, 4	

Chemical injection points (continued)

Manufacturer / supplier:	Uniservice Group				Table No. 29
Product name / method:	**II**				
Chemical name	**Injection point No.**	**Continuous**	**Batch**	**Note No.**	**Valid flow diagram No.**
Hardness control	3, 3a, 3b		X	1	1, 2, 3
Alkalinity control	3, 3a, 3b		X	1	
Oxygen control	2, 2a, 2b	X		1, 3, 4	
Condensate control	2, 2a, 2b	X		1, 3, 4	

Chemical injection points (continued)

Manufacturer / supplier:	Uniservice Group				Table No. 30
Product name / method:	**II**				
Chemical name	**Injection point No.**	**Continuous**	**Batch**	**Note No.**	**Valid flow diagram No.**
Hardness control	1		X	2	1
Alkalinity control	1		X	2	
Oxygen control	2	X		3, 4	
Condensate control	2	X		3, 4	

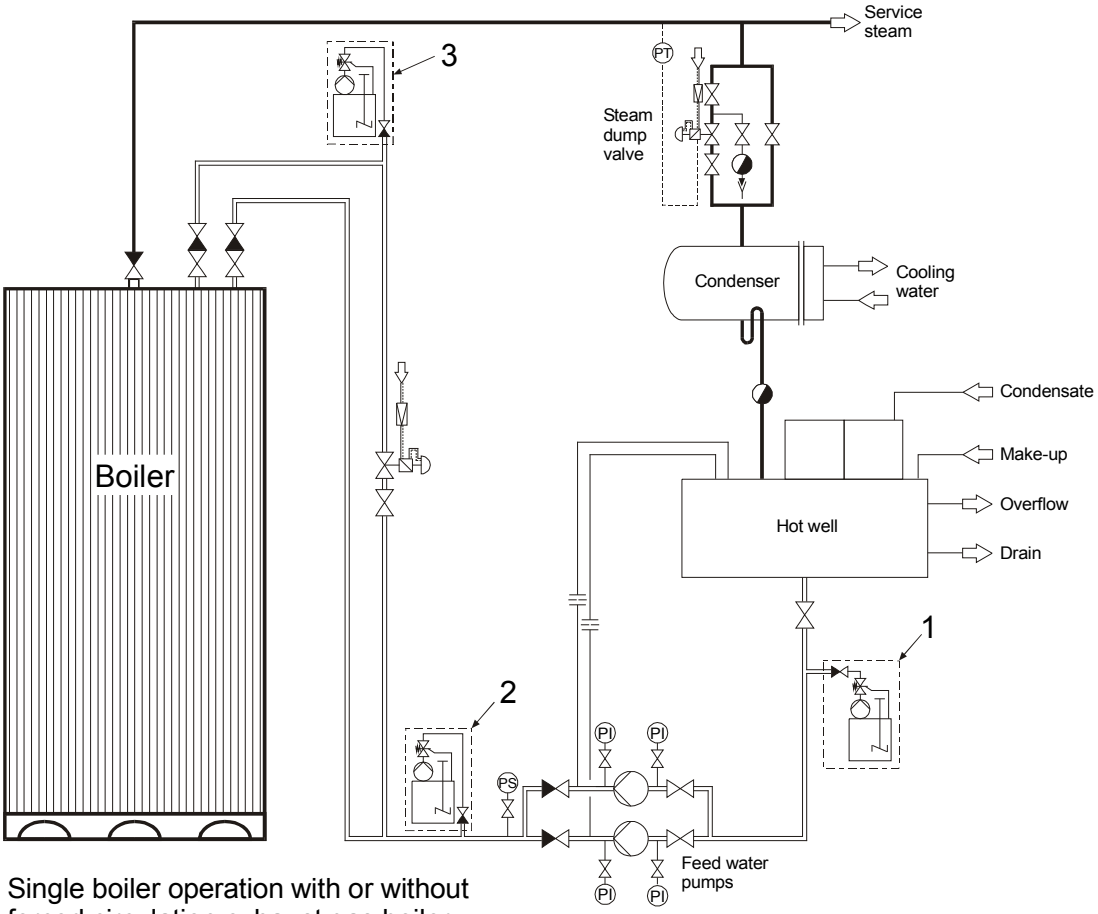
Chemical injection points (continued)					
Manufacturer / supplier:		**Uniservice Group**			**Table No. 31**
Product name / method:		**One Shot**			
Chemical name	**Injection point No.**	**Continuous**	**Batch**	**Note No.**	**Valid flow diagram No.**
BWT One Shot	3, 3a, 3b		X	1	1, 2, 3
Alkalinity control	3, 3a, 3b	X		1, 3, 4	
(Hydrazine)	2, 2a, 2b	X		1, 3, 4	

Chemical injection points (continued)					
Manufacturer / supplier:		**Uniservice Group**			**Table No. 32**
Product name / method:		**One Shot**			
Chemical name	**Injection point No.**	**Continuous**	**Batch**	**Note No.**	**Valid flow diagram No.**
BWT One Shot	1		X	2	1
Alkalinity control	2, 2a, 2b	X		3, 4	
(Hydrazine)	2, 2a, 2b	X		3, 4	

Chemical injection points (continued)					
Manufacturer / supplier:		**Uniservice Group**			**Table No. 33**
Product name / method:		**Organic Treatment**			
Chemical name	**Injection point No.**	**Continuous**	**Batch**	**Note No.**	**Valid flow diagram No.**
OBWT 3	3, 3a, 3b	X		1	1, 2, 3
OBWT 4	2, 2a, 2b	X		1, 3, 4	

Table 2

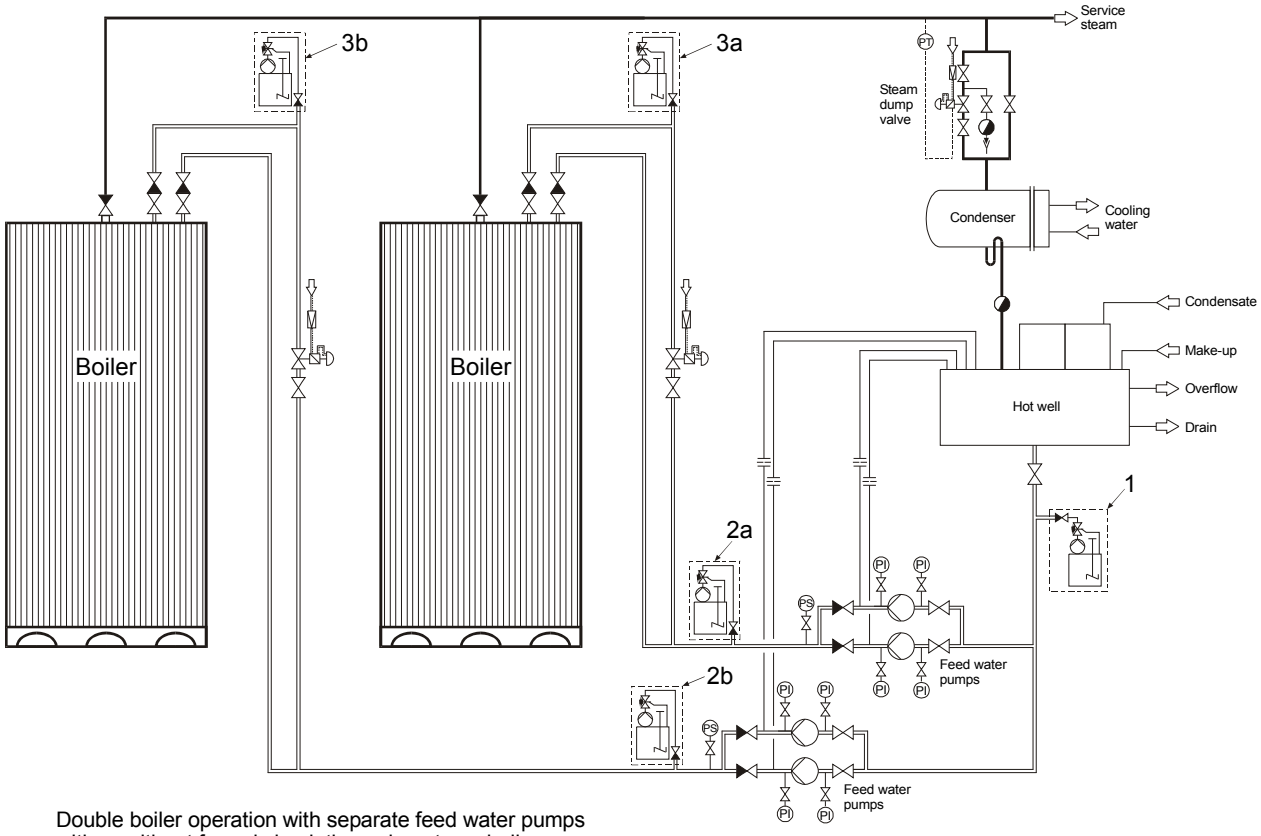
Flow diagram No.: 1



Single boiler operation with or without forced circulation exhaust gas boiler

Figure 1 **om9210_99_flowdix0060010en.wmf**

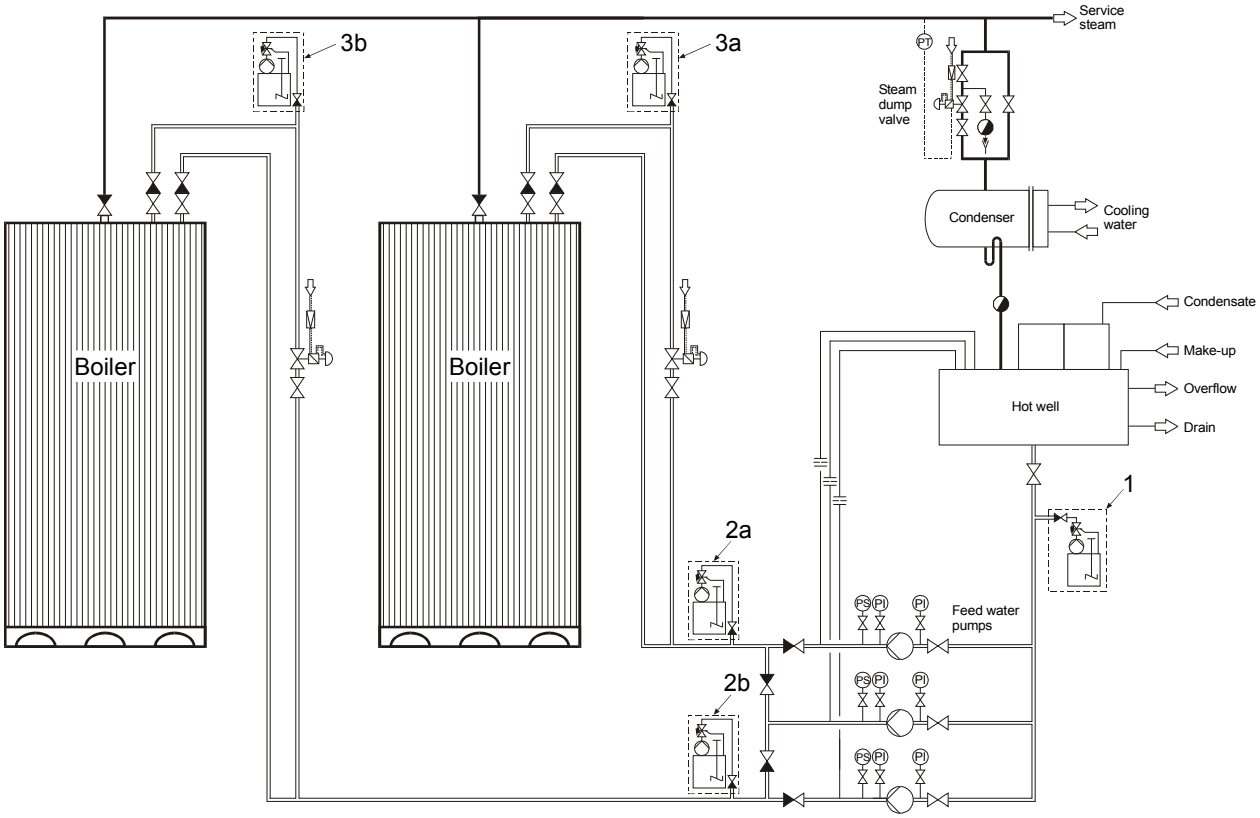
Flow diagram No.: 2



Double boiler operation with separate feed water pumps with or without forced circulation exhaust gas boiler

Figure 2 **om9210_99_flowdix0060020en.wmf**

Flow diagram No.: 3



Double boiler operation with common feed water pumps
with or without forced circulation exhaust gas boiler

Figure 3 **om9210_99_flowdix0060030en.wmf**

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Safety valves

OM6040_01 Safety valves.....30-2
OM6040_02 Temporary locking of a safety valve.....30-6

Safety valves

1 General

In the following the measures required to achieve a safe and reliable operation as well asmaintenance of the safety valves will be described, together with adjustment and dismantling instructions.An installation example of the safety valve is shown in Figure 3.

Mounting of safety valves, example

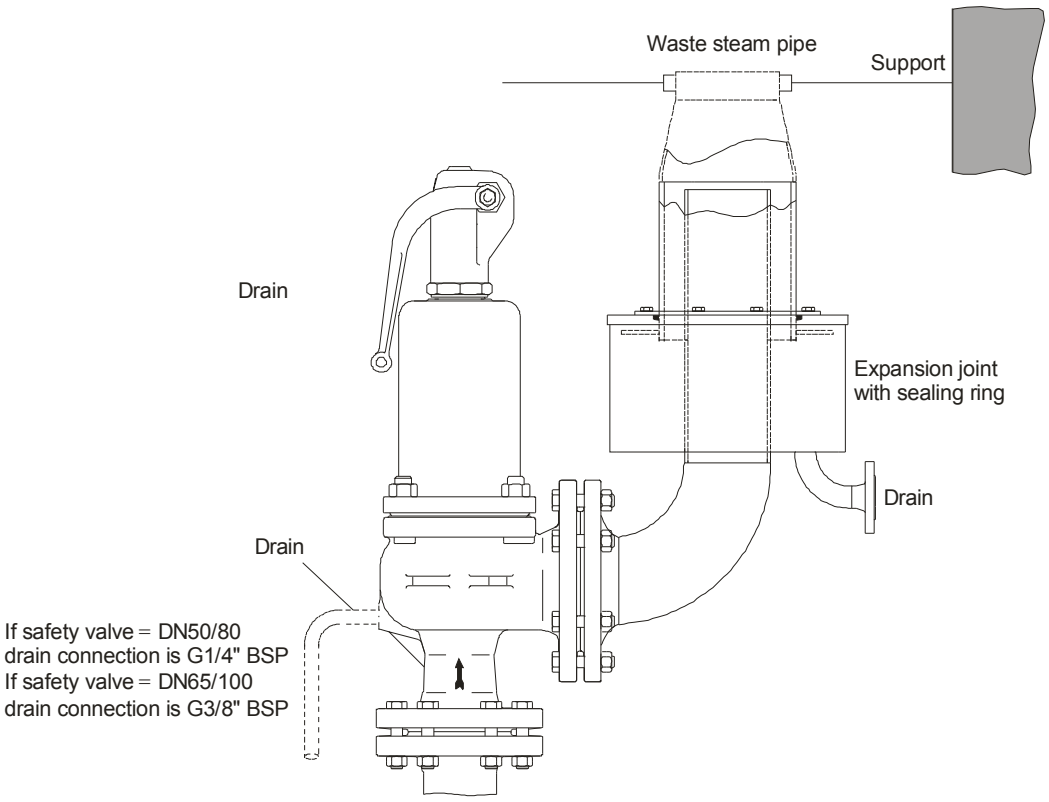


Figure 1 **om6040_01_safe_0x0056591en.wmf**

2 Maintenance and start-up of boiler

A regular inspection of the safety valve is recommended at least once a year. Some media and appliances require a more frequent inspections, this is according to the experience of the supplier.

Warning: Prior to any handling and dismantling of the safety valve ensure that the system is depressurised.

Before lighting-up the boiler, pipe connections must be thoroughly cleaned for dirt and foreign bodies.If the valve is not completely tight, which often is the case after start up of the plant, this is usually caused by impurities between the seat and the cone. In order to remove these impurities the valve must be heavily blown out by means of the lifting device. If the valve is not tight after several blows, it may be due to the fact that a hard foreign body has got stuck between the cone and the seat, and it will then be necessary to dismount the valve for overhaul.

Warning: In case of a leaking safety valve the valve must be inspected and overhauled as soon as possible. It must be ensured that the boiler is totally depressurised before dismounting the valve.

Note: Before dismantling the safety valve in the workshop the position of the adjusting screw must be measured and noted which will facilitate the adjustment later when the valve is to be adjusted when in service.

In case the facings between the cone and the seat have been damaged, they must be grinded.

Step A: The cone can be grinded against a cast iron plate, using a fine grained carborundom stirred in kerosene.

Step B: The seat in the valve body can be grinded in the same way by using a cast iron punch of suitable size.

Note: Never use the cone itself when grinding the seat.

Warning: The spindle and the valve cone must always be secured against turning as the seat and the cone may thus be damaged.

Step C: Before assembly the valve must be thoroughly cleaned, and all traces of grinding material and impurities must be removed.

Step D: When the valve has been mounted and the boiler is commissioned, the valve must be checked for leakage and adjusted to the set pressure.

Step E: The adjustment screw is secured by means of its lock nut, and the valve is sealed.

2.1 Routine check

The following should be regarded as recommendations of routine checks on the safety valves, in order to secure a correct function:

Monthly

Step A: Examine the safety valves for any leaking, such as:
- Is water seeping from the drain plug at the valve body?
- Is the escape pipe hot due to seeping steam from the valve seat?

Step B: Examine the drain and expansion device at the escape pipe.

Step C: Examine the lifting gear device, i.e. clean up and grease all sliding parts.

Yearly

Step A: The safety valve should be tested in operation by raising the boiler pressure.

Step B: Expansion and exhaust pipe should be examined at the same time.

3 Adjustment and dismantling

Safety valves are delivered with the required spring setting and sealed against unauthorised adjustment.Adjustments are only allowed in the spring margins. Outside the margin a new spring is required. The pressure in a system should not exceed 90% of the set pressure.

All item numbers mentioned in the following sections refer to Figure 3.

3.1 Dismantling of lifting device

Safety valve with open cap:

Step A: Remove bolt(39) and remove lift lever (41)

3.2 Set pressure change without spring change

Note: Pay attention to spring range.

Step A: Spindle (14) must be held fast by all alterations.

Step B: Loosen lock nut (21).

Step C: Turn the adjusting screw (17) clockwise for higher and anticlockwise for low set pressures.

Step D: Secure the new setting with the lock nut (21) and reassemble lifting device.

3.3 Spring change

Step A: Spindle (14) must be held fast by all alterations.

Step B: Loosen lock nut (21) and turn adjusting screw (17) anticlockwise, then the spring (37) is not under tension.

Step C: Loosen the nuts (8) and remove the bonnet (42).

Step D: Remove the upper spring plate (26), spring (37), spindle (14) with disc (12), guide plate (4), and lower spring plate (26).

Step E: Clean the seat (2) and disc (12).

Step F: Remount the spindle unit with the new spring and upper spring plate.Assemble bonnet (42) and adjust to the spring range.

Step G: Secure the spring setting through the lock nut (21) and remount lifting device.

Assembling drawing of safety valve

47 Ball
42 Bonnet
41 Lifting lever
40 Split pin
39 Bolt
38 Screw
37 Spring
29 Cap
27 Gasket
26 Springplate
23 Lead seal
22 Drain screw
21 Lock nut
18 Ball
17 Adjusting screw
16 Slotted pin
15 Gasket
14 Spindle
13 Lift aid
12 Disc
10/25 Split cotters
9 Lift limitation ring
8 Hex. nut
7 Gasket
4 Spindle guide
3 Stud
2 Seat
1 Body

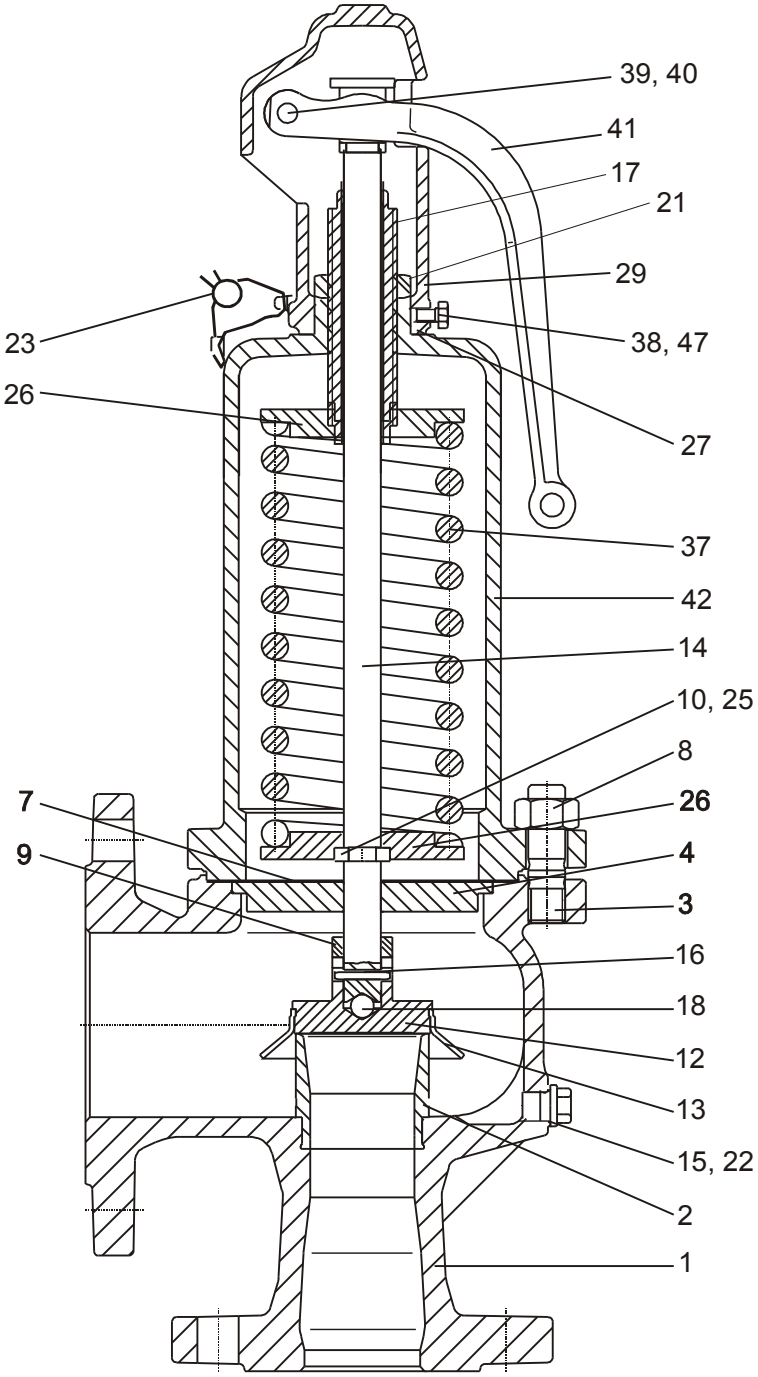


Figure 2 **om6040_01_safe_0x0056600en.wmf**

Temporary locking of a safety valve

1 General

During commissioning work or later tests of the opening pressure for the safety valves, only one safety valve should be checked at a time. This means that the other safety valve must be locked. The following instruction describes the temporary locking of a safety valve.

1.1 Procedure for locking of a safety valve

Step A: Remove the bolt (39) and split pin (40), see Figure 2.

Step B: Remove the lifting lever (41).

Step C: Unscrew the screw (38) and break the lead seal (23), if provided.

Step D: Unscrew the cap (29).

Step E: Place one or two bolts (48) on top of the spindle. The height of the bolts should be approximately 1-2 mm higher than the normal distance between the top of the spindle and the inside top of the cap (29).

Step F: Carefully screw on the cap until the spindle and bolts are locked. The safety valve will be completely locked when the bolts cannot be moved anymore.

Step G: The other safety valve can now be tested without any interference from the locked safety valve.

1.2 Procedure for unlocking of a safety valve

Warning: As soon as the test procedure for the safety valve has been carried out the locked safety valve must be unlocked.

Step A: Unscrew the cap (29) and remove the bolts (48).

Step B: Mount the cap (29) again and screw in the screw (38).

Step C: Mount the lifting lever (41), bolt (39), and split pin (40).

Step D: Provide the safety valve with a lead seal (23), if necessary. This depends on the local rules of the classification society.

Temporary locking of a safety valve

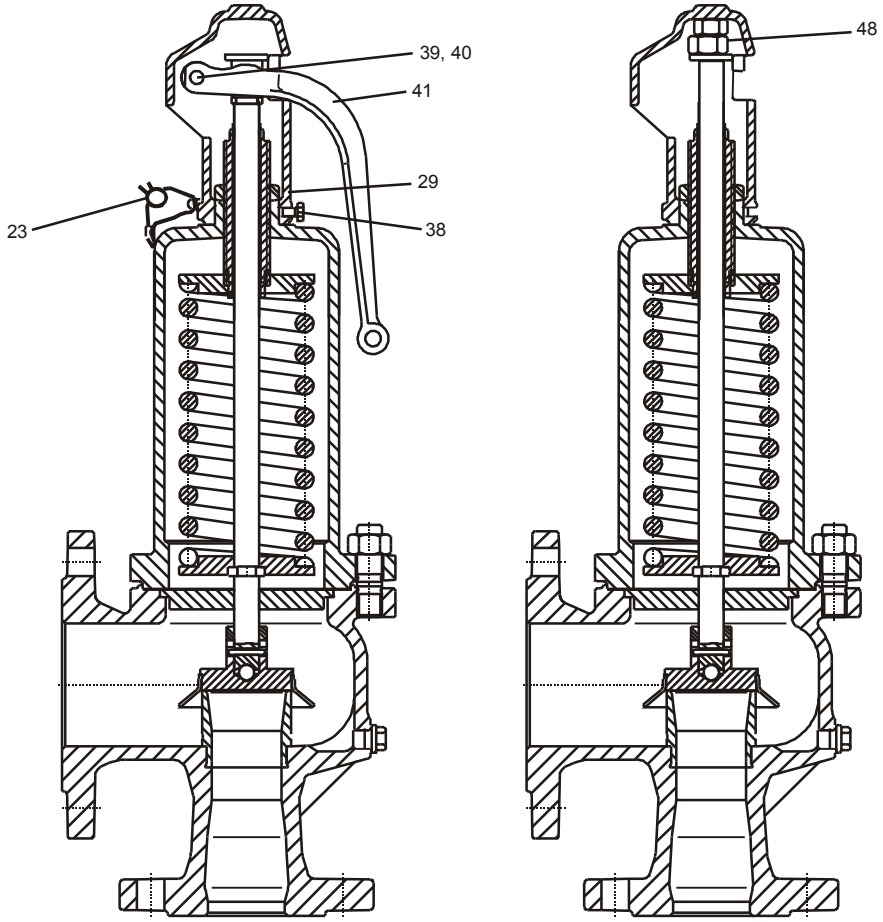


Figure 1 **om6040_02_safe_0x0056610en.wmf**

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Circulation flow measurement

OM9440_01 Circulation flow measurement.....31-2

Circulation flow measurement

1 Description

A water tube exhaust gas boiler requires a continuous forced circulation of water through the boiler as dry running would seriously increase the danger of a fatal soot fire.The forced circulation is provided by two circulating pumps. One of the pumps must be kept in continuous operation (also in port) and the other pump in automatic stand-by operation mode.

The circulationflow measurement control system will ensure a continuous water circulation. The system consists in general of an orifice, differential pressure indicator switch, and reducing valve, see Figure 1.

Illustration of the circulation flow measurement system

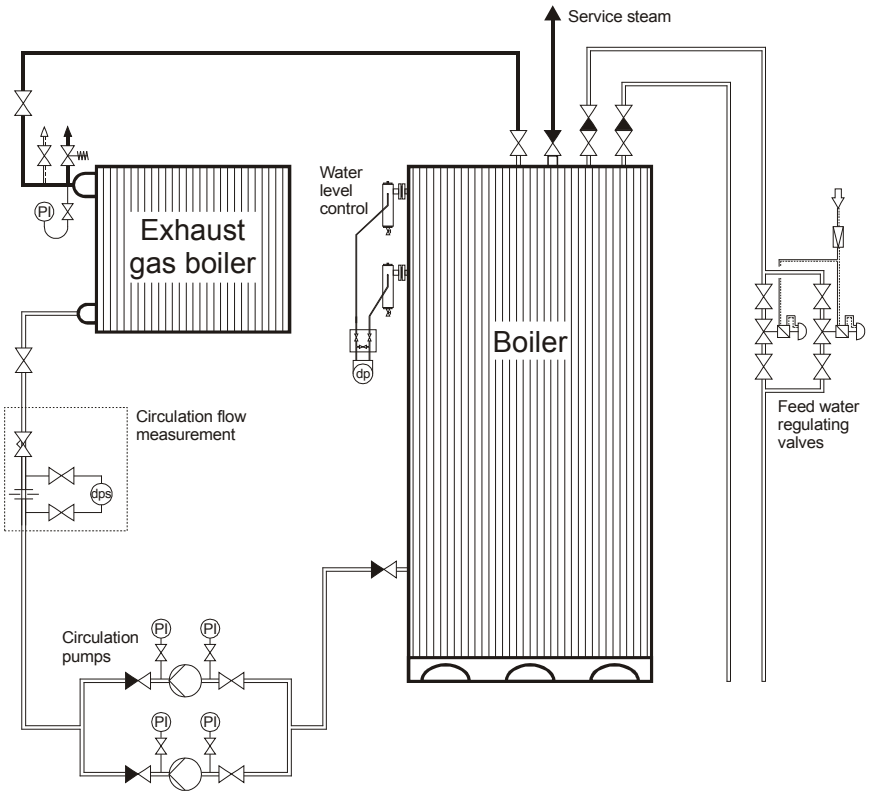


Figure 1 **om9440_01_fixcirx0063280en.wmf**

The reducing valve and the orifice will protect the pump by reducing the discharge flow variations resulting from different working conditions. The pressure drop in the

boiler and circulation return pipe as well as the required static lift (due to differences in specific volumes between water and steam/water mixtures in the return pipe) strongly depend on the boiler load and are smallest when no steam is generated. This might give rise to large flow variations which would not be desirable for a reliable pump operation. However, variations are reduced when the pressure drop across the reducing valve and orifice becomes considerable compared to the total back pressure (at design load). The reducing valve is adjusted (and locked in position) to obtain the circulation flow specified for the evaporator at boiler design load by observing the pressure drop across the orifice. The differential pressure indicator switch has two switches which should be used for:

- Alarm in case of low circulating water flow.
- Start of the stand-by pump in case of too low circulating water flow.

In addition to this, the stand-by pump should also be started in case of overload on the motor of the operational pump.

2 Design recommendations

The typical system is shown in Figure 1. The actual system may be slightly different but the following descriptions and recommendations would generally still be valid.

All the components of the circulating system have to be carefully designed and installed to ensure a reliable, continuous circulation in the exhaust gas boiler under all working conditions. The following working conditions must be taken into account when designing the circulating system:

Main engine not running

The boiler and pipes are all filled with water and pressure drops are relatively small. The total flow calculated under these conditions is the maximum expected circulating pump discharge flow. If this is unacceptable high then the design pressure drop across the reducing valve (and thereby also the pump discharge head) should be increased and the system recalculated at all load conditions described.

Start of the main engine

When the steam production starts, most of the water in the evaporator tubes and circulating return pipe will be forced into the oil-fired boiler / steam drum causing a certain (considerable) water level increase (swell). The feed water supply is temporarily closed until the water level has dropped again.

Steady load on the main engine

The medium in the evaporator and return line is a mixture of steam and water, and the pressure drop will increase considerably due to the high specific volume and velocity of the medium. The pressure drop depends on both main engine load and circulating water flow. The height between the water levels of the oil-fired boiler / steam drum and the exhaust gas boiler evaporator section should also be taken into consideration

when steam is generated due to the difference in the specific volumes of water to the evaporator and mixture of water and steam from the evaporator.

Changes in the steam demand

Sudden increases in the steam demand (e.g. due to tank cleaning, soot blowing, etc.) will inevitably cause the steam pressure to drop creating instability in the system. Boiling will start (close) below the water level surface of the oil-fired boiler / steam drum until the water temperature has stabilized again at the saturation point.The extent of this phenomenon depends entirely on the pressure decrease rate and size. Very large and sudden drops could cause boiling in the entire system. This again could cause cavitation in the circulating pumps eventually leading to pump failure.

Shut-down of the main engine

The steam volume in the evaporator section and return pipe will be replaced gradually by water. As the feed pump capacity is normally smaller then the circulating pump capacity, this will create a certain (considerable) water level decrease (shrink).

Circulating pump calculations

Special attention must be paid to the circulating pump installation as it is vitally important that the pumps are running without any problems at all.

Circulating pump capacity

The pump discharge flow must never be less than indicated and the discharge head must be sufficient to ensure this. If the exhaust gas boiler is supplied by Aalborg Industries please refer to the provided exhaust gas boiler calculations.As a guideline for the circulation at design load the combined pressure drop across the orifice and reducing valve should not be less than 1.0 bar.

The preliminary design derives from a calculation based on steady load on the main engine at design load (the position of the reducing valve is decided). The system then has to be calculated at full boiler load to confirm that the total circulating water flow is not less than the minimum specified. The positions of reducing valve remain unchanged.If the total flow turns out to be insufficient then the pump capacity must be increased and the system recalculated at design load and full load.The maximum flow determines the motor size required and the location of the pumps.

Circulating pump suction conditions

The overall aim is to ensure the best possible suction conditions so that cavitation in the circulating pumps will not occur under any working conditions. Cavitation involves serious consequences such as:

- Increased risk of a fatal soot fire due to reduced or even stopped circulation of boiler water.
- Excessive wear on impellers, bearings, etc.
- Troubles with leaking or destroyed mechanical shaft seals.

Cavitation will not occur as long as the NPSH (net positive suction head) available at the pump suction inlet is higher than the NPSH required by the pump.The following important points should be considered carefully:

- The NPSH required by the pump is entirely determined by the particular choice of circulating pump and depends on the discharge flow as shown on the pump performance curves. The pump manufacturer has various means for reducing the NPSH, if required (e.g. reduced speed, inducer, etc.).
- The suction pipe must be designed in accordance with the recommendations of the manufacturer. The water velocity should not exceed 0.5 - 1.0 m/s and the pressure drop in general should be as small as possible.
- The suction pipe must have a continuous fall from the suction valve on the oil-fired boiler / steam drum to the pump.

3 Installation

The installation details are described inthis section and in Figure 2 and Table 1. The important points mentioned below should be observed.

Sketch of the installation details

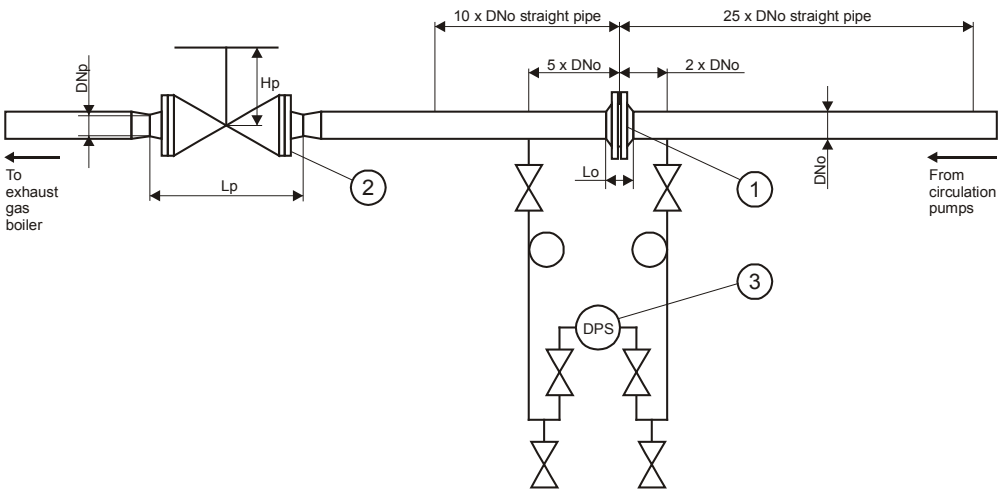


Figure 2 **om9440_01_fixcirx0063290en.wmf**

Installation details								
Size	Boiler design Steam output [kg/h]	Pos.1: orifice (with counter flanges)			Pos.2: reducing valve (with counter flanges)			
		DNo [mm]	Lo [mm]	kv flow Coeff.	DNp [mm]	Lp [mm]	Hp [mm]	kv flow Coeff.
1	0 - 700	32	93	6.83	20	233	189	7.0
2	701 - 1000	40	99	10.9	25	243	203	10.5
3	1001 - 1800	50	105	18.6	32	267	206	19.0
4	1801 - 3000	65	113	30.0	40	293	246	31.0
5	3001 - 4300	80	125	45.0	50	329	254	45.0
6	4301 - 7400	100	139	73.0	65	397	293	77.0
7	7401 - 11300	125	145	117.0	80	429	322	118.0

Table 1

3.1 Installation

3.1.1 Orifice

The orifice must be installed in a straight pipe with a length of at least 25 and 10 times the nominal pipe size before and after the orifice, respectively.The orifice must be properly centred by means of flange connection bolts.

3.1.2 Differential pressure indicator switch

The pipe connections for impulse legs should not be located closer to the orifice than 2 and 5 times the nominal pipe size before and after the orifice, respectively. The connections should be located on the lower side of the pipe for proper venting when installed in a horizontal pipe.

The impulse legs must be of sufficient length to avoid overheating of the pressure switch. The impulse legs must be provided with isolating valves close to the circulating water pipe. Additional valves at the pressure switch as well as drain cocks are recommended for easy blow-out of the impulse legs. The recommended minimum pipe size is 8 mm (OD).

The pressure switch should always be located below the lower impulse leg connection. The high pressure impulse leg (before the orifice) must be connected to “+” and the low pressure impulse leg connected to “-“. The impulse legs must be designed in such a way that there is no strain on the pressure switch.

3.1.3 Reducing valve

Easy access to the valve should be provided as the valve has to be adjusted and locked later when the boiler is put into operation. It is recommended that the valve is located as close to the differential pressure indicator switch as possible as the valve is adjusted in accordance with the readings of this instrument.

4 Operation

When the circulating system is ready for operation and has been filled with water, adjustments should be made in accordance with the following recommendations to ensure optimum operation security of the system (see also Figure 2).

4.1 Temporary adjustments

Step A: Close the reducing valve (pos. 2) when all other valves in the circulating / feed water lines have been opened.

Step B: Make sure that the impulse legs are completely filled with water and adjust the zero-point of the differential pressure indicator switch (pos. 3). Adjust the alarm switch (low flow) and the automatic stand-by switch to the specified set-points.

Step C: Open the reducing valve (pos. 2) approximately one turn on the hand wheel.

Step D: Start circulating pump No. 1 in accordance with instructions.

Step E: Adjust the stroke of the reducing valve to obtain the specified design pressure drop across the orifice (pos. 1). When the oil-fired boiler is acting as steam space for the exhaust gas boiler and the boiler water is already heated, the reducing valve should be opened slowly to avoid excessive thermal shock stresses on the cold exhaust gas boiler tubes.

Step F: Check that the pump is running within the permissible range.

Step G: Engage the automatic stand-by position of circulating pump No. 2.

Step H: Check the adjustment of the low flow alarm switch and the switch for stand-by pump start by throttling the reducing valve (pos. 2). Adjust the switches, if necessary.

Step I: Re-adjust the reducing valve. Check proper stand-by function on opposite operation (i.e. pump No. 2 running and pump No. 1 stand-by).

Step J: Re-adjust the reducing valve (pos. 2) to obtain the specified design pressure drop across the orifice (pos. 1). Lock the valve temporarily by means of the counter nut.

Step K: The system is now ready for a final adjustment during the sea trial.

4.2 Final adjustments

Final adjustments should be performed at steady boiler design load (i.e. steady main engine load, normal water level in the oil-fired boiler / steam drum, feed water control valve open, and steady steam output).

Step A: Adjust the reducing valve (pos. 2) to obtain the specified pressure drop across the orifice (pos. 1).

Step B: Lock the valve by firmly fastening the counter nut on the valve spindle. Remove the hand wheel in order to avoid any unintentional operation of the valve.

4.3 Operation

It is essential that the circulating water pumps are running continuously (also in port) without any problems.The system behaviour under all working conditions should be observed during the first period of operation, especially at full load, no load (main engine stopped) and large load variations.In case of low flow alarm at full load, the reducing valve and mixing valve should be re-adjusted (if required, to a higher total flow rate) in accordance with the above instructions.

Check that the circulating water flow does not exceed the permissible range of the circulating pumps at any load conditions.In case of automatic stand-by pump start, the cause should be investigated immediately so that the necessary action can be taken to eliminate the operational problems.

The impulse legs for the differential pressure indicator switch should be regularly blown through to remove deposits, if any. The switch should not be reconnected before the temperature is sufficiently low.

4.4 Setpoints

Set point record	
Object	**Pressure drop across orifice [bar]**
Design flow	0.5
Low flow alarm	0.33
Stand-by pump start	0.18

Table 2

Enter corresponding water flow (m^3/h) at design flow, low flow alarm (80% of design flow) and stand-by pump start (60% of design flow).Use throttle orifice performance curve (provided in the documentation) to find pressure drop across orifice at the specified 3 conditions.

4.5 Adjustment / setpoint record

The actual adjustments of the various components should be recorded below to provide valuable information for operation and maintenance. Re-adjustments should always be written down also.

4.5.1 Reducing valve

Reducing valve record			
Stroke adjustment (number of turns from closed position)			
Corresponding pressure drop across orifice [bar]			
Notes			

Table 3

4.5.2 Differential pressure indicator switch

Differential pressure indicator switch record			
Differential pressure at low flow alarm [bar]			
Differential pressure at stand-by pump start [bar]			
Notes			

Table 4

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Circulation pumps (MISSION XS)

051868	Technical data for circulation pumps	32-2
OM5540_26	Circulation pumps, type NCL	32-4

Technical data for circulation pumps

1 General data

- Project No.:.....051868-01-2, 051868-02-2, 051868-03-2, 051868-04-2
- 051868-05-2, 051868-06-2, 051868-07-2,051868-08-2
- Hull No.:.....H2390, H2391, H2392, H2393,
- H2403, H2404, H2405, H2406
- Classification society:.....GL&CCS H2390-91
- .....CCS H2392-93+H2403-06
- Pressure gauge calibration:.....bar
- Thermometer calibration:.....°C
- Language for signs:.....UK

2 Data for circulation pumps

- Pump type:.....NCLs26/170DRe
- Medium:.....Water
- Delivery head:.....35 m
- Pump capacity:.....16 m^3/h
- NPSH:.....1 m

3 Mechanical seal

- Type:.....Carbon Steel
- Cooling water quantity:.....200-400 l/h

4 Materials

- Casing:.....GGG 40.3
- Impeller:.....GG25
- Shaft:.....1.4021

5 Data for pump motor

- Motor type:.....ABB
- Power supply:.....3 x 440V, 60 Hz
- Rated output for motor:.....4,6 kW
- Rated current:.....7.5 A
- Starting method:.....Direct
- Starting current:.....6.3 A
- Power consumption:.....3.3 kW
- Revolutions:.....3500 r.p.m.
- Ambient air temperature:.....40°C
- Insulation class:.....F
- Degree of protection:.....IP55

Circulation pumps, type NCL

1 General

This chapter provides instructions for the installation, operation and maintenance of the standard pump, type NCL, seal-less centrifugal pump with magnetic coupling.

Note: It is essential that this instruction be thoroughly reviewed and that complete comprehension of the matters explained herein is attained before attempting installation and start-up.

The design, materials and workmanship incorporated into the pump are based on years of experience. They assure trouble-free service throughout the lifetime of the pump. However, like any rotating equipment, satisfactory performance depends on correct initial sizing, proper installation, periodic inspection, monitoring of operating conditions (temperature, vibration, flow) and prescribed maintenance. This instruction has been prepared to assist the operator in understanding the workings of the pump and to assure proper installation, operation and maintenance.

1.1 Factory inspection

Before delivery, all pumps are performance-tested in a factory test area at the specified speed. Test liquid is water at 20°C. Test pressure and the specified service conditions (capacity, differential head and absorbed power) are documented and reconfirmed by a shop expert. Inspection certificates B according to EN 10204 (DIN 50049 3.1 B), are available on request.

Certificates of further characteristics such as vibration, NPSH-value, noise level, etc., are available if specified in the purchase order.

The hydraulic test is performed in accordance with EN ISO 9906, class 2, the pressure test is performed with 1.5times the maximum operating pressure unless otherwise specified.

1.2 Identification

Name tag

A name tag is located on the bearing bracket of each pump providing the necessary information. When ordering spare parts or when contacting Aalborg Industries about problems, the pump model, size, serial number, and the item number of the required parts should be stated.

Identification according to explosion-proof directive

Since the effective maximum surface temperature does not depend on the according ignition source, but on the temperature of the pumped liquid, no identification ensues with a temperature class or a temperature. The symbol “X” has been integrated in the identification.

1.3 Safety

The chemical standard pumps of type NCL are manufactured in accordance with state of the Art-Technology and are safe to operate. However, these units bear danger if they are inexpertly installed or handled. Each person who is in charge of assembly, installation, operating and maintenance of NCL-pumps in a plant, must have read and understood the complete manual.

Special attention must be paid to the following points when operating the pump:

- Never operate the pump without correctly installed coupling guard.
- When maintaining the pump, power supply to the driver must be interrupted and secured against unauthorized restart.
- Never disassemble the pump before it is completely drained and cleaned from pumped liquid.
- Never use heat for pump disassembly.
- Never touch the shaft sealing parts while the pump is in operation and the pump casing is pressurised.
- Never start the pump without making sure that pump and suction line are completely filled with liquid.
- Never run the pump with the discharge valve closed or below minimum flow.
- Never run the pump dry.
- Never start operation without connection of the required auxiliary devices for supply and monitoring of the shaft sealing.
- Never operate the pump with the suction valve closed or with clogged suction strainer.
- If it cannot be excluded that larger solids (>0.5 mm) will be contained in the pumped liquid, a filter must be provided on the suction side. Suction strainers must have a net “free area” of at least six to seven times the suction pipe area. Screen with a mesh width of 480 micron is recommended. Pressure losses at rated capacity should not exceed 1 to 1.5 m. There should be a minimum of two pipe diameters of straight pipe between strainer outlet and pump suction flange.

2 Description

2.1 Application / defined use

The NCL-pumps are used where ever aggressive liquid is handled at extreme temperatures and where the shaft sealing must meet utmost requirements. NCL-pumps are suitable for a temperature range of -40°C up to +350°C and an operating pressure up to 40 bar. Common shaft sealing systems are available for the different pumped liquids.

For the defined use of the pump it is absolutely necessary that the pump is constantly filled with liquid. The maximum speed is determined with 2900 rpm at 50 Hz and with 3500 rpm at 60 Hz.

2.2 Construction

The model NCL is a single flow, single stage volute casing pump of back-pull-out design with end suction flange and vertical discharge flange. The flange to flange dimensions meet the standards of DIN EN 22858. Disassembly of the rotating hydraulic part is possible without removing the suction casing from the piping. If spacer-type couplings are used, the drive motor can remain on the base-plate while the hydraulic part is being disassembled.

2.2.1 Volute casing, part No. 102

The volute casing is sealed on the drive side by the intermediate casing. The intermediate casing is screwed to the volute casing by studs. The pumped liquid is sealed from the atmosphere by a confined gasket. Replaceable wear rings are available in the standard configuration. The volute casing can be delivered foot mounted or centre-line mounted. Complete drainage of the pump is possible through the drain connection at the bottom of the volute casing.

2.2.2 Impeller, part No. 233

The closed impeller are keyed to the pump shaft and secured by a cap nut with Heli-Coil insert, respectively by cheese head screws at frame 0. All impellers are dynamically balanced according to DIN ISO 1940 / part 1, grade G6.3. The impellers are also hydraulically balanced such that no thrust loads will occur within the performance range.

2.2.3 Intermediate casing, part No. 113

The intermediate casing connects the volute casing with the bearing bracket lantern respectively the bearingbracket. The shaft sealing is located in the intermediate casing. Interchangeable wear rings in theintermediate casing are standard.

2.2.4 Bearing bracket, antifriction bearings

The pump shaft is carried in generously dimensioned oil-lubricated antifriction bearings of heavy duty design,outside the pumped liquid. The antifriction bearing on coupling side is designed as a rigid bearing with pairedangular ball bearings in X-arrangement. A roller bearing -designed as movable bearing -is provided on the pump side. The oil level is controlled bya constant level oiler. Bearings have a lifetime of more than 25,000operating hours, even at upset conditions.

The radial seal ring, located in the bearing bracket lantern on pump side, is protected by an additional deflector that avoids entrance of possible seal leakage into the bearing bracket. The bearing bracket lantern is designed as a drip pan and provided with threaded leakage connection.

A special design of grease lubricated bearings is also available. For that, a fully synthetic water resistant non melting lubricant FDA H1 is used. In this case, no constant level oiler is required.

2.2.5 Jacketed design

The jacketed design is used in plants where the pumped liquid may cool down excessively or where the temperature of the liquid in the pump may drop below the solidification - respectively crystallisation point during downtime. For heating fluid should for instance be used heating steam or thermal oil.

The heating chamber of the volute casing is designed such that the whole front side including the discharge flange is pressurised by the heating fluid. Only this grants a constant and complete heating up of the liquid.

The jacketed intermediate casing provides a sufficient heating capacity within the shaft sealing area.

If jacketed pumps are subject to the explosion proof directive 94/9/EG, the prevailing temperature class requires special attention. The heating fluid must not exceed the allowable surface temperature of the prevailing temperature class.

2.2.6 Design with open impeller

Pumps with open impellers are used for handling aggressive polymerizing liquids which tends to lump and for gas contaminated liquids.

3 Shaft sealing

3.1 Mechanical seals, defined use

For each installed mechanical seal, separate operating and maintenance instructions are supplied giving information on the designations, materials, application limits, and operating methods.

According to the explosion proof directive 94/9/EG, mechanical seals should be considered as components and are therefore not provided with a CE-identification, but a declaration of conformity will be issued. The operating instructions for the mechanical seal indicate the arising surface temperature of the atmospheric seal part.

The defined use of the mechanical seal requires the availability of a constant liquid in the sealing gap.

3.2 Auxiliary equipment

Double mechanical seals additionally require a thermosiphon vessel. Installation, function, operating method, and monitoring devices are described in a separate instruction manual. Thermosiphon vessels are subject to the Directive 97/23/EG for pressure vessels.

4 Installation

Attention: Installation, foundation, and maintenance of pumps handling inflammable liquids AI, AII, AIII, B and other pollutive products may only be performed by companies or their personnel who possess the permission according to the local state regulations regarding the water protection law.

Inspect the pump as soon as it is received. Make notes of damaged or missing items on the receipt and freight bill. File any claims with the transportation company immediately. Check for identical speed on pump and motor name tag.

4.1 Storage requirements

Short term - less than six months

The normal packaging procedure is designed to protect the pump during shipping. Upon receipt, store in a covered and dry location.

Long term - more than six months

Preservative treatment of machined surfaces will be required for pumps of material GGG40.3 or GS-C25. Store the pump in a sheltered dry place. Rotate shaft several times by hand every three months by removing the coupling guard. If required, disassemble and inspect prior to final installation. Refer also to driver manuals for their long term storage.

4.2 Alignment of base-plate / base-frame on the foundation

Pre-condition for a proper and trouble-free operation of the pump is the accurate assembly of the entire unit. Improper installation inevitably results into increased vibrations and thus, to damage on the elastic coupling and the antifriction bearings. Therefore, the pump should be assembled by specially trained personnel only.

If the pump is delivered completely mounted with motor a careful assembly is guaranteed. After examining the unit on site for possible transportation damage, the following steps should be taken:

- Alignment of base-plate or base-frame by means of a water level.
- Elimination of unevenness in the foundation by suitable supports.
- Checking respectively realignment of the coupling after tightening the foundation bolts.

Note: The proper alignment of the entire unit prior to start-up is the responsibility of the owner only.

4.3 Alignment of flexible couplings, brand “KTR / FLENDER”

If motor and coupling is mounted on site by the owner, the following must be observed:

- Before starting alignment procedure, remove pump support foot from bearing bracket. Afterfinal alignment, assemble the support foot again, free of any stress.
- After inserting the keys into the shaft grooves, the coupling halves should be slid onto theshaft ends on pump and motor side until they flush with the shaft surface. It is important thatthe hub halves are slid on without excessive force. Wedging by using a hammer inevitablycauses damage to the bearings or sleeve bearings. After installation, the hub halves should be secured by threaded pins. If both coupling halves are mounted, the alignment of pumpand motor shaft relative to each other must be checked. Depending on the coupling design,this is done as follows:

4.3.1 Standard couplings without spacer, PKZ / B

Alignment is made by placing a straight edge across both coupling halves at three points staggered by 120degree (shown in Figure 1). Any possible displacement becomes visible as a light gap and must becorrected.After the motor adapter screws are tightenedfinally, the coupling space “B” must be checked.

Standard couplings without spacer, PKZ / B

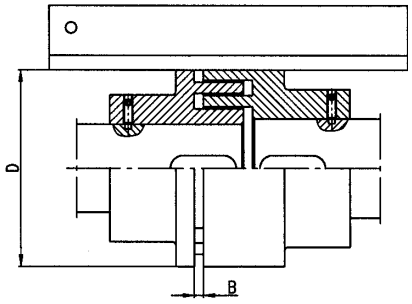


Figure 1 **om5540_26_ncl08x0054430en.wmf**

Measures for standard couplings without spacer, PKZ / B		
Coupling diameter, D [mm]	**KTR, B [mm]**	**FLENDER, B [mm]**
80 – 125	2 – 4	2 – 4
131 – 225	2 – 6	2 – 6
250 - 288	2 - 7	3 – 8

Table 1

4.3.2 Spacer-type couplings, PKA / H

The advantages of the back-pull-out design -such as disassembly of rotating parts without removingthe casing from the piping -can only be utilized whenusing spacer-type couplings (couplings with removablepiece). In this case, the driver can also remain on thefoundation.An alignment check is made by using a dial indicator asshown in Figure 2. The distance “X” betweenthe pre-mounted coupling halves complies with the spacerlength.

Alignment check

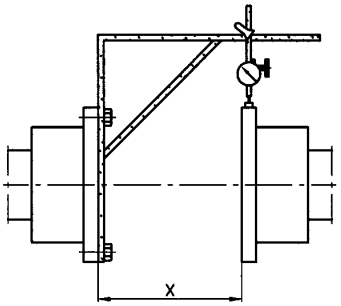


Figure 2 **om5540_26_ncl09x0054440en.wmf**

Two types of misalignment

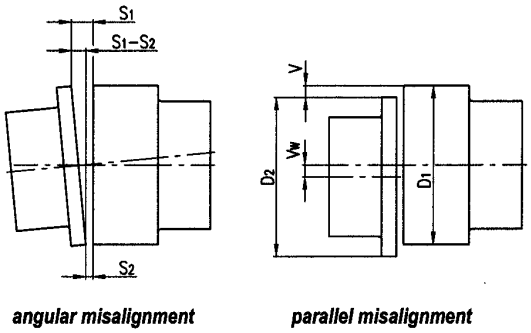


Figure 3 **om5540_26_ncl10x0054450en.wmf**

Use the dial indicator as shown in Figure 2and determine the parallel misalignment V_w, see Figure 3. Realign if V_w exceeds 0.1 mm.Place the dial indicator now at the coupling end and determine the angular misalignment S_1 -S_2, see Figure 3.

The units are lined up if the following alignment error E_z is not exceeded:

- The available angular misalignment is:
- S_1 -S_2
- The parallel misalignment V_w is:
- $V_w = V – ((D_2 – D_1) / 2)$
- The available error $E_v$is:
- $E_v = V_w + (S_1 - S_2)$
- Allowable misalignment E_z:
- E_z = 0.3 mm at 3000-3500 min^1
- E_z = 0.5 mm at 1500-1750 min^1

If one of the two errors is zero, the allowable deviation for the other error may be fully utilized.

Before mounting the distance sleeve, check direction of rotation of the driver (clock-wise when viewing theshaft end of the pump). Assembly of the bipartite distance sleeve

is done by joining both parts -which areprovided with claws and rubber packages -by hand such that the gap “B” is zero, see Figure 4. Insert theseparts between the hub-half faces on motor and pump side and fit them into the centrings. Screw bothintermediate parts to the hub halves and tighten the screws evenly and cross wise.

Measures of the coupling space “B”		
Coupling diameter, D [mm]	**KTR, B [mm]**	**FLENDER, B [mm]**
80 – 86	4	4
97 – 195	5	5
200 - 288	6	6

Table 2

Check of the coupling space “B”

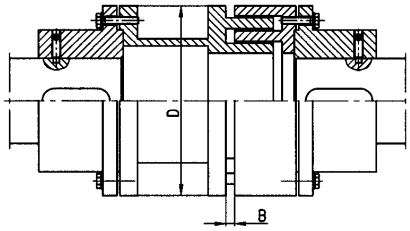


Figure 4 **om5540_26_ncl11x0054460en.wmf**

4.4 Special coupling design

When using couplings of different designs from other manufacturers the special alignment instructionsthat apply to such couplings must be considered.

4.5 Documentation according to directive 94/9/EG

Couplings are required for a safe operation of the pumps. They are defined to transmit energy and therefore,are subject to the Explosion Proof Directive and will have a CE-marking. A declaration of conformity will alsobe supplied.

4.6 Coupling guard

Never operate pumps without properly mounted coupling guards (shock protection). If thecoupling guard is manufactured and supplied by Aalborg Industries, compliance with the validtechnical safety requirements -such as proper stability, sufficient distance to rotating partsand no use of light metal for operation in hazardous areas -is guaranteed. If the couplingguard is provided by the user, it must be in accordance with the above mentionedrequirements and meet the standard EN 809.

4.7 Piping

The pump must be stress-free connected to the piping. That means, the connecting flangesof the pipes must be in exact alignment with the pump flanges. Never draw piping into placeby imposing force. If piping will be cleaned or flushed after installa-

tion, suction anddischarge opening must be closed by blanks. No solids must get into the pump duringstandstill.

General

- All piping must be supported and must line up naturally with the pump flange.
- Do not make final connection of piping to pump unit until grout has hardened.
- Piping that handles hot liquids, require proper installation of expansion loops so that linearexpansion of piping will not cause misalignment.
- Piping should be arranged to allow pump flushing and draining prior to the removal of pump forservicing.
- Gasket installation and materials must be suitable for the service.
- The allowable forces and moments must be considered.

4.7.1 Suction pipe

When using volute casing pumps, care must be taken for the NPSH-conditions. The suctionpiping requires careful design for these pumps. It is especially important that theavailable NPSH of the system is exactly determined.

- NPSH-available ≥ NPSH-required + minimum 0.5 m

The suction pipe should be flushed before connection to the pump and the following be considered:

- Use of elbows close to the pump suction flange should be avoided. There should be a minimum of two pipe diameters of straight pipe between the elbow and suction inlet.
- Suction piping must never be of smaller diameter than the pump suction.
- Reducers, if used, must be eccentric at pump suction flange as shown in Figure 5.
- Suction strainers if used must have a net “free area” of at least six to seven times the suctionpipe section. Screen with a mesh width of 480 micron is recommended. Pressure losses atrated capacity should not exceed 1 to 1.5 m. There should be a minimum of two pipediameters of straight pipe between strainer outlet and pump suction flange.
- Separate suction lines are recommended when more than one pump is operating from thesame suction vessel.
- Never connect a larger suction pipe directto the pump suction flange. Flow eddiesreduce the free flow area of the pump.Additional losses reduce the calculatedavailable NPSH, cavitation can occur.

The use of reducers

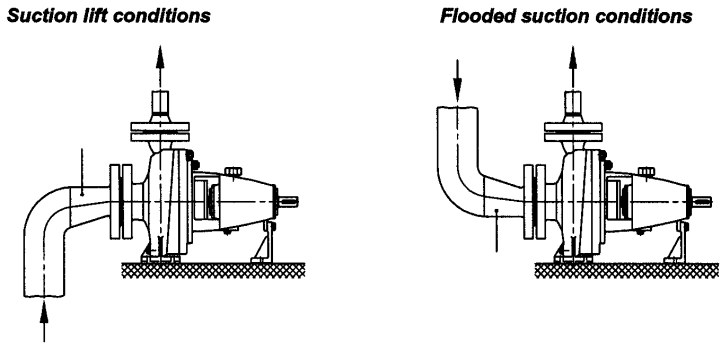


Figure 5 **om5540_26_ncl12x0054470en.wmf**

Suction lift conditions

- Suction pipe must continuously slope upwards towards pump suction to eliminate air pockets.
- All joints must be air tight.
- A foot valve should be provided to allow proper filling of pump and suction line before start-up.
- Connection must be provided to fill suction line and pump with liquid before starting the pump.

Flooded suction conditions

- An isolation valve should be installed in suction line to permit closing of the line for pumpinspection and maintenance.
- Suction pipe should slope gradually downwards to the suction flange.
- The suction pipe shall be submerged sufficiently below the minimum liquid surface to preventvortex and air entrapment at the source.

4.7.2 Discharge pipe

- Isolation valve should be installed in discharge line to permit closing of the line for pumpinspection and maintenance. If an additional check valve is foreseen, it should be placedbetween discharge flange and isolation valve.
- Diffusers, if used, should be placed between discharge flange and isolation valve. Maximumallowable opening angle 8°.
- Cushioning devices should be used to protect pump from surges and water hammer, if quick-closing valves are installed in system.
- If a by-pass pipe is provided for obtaining a minimum flow, the by-pass pipe must lead back tothe suction source -not to the pump suction pipe.

4.7.3 Final piping check

After connecting piping to the pump:

- Rotate shaft several times by hand to be sure that there is no binding and all parts are free.
- Check alignment according to the alignment procedure outlined in section 4.2 and 4.3 to maintainabsence of stress through piping. If stress exists, correct piping.

4.7.4 Allowable forces and moments

Illustration of forces and moments

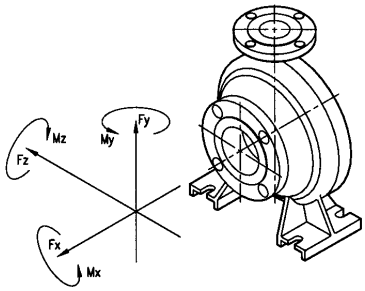


Figure 6 **om5540_26_ncl13x0054480en.wmf**

Allowable forces and moments												
Pump size	Suction side, forces and moments						Pressure side, forces and moments					
	Fx	Fy	Fz	Mx	My	Mz	Fx	Fy	Fz	Mx	My	Mz
	[N]	[N]	[N]	[Nm]	[Nm]	[Nm]	[N]	[N]	[N]	[Nm]	[Nm]	[Nm]
26/170	800	520	640	415	320	207	570	710	462	370	280	185
26/210												
32/165	890	580	710	460	355	230	605	755	490	390	300	195
32/200												
32/250												
40/165	1100	680	870	670	490	310	640	800	500	415	320	210
40/210												
40/250												
40/320												
50/165	1335	890	1070	950	720	475	710	890	580	460	355	230
50/200												
50/250												
50/330												
65/165	1780	1155	1425	1330	1005	680	880	1070	700	670	490	310
65/200												
65/250												
65/320												
80/165	2350	1500	1850	1700	1280	850	1070	1335	890	950	720	475
80/200												
80/250												
80/320												
100/200	2350	1500	1850	1700	1280	850	1425	1780	1155	1330	1005	680
100/250												
100/320												
100/400												
125/250	3115	2045	2490	2305	1765	1180	1880	2350	1535	1700	1280	850
125/320												
125/400												
150/250	4895	3115	3780	3530	2580	1765	2490	3115	2045	2305	1765	1180
150/320												
150/400												
150/500												
200/250	4895	3115	3780	3530	2580	1765	3780	4895	3115	3530	2580	1765
200/320	6695	4450	5340	5020	3800	2440	3780	4895	3115	3530	2580	1765
200/400												
200/500												

Table 3

4.8 Insulation

Insulation, if foreseen for pumps handling hot liquids, should cover the volute casing and intermediate casingonly. To avoid overheating of the antifriction bearings, a completely heat dissipation by radiation must beguaranteed in the area of bearing bracket. Thus, insulation of antifriction bearing and bearing bracketlantern is not allowed.

Insulation can also be required if the specification regarding maximum surface temperature within theexplosion proof ness must be fulfilled. This is especially the case if the liquid temperature exceeds theallowable temperature of the given temperature class.

4.9 Safety devices

All safety devices for temperature, vibration, leakage etc, must be properly connected to the motor circuit respectively the control panelbefore start-up. Consider special descriptions and wiring diagrams.

4.10 Earth connection

An earth connection at the base-plate or frame is provided as standard. Earth connections must beplugged in any case.

4.11 Drive motor

The drive motor is an electric device and must be connected by skilled and trained personnel only. Allapplicable state and local laws and safety regulations as well as the motor instruction manual must beobserved.

Note: The proper connection of the electric motor including the provided pump protection devicesthe responsibility of the owner only.

5 Operation

5.1 Start-up procedure / lubricants

When the before mentioned instructions have been performed, and the protection strainer on suction side hasbeen checked and possible blanks have been removed, the pump can be put in operation as follows:

Step A: Before start-up, the bearing bracket must be filled with oil.If start-up follows a longer storage period of the pump, it is recommended to fill the bearing-bracket first with petrol and rotate the pump shaft several times by hand to clean the bearingsfrom possible impurities.

Step B: For filling up the bearing bracket, remove the vent plug 913 from the top of the bearing bracket (see the sectional drawings later in this chapter).

Step C: Fill in the oil through the vent plug connection -at back-folded constant level oiler -until thefilling level reaches the connection elbow of the oiler. Then, fill the oil reservoir in accordancewith Figure 7 and put it back to upright position. The oil will run now from the oil reservoirinto the bearing bracket until the required level is reached. As long as the oil reservoir is filledduring operation with oil, a sufficiently oil filling in the bearing bracket is ensured. If the oil level inthe reservoir drops down to about 1/3 of the total height, refilling is recommended.

Step D: After the first start-up of new pumps, the oil filling should be renewed after 200 operating hours,then once a year.

- Filling volumes:
- Frame size 0/I = 0.75 litre
- Frame size II = 1.00 litre
- Frame size III = 1.25 litre
- Frame size IV = 2.70 litre

Filling the level oiler

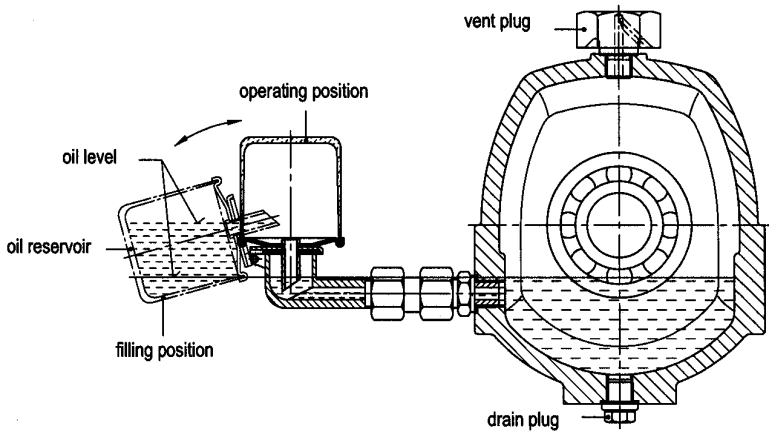


Figure 7 **om5540_26_ncl14x0054490en.wmf**

Step E: If the following mentioned lubricants are not available and no others are specified by the factory,any motor oil with a viscosity of 68 mm^2/sec at 40°C can be used.

Step F: For the design with grease lubrication, a fully synthetic water resistant non melting lubricantFDA H1 should be used, e.g. GOLD LUBE PLUS.

Lubricants for antifriction bearings			
Aral	**Shell**	**BP**	**Esso**
Aral Vitam GF 46 Aral Vitam GF 36	Shell Rimula X X 20W-20	BP Energol VS 68 (ISO) BP Energol HPL 68 (ISO) BP Energol HD SAE 20W-20	Esstic 68 Esstic 50 Essolube HDX 20W/20
Fina	**Fuchs**	**Mobil**	**Texaco**
Fina Cirkan 68 ISO Fina Solna 68 ISO Purfina Motor Oil SAE 20W-20	Renolin 206 Renolin B 15 Renolin HD 20W-20	Mobil Vactra Oil Heavy Medium, Mobil HD 20W-20	Rando Oil 68 Ursa Oil P 68 Ursa Oil Extra Duty SAE 20W/20

Table 4

Step G: If cooling is provided, open valves in the cooling line and check the flow.

Step H: Pumps with heating jacket, type NCLb, need pre-heating prior to start-up.Remove coupling guard and turn the pump shaft by hand.Driver must be locked and secured against unauthorized re-start. If the shaft is blocked, theproduct inside the pump is not completely liquefied. A start-up at these conditions is notpossible. Continue pre-heating until easy rotation is possible. Pre-heating time:30 minutes to 1 hour.

Step I: Fill up pump suction pipe completely with liquid. Open suction valve, close discharge valve.

Step J: If a thermosiphon vessel is available, fill it with buffer fluid up to middle of sight glass. Underconsideration of corrosion resistance and the compatibility with the pumped liquid and theenvironmental conditions, any liquid can be use. The used buffer fluid, however, must be free ofsolids, may not tend to sedimentation, should have a high boiling point, high heat capacity, andthermal conductivity.

Note: Instructions given in the manual for thermosiphon vessel must be observed.

Step K: The sealing chamber must thoroughly be vented in order to avoid dry running and consequentdamage of the seal faces.

Note: Instructions given in the manual for mechanical seal must be observed.

Step L: If all points mentioned before have been checked, start driver briefly for a few seconds, shut offand check for smooth run down and the proper direction of rotation (clockwise direction whenviewing the shaft end). The pump must not come to a jerky stop after shut off.

Step M: If no problems occur after the test start, the pump can be restarted finally.

Step N: Immediately observe the pressure gauges. If discharge pressure is notquickly attained, stop driver, re-prime and attempt to restart. Adjust dischargevalve until rated flow is obtained.

Note: Continued operation with dead headed pump will cause overheating withinthe pump. Cavitation, break down of the mechanical seal through flashing ofthe liquid in the sealing gap and thus, temperature increase at theatmospheric seal, may be the consequences and must be avoided in anycase.

5.2 Operation

Step A: Always adjust capacity with the valve in discharge line. Never throttle flow bysuction valve.

Step B: Pump and motor should always operate steadily and free of vibrations. A sudden increase of running noise is always a sign of possible trouble.

Step C: The ampere load specified on the name tag of the drive motor must not be exceeded.

Step D: During operating with a capacity higher than rated and stamped on the pump name tag, ensure that the NPSH-available > NPSH-required.

Step E: Bearing temperature and oil level in the constant level oiler must be controlled regularly.

Step F: Isolation valves in the auxiliary pipes must always be opened during operation.

Step G: After a longer operation time, the surface temperature at the wetted casing parts – especiallythe volute casing -will adjust itself according to the liquid temperature. This requiresconsideration within the bounds of the explosion proof ness and the T-classification.Concerning the surface temperature at the mechanical seal, adhere to the instruction manualfor the selected seal.

5.3 Shut down

Step A: Close valve on discharge side slowly.

Step B: Immediately after closing the valve, the driver must be shut off and checkedfor steady run-down.

Step C: Close valve on suction side.

Step D: Close auxiliary seal flushing.

Step E: Close heating pipes for jacketed pumps.

Step F: Close cooling water when the pump has cooled down.

Step G: For shut-down in winter, drain pump and cooling chambers. Open condensate drain connectionat jacketed pumps.

5.4 Preventive maintenance

The NCL-Pumps with oil lubricated antifriction bearings and constant level oilers are designed to bemaintenance-free and do not require any adjustments. But without doubt, a routine maintenance programcan extend the lifetime of the pump and can prevent serious damage. Well maintained equipment will lastlonger and requires less repair work. The operator should keep maintenance records to help pinpoint potential causes ofproblems.

5.4.1 Routine maintenance

Gauges

In the suction or discharge line -right in front or behind the pump - manometer or vacuummeter should be provided for controlling operating conditions. The maximum pressure ofthese gauges should be 50% above the operating pressure. Install isolation valves and condensersin the measuring lines in front of the gauges.

Vibration monitoring

All rotating pump parts are properly dynamically balanced, according to DIN ISO 1940/part1, gradeG 6.3. During performance tests, the pump is checkedfor vibration and it is ensured that a rate of velocity = 2.8mm/s will not be exceeded. During operation a vibration rate of 4.5 mm/s isallowable. If this rate is exceeded, change ball bearings immediately.

If a vibration rate of more than 4.5 mm/s is noted at start-up of a new pump, the reasonmay be excessive stress from the piping connections or unstable foundation. Please improvebefore continuing operation.

The bearing bracket is also available with four location holes M8, staggered each by 90°, to installmeasuring studs for vibration monitoring in accordance with the SMP-method (shock-pulse-method), see Figure 8. It is recommended to perform vibration measurements in regular intervals and to keeprecords of the measured values.

Possible appearing damages toantifriction bearings can be recognisedin time and serious failures can beavoided by a preventive replacementof the ball bearings.

Measuring points for vibration monitoring

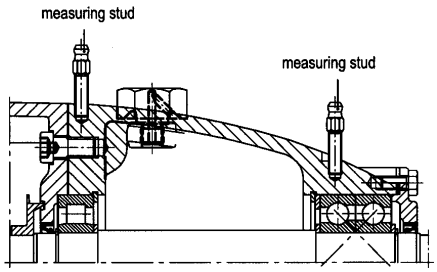


Figure 8 **om5540_26_ncl15x0054500en.wmf**

5.5 Bearing maintenance

Obtainment of a long service life requires careful monitoring and maintenance of the pump bearings. Thisincludes for instance a constant check of the oil level in the bearing bracket and the bearing temperature.The bearing temperature should not be more than 50-60°C above the ambient temperature andnot exceed 80-90°C.

The oil filling must be changed yearly. The vent holes in the vent screw must not get clogged.For renewing the grease lubrication, the antifriction bearings must be dismantled.

5.6 Trouble shooting

If the pump does not develop the required performance, or if other unexpected thingshappen during start-up, please see the trouble shooting list in Table 5.Before calling Aalborg Industries or disassembling the unit, please check carefullythe environment of the pump. Check simple things, such as forgotten blanks in the piping, motor and pumpspeed in accordance with the labels, wire connections in the terminal box. Make sure that control devicesare properly connected and measuring instruments are calibrated.

Trouble shooting list		
Failure	**Problem**	**Remedy**
No liquid delivered at start-up	Suction line is not completely primed or insufficiently filled. Block valve in suction line is closed, blanks have not been removed. Feed line or suction line contain air pockets which cannot be eliminated by filling up because piping is incorrectly laid out.	Fill again pump and suction line. Check foot valve in suction line. Open valve, remove blanks. Check layout of the pipes. Suction line at suction lift conditions must continually slope upwards, at flooded suction conditions gradually slope downwards to the pump.
Pump does not obtain rated flow or head after start-up	Block valve in suction line is not opened completely. Motor speed is not identical with the pump speed according to the name tag. Strainer basket filter on suction side is clogged. Suction pipe is leaking. Pump rotates in wrong direction. Differential head of the system is higher than specified in the order and stamped on the name tag. Viscosity of pumping liquid is higher than stated in the order. Capacity reduces at increasing operating temperature. NPSH-available < NPSH-required. Pump cavitates.	Open valve. Change motor, check up with application engineer. Clean the filter. Retighten flange connection on suction side. Change motor wiring. Check with the application engineer whether the pump can at this stage be equipped with a larger impeller (check power rating of the motor). Check with application engineer. Increase feed head by raising the liquid level on suction side, improve NPSH-available. Installation of inducer improves NPSH-required. Check with application engineer. As described before. Cavitation creates slide bearing failure. Never operate pump under such upset conditions.
Motor requires excessive power	Differential head lower than rated. Density or viscosity is higher than specified in the order. Motor speed is not identical with the pump speed according to the name tag.	Throttle discharge valve to obtain the capacity according to the name tag. Correct impeller diameter. Check with the application engineer. Change motor.
Failure	**Problem**	**Remedy**
Pump is noisy and vibrates after start-up	Coupling between motor and pump is incorrectly mounted or aligned. Base not rigid enough. Foundation bolts are loose. Pump cavitates.	Check and correct according to section 4.3/4.4. Before removing the coupling guard, make sure that driver is shut off and secured against unauthorized restart. Stabilise and support the area of pump- and motor feet. Tighten foundation bolts. NPSH-improvement.
Pump gets noisy and vibrates after a longer operating time	Pump ball bearings are worn out. Motor ball bearings are worn out.	Replace ball bearings. Use brand new originally packed bearings only. Replace bearings according to the instructions in the motor manual.

Trouble shooting list		
Ball bearings run hot	Misalignment of elastic coupling. Coupling space “B” is not maintained. Motor shows axial load. At high-speed operation, the ball bearings are not sufficiently cooled by the motor exhaust air.	Realign coupling as described in item 4.2 and 4.4. Correct spacing according to item 4.3 and 4.4. Installation of a fan wheel to the coupling half on motor side. (Temperature reduction 10-15°C).

Table 5

5.7 Impeller trimming

Any existing unbalance of the impellers is eliminated by balance grooves provided in the impeller shrouds. It is recommended to trim the impeller shrouds only that far, that diameter D_{min} is maintained, see Figure 9. Otherwise, the impeller must be rebalanced after trimming.

- D_{rtd} = rated impeller diameter
- D_{req} = required impeller diameter
- D_{min} = minimum allowable shroud diameter; D_N + 5 mm
- D_N = outer diameter balance groove

Impeller trimming

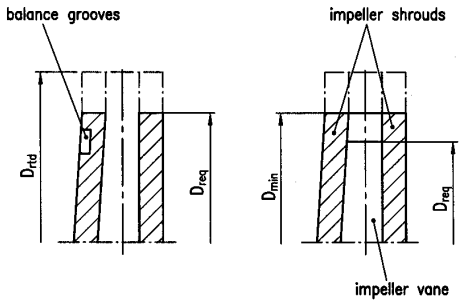


Figure 9 **om5540_26_ncl16x0054510en.wmf**

6 Disassembly

6.1 General

Note: When disassembling the pump unit, the coupling guard must be removed inany case. Prior to this the power supply to the motor must be interrupted andthe driver secured against unauthorized restart. Before the rotating part orthe complete pump is disconnected from the piping, the pump must bedepressurised, cooled down, completely drained and thoroughly flushed ifhazardous liquids have been handled. During disassembly and drain-age,protective clothing, gloves and eye glasses must be used.

Independent from the installed shaft sealing system proceeds as follows:

Step A: Drain and dismantle available fluid reservoirs

Step B: Remove auxiliary piping and monitoring devices.

Step C: Drain cooling and/or heating jackets.

Step D: Remove spacer from coupling if available, otherwise disconnect and remove drivemotor.

Step E: Remove support foot at bearing bracket.

Step F: Drain oil bath in the bearing bracket completely through drain plug. Remove constantlevel oiler. Collect oil in a bucket, protect environment.

Step G: Remove pump from piping system if required.

Step H: Loosen and remove adapter nuts 920.2 from intermediate casing 113, together with thewashers 554.2, see Figure 10.

Step I: Loosen connection between intermediate casing and volute casing by jack screws (threadholes available in the intermediate casing).

Step J: Remove complete bearing bracket unit and clamp it in vertical position in a work bench or in achuck jaw according to Figure 10. Protect shaft against any damage.

Step K: Loosen and remove impeller nut 922 (right hand thread) and respectively inner hexagon cap screw914.12 (at frame 0).

Step L: Remove impeller 233 by puller. Place the puller under the vanes to avoid damage to theshrouds.

Step M: Remove key 940.1.

Disassembly

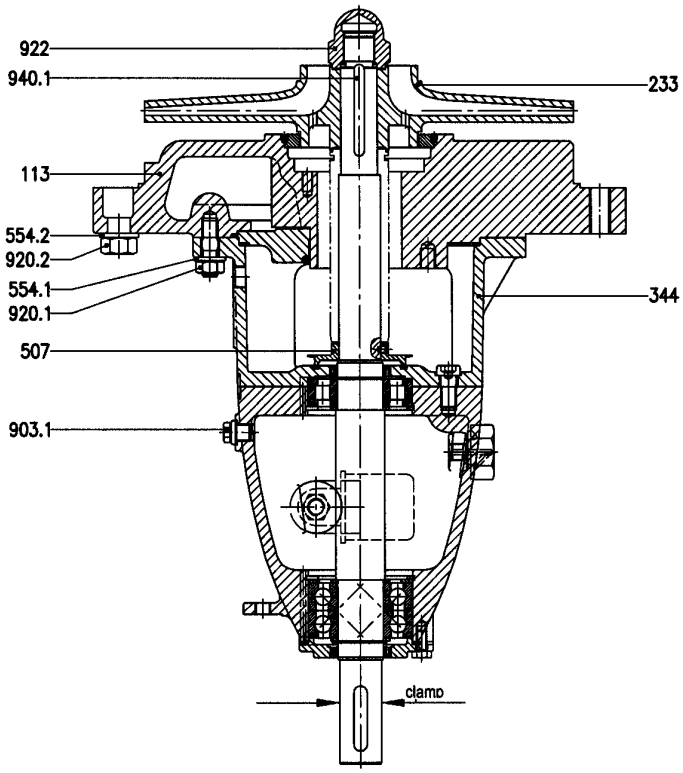


Figure 10 **om5540_26_ncl17x0054520en.wmf**

6.2 Disassembly of mechanical seal

For disassembling the mechanical seal, follow the instructions given of the seal manual.

6.3 Open impeller design

Pumps with open impellers, NCLo-types are provided with an interchangeable wear disk 556.2 serving alsoas packing ring or seal ring support, see Figure 11. When disassembling the shaft sealing, remove at first the innerhexagon cap screw 914.1 and then the wear disk.

Open impeller design

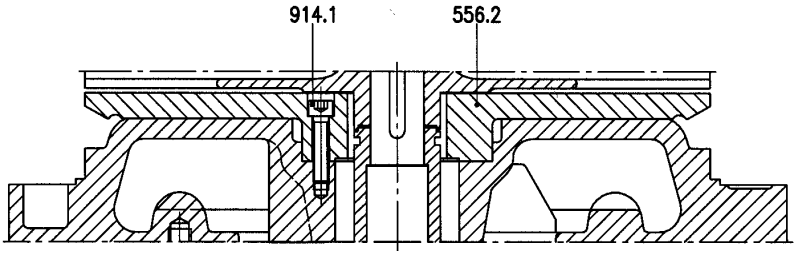


Figure 11 **om5540_26_ncl18x0054530en.wmf**

6.4 Replacement of antifriction bearings

The following procedure concerns the replacement of antifriction bearings after the steps according to section6.1 to6.3 have been performed.

Step A: Loosen and remove the hexagon nuts 920.1 from the bearing bracket lantern 344, togetherwith the washers 554.1, see the sectional drawings later in this chapter.

Step B: Pull off the intermediate casing 113.

Step C: Loosen the grub screw 904.1 and remove the deflector 507.

Step D: Loosen and remove the hexagon head bolts 901.2 and pull off the bearing cover 360, completewith shaft seal ring 421.2.

Step E: Press the shaft down with a drilling machine spindle and out off the bearing seat 325.

Step F: Loosen and remove the inner hexagon cap screws 914.2 from the bearing bracket lantern 344,together with the spring washers 930.3. Pull off the bearing bracket lantern. Press the outerring of the roller bearing 322 out off the seat in the bearing bracket 330.

Step G: Remove the inner ring of the roller bearing from the shaft, using a puller. Remove the disk550.1.

Step H: Remove the circlip 932.2 and the disk 550.3from the shaft and pull off the angular ball bearing 325 from the shaft using a puller.

Step I: Removethe disk 550.2.

Step J: When replacing antifriction bearings,only use brand new originally packedbearings as listed in Table 6.

Antifriction bearing types		
Frame size	Antifriction bearings	
	322	325
0	NU 306	2 x 7306 BUA
I	NU 306	2 x 7306 BUA
II	NU 307	2 x 7307 BUA
III	NU 409	2 x 7311 BUA
IV	NU 411	2 x 7313 BUA

Table 6

7 Inspection

7.1 Impeller / wear ring

7.1.1 Closed impeller / wear ring

The impeller must be free of corrosion and may not show any scouring or mechanical damage. The sliding surfaces in the wear ring area may not have any visible grooves. Impeller diameters have to be measured. The total clearance in new condition is 0.6 mm. If the clearance exceeds 0.9 mm, the wear ring must be replaced.

7.1.2 Open impeller / wear disk

If NCLo-pumps are disassembled because of lack of performance while handling abrasive liquids, it can be assumed that the impeller as well as the wear disk on suction side must be replaced. The wear disk on discharge side can be reworked if the available grooves are not exceeding 0.5 mm.

7.2 Volute casing / intermediate casing

Possible pitting must not exceed a depth of 1.0 mm. Centrings and seats of gaskets or O-rings must not show any mechanical damage, corrosion, or erosion. Circulation holes in the intermediate casing must be free of solids or sediments.

7.3 Bearing bracket 330 / bearing bracket lantern 344 / antifriction bearing

The bearing bracket lantern must be free of corrosion which may be caused by seal leakage (possibly use corrosion resistant material). Centrings may not be damaged. The bearing bracket must not show any cracksat the area of support foot.

Ball bearing seats must be measured. The bearing bracket or bearing bracket lantern must be replaced if themaximum bore diameters are exceeded (see Table 7).

Maximum bore diameter			
Bearing bracket	**Bore "bearing bracket " lantern [mm]**	**Bore "bearing bracket" pump end [mm]**	**Bore "bearing bracket" coupling end [mm]**
0	72.01	72.01	72.01
I	72.01	72.01	72.01
II	80.01	80.01	80.01
III	120.01	120.01	120.01
IV	140.01	140.01	140.01

Table 7

The bearing bracket lantern must not show any cracks at the area of the adapter flange.Ball bearings must be in good condition. They must be replaced if the pump was operating for some time.Check the radial seal rings for cracks on the lip seals.

7.4 Pump shaft

The pump shaft must be free of corrosion and pitting at the area of shaft sleeve and impeller seat. Visiblegrooves at the area of the radial seal rings are not acceptable. Ball bearing seats and impeller seats must bemeasured, and shafts must be replaced if the measured values are below the minimum diameters (see Table 8).

Minimum diameter of ball bearing seat			
Frame size	**B all bearing seat pump end [mm]**	**Ball bearing seat coupling end [mm]**	**Impeller seat [mm]**
0	30.00	30.00	17.99
I	30.00	30.00	21.99
II	35.00	35.00	27.99
III	45.00	45.00	37.98
IV	55.00	55.00	47.98

Table 8

7.5 Shaft sleeves

Shaft sleeves must be free of corrosion. Visible grooves or damage on O-rings, throttle bushings andpacking rings are not acceptable. Replace if required.

7.6 Seal end plate

Seal end plates must be free of corrosion. Centrings, gasket seats, O-ring seats must not show anymechanical damage or wear. Replace if necessary.

8 Reassembly

After inspection and replacement of unusable parts, reassembly must be done as described in section 6, but in reverse order.

8.1 Open impeller design - NCLo

In case the wear disk 556.2 on discharge side has been replaced or reworked, the gap S_D must be measured after reassembly of the open impeller. The allowable value is 0.3 – 0.5 mm, see Figure 12. If this value is exceeded, fit an additional gasket.

After tightening the impeller nut and a final check of the gap S_D, the distance L_2 between impeller edge and gasket seat 400.5 in the intermediate casing must be measured. The distance between edge of wear disk 556.1 and gasket seat 400.5 in the volute casing must be adjusted by inserting additional gaskets 400.14 such that the following is maintained:

- $L_1 + h - L_2 = 0.3 - 0.5$ mm = S_S

Reassembly of open impeller - NCLo

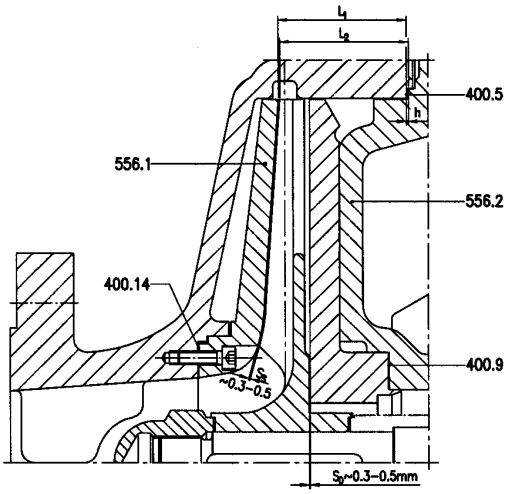


Figure 12 **om5540_26_ncl07x0054420en.wmf**

8.2 Torque setting

Torque setting						
Part No.	**Designation**	**Frame 0 [Nm]**	**Frame I [Nm]**	**Frame II [Nm]**	**Frame III [Nm]**	**Frame IV [Nm]**
914.2	Inner hexagon cap screw – bearing bracket lantern	40	40	80	80	190
914.12	Inner hexagon cap screw – impeller	8.8 = 40 A4-70 = 26				
920.1	Hexagon nut – bearing bracket lantern	8.8 = 80 A4-70 = 50	80 50	80 50	190 130	190 130
920.2	Hexagon nut – intermediate casing	8.8 = 80 A4 = 50	8.8 = 80 A4 = 50		8.8 = 190 A4 = 130	
	up to impeller diameter 250			8.8 = 80 A4-70 = 50		
	up to impeller diameter 320			8.8 = 190 A4-70 = 130		
	up to impeller diameter 400					8.8 = 190 A4 = 130
	up to impeller diameter 500					8.8 = 360 A4 = 250
922	Impeller nut		120	136	158	158

Table 9

9 Spare parts identification

Figure 13 to Figure 18 illustrate sectional drawings of the different pump types and in Table 11position numbers are explained.

Type NCL, frame size 0 / I / II, standard design

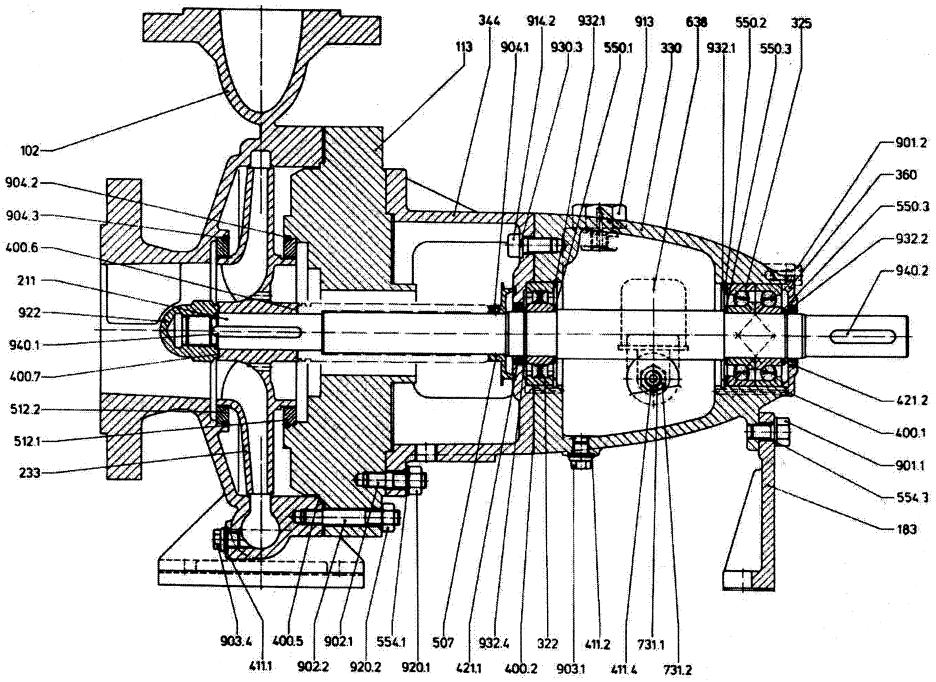


Figure 13 **om5540_26_ncl01x0054360en.wmf**

Type NCL, frame size III / IV, standard design

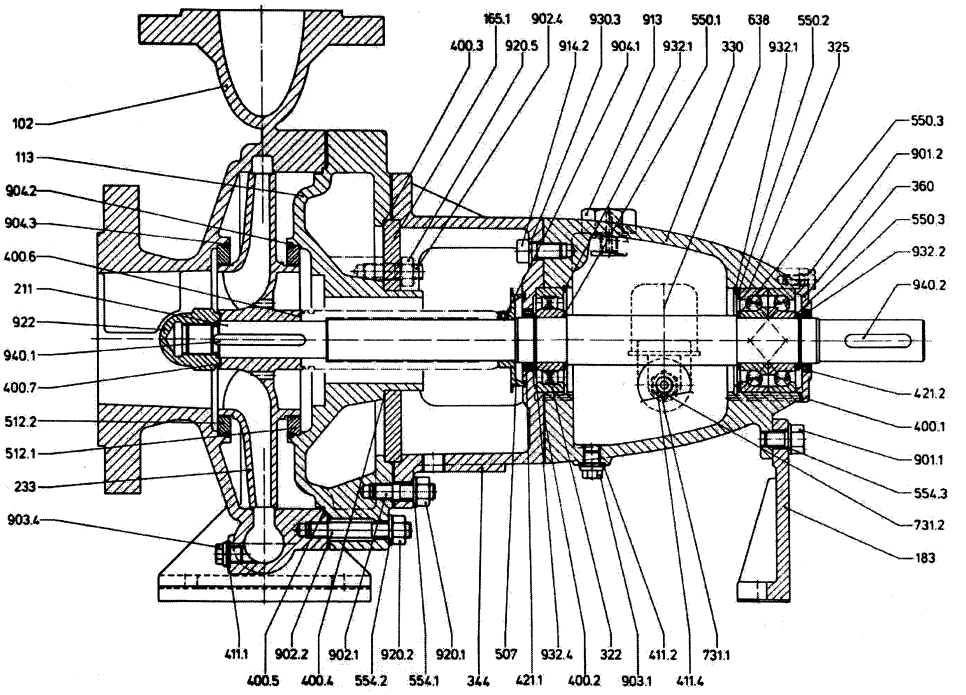


Figure 14 **om5540_26_ncl02x0054370en.wmf**

Type NCLb, frame size I - IV, jacketed design

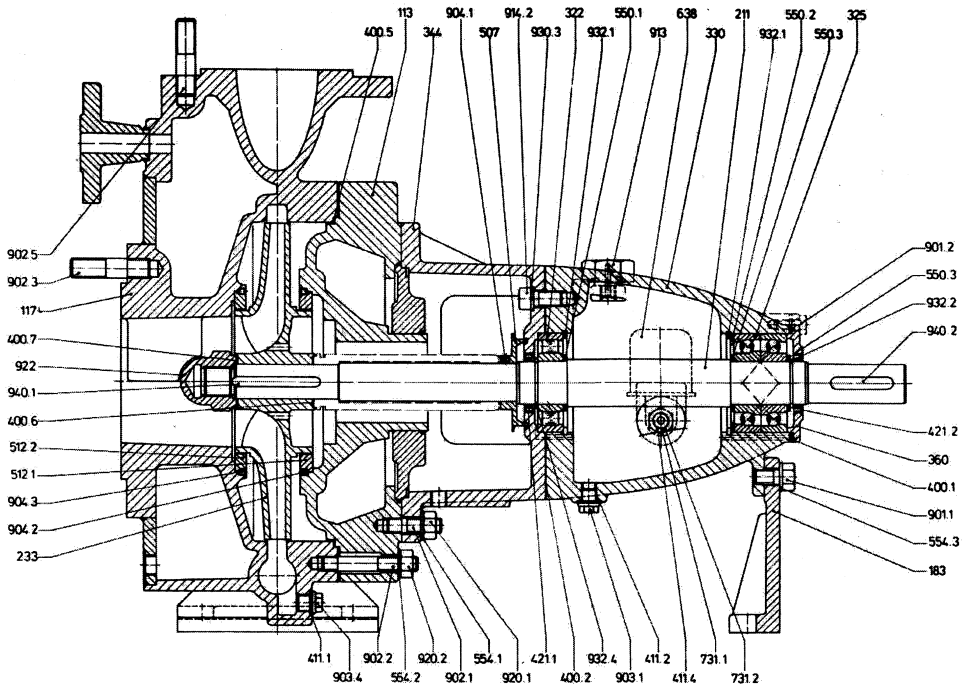


Figure 15 **om5540_26_ncl03x0054380en.wmf**

Type NCLo (ductile iron), frame size I / II / III, open impeller design

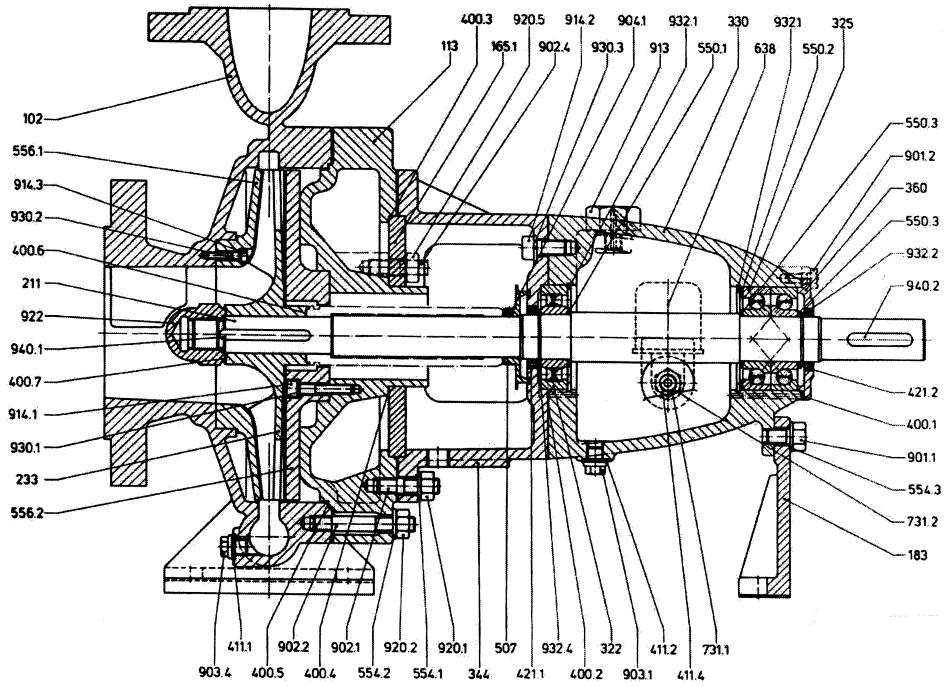


Figure 16 **om5540_26_ncl04x0054390en.wmf**

Type NCLo (ductile iron/stainless steel), frame size I / II, open impeller design

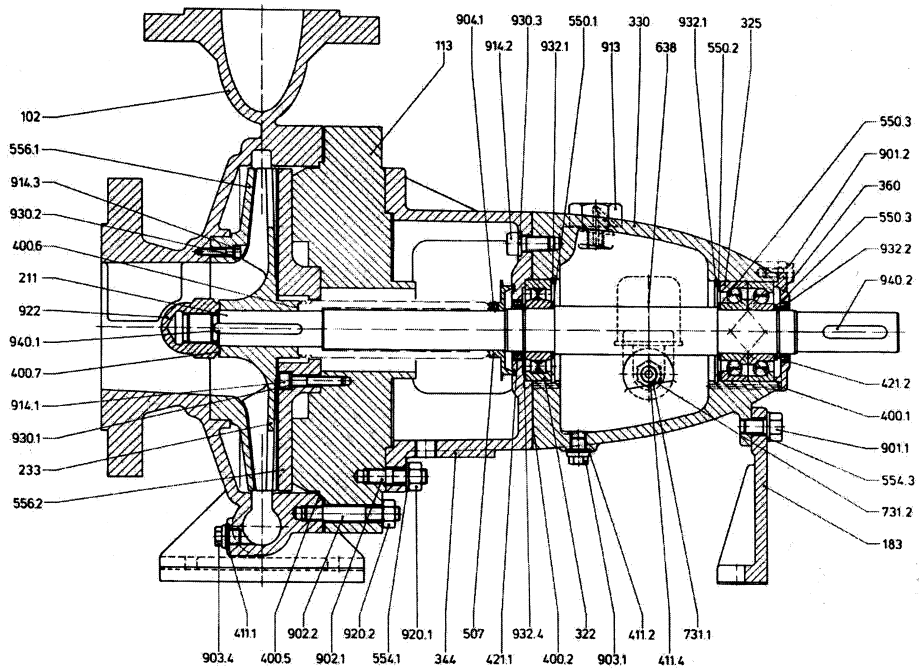


Figure 17 **om5540_26_ncl05x0054400en.wmf**

Type NCLo (ductile iron/stainless steel), frame size I / II / III, open impeller design with heating jacket

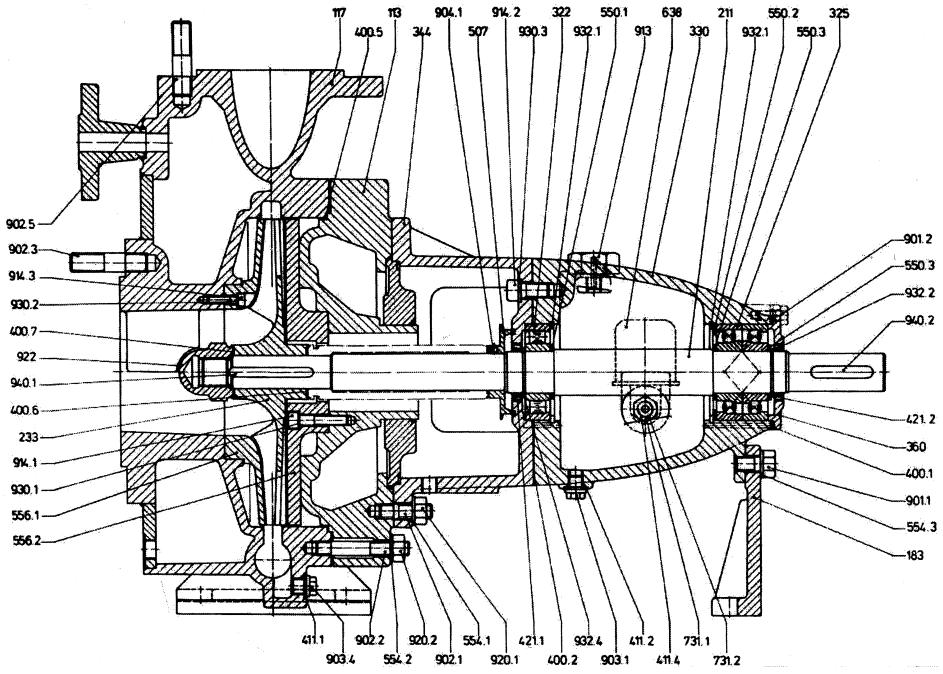


Figure 18 **om5540_26_ncl06x0054410en.wmf**

Part list and material specification for standard design				
Part No.	**Designation**	**Standard materials**		
		NCLs **NCLos**	**NCLhu** **NCLohu** **NCLbhu**	**NCLh** **NCLoh** **NCLbh**
102	Volute casing	GGG40.3	GS-C25	1.4408
113	Intermediate casing	St52.3 / GGG40.3	St52.3 / GS-C25	1.4571 / 1.4408
113	Intermediate casing, jecketed	---	GS-C25	1.4581
117	Volute casing, jacketed	---	GS-C25	1.4581
165.1	Cover of cooling chamber	GG25	GG25	GG25
183	Support foot	GG25	GG25	GG25
211	Pump shaft	CK45 / 1.4021	CK45 / 1.4021	CK45 / 1.4021
233	Impeller	GG25 / GGG40.3	GG25 / GGG40.3	1.4408
322	Roller bearing	St	St	St
325	Angular ball bearing	St	St	St
330	Bearing bracket	GG25	GG25	GG25
344	Bearing bracket lantern	GG25	GG25	GG25
360	Bearing cover	GG25	GG25	GG25
400.1	Gasket	Vulkolan	Vulkolan	Vulkolan
400.2	Gasket	Novetec Premium	Novetec Premium	Novetec Premium
400.3	Gasket	Novetec Premium	Novetec Premium	Novetec Premium
400.4	Gasket	Novetec Premium	Novetec Premium	Novetec Premium
400.5	Gasket	Novetec Premium	Novetec Premium	Novetec Premium
400.6	Gasket	Novetec Premium	Novetec Premium	Novetec Premium
400.7	Gasket	Novetec Premium	Novetec Premium	Novetec Premium
411.1	Joint ring	Top Chem 2000	Top Chem 2000	Top Chem 2000
411.2	Joint ring	Top Chem 2000	Top Chem 2000	Top Chem 2000
411.4	Joint ring	Top Chem 2000	Top Chem 2000	Top Chem 2000
421.1	Radial seal ring	Perbunan	Perbunan	Perbunan
421.2	Radial seal ring	Perbunan	Perbunan	Perbunan
452	Gland	GS-C25	GS-C25	1.4408
454	Follower	St37	St37	1.4571
457	Packing ring	St52.3	St52.3	1.4571
507	Deflector	1.4408	1.4408	1.4408
512.1	Wear ring	GG25	GG25	1.4571
512.2	Wear ring	GG25	GG25	1.4571
524	Shaft sleeve	1.4571 / SL-17	1.4571 / SL-17	1.4571 / SL-17
550.1	Disk	FSt	FSt	FSt
550.2	Disk	FSt	FSt	FSt
550.3	Disk	FSt	FSt	FSt
554.1	Washer	St	St	St
554.2	Washer	St	St	1.4571
554.3	Washer	St	St	1.4571
556.1	Wear disk	St52.3	St52.3	1.4571
556.2	Wear disk	St52.3	St52.3	1.4571
638	Constant level oiler	St-galvanized/glass	St-galvanized/glass	St-galvanized/glass
731.1	Pipe union	C45 + PB	C45 + PB	C45 + PB
731.2	Pipe union	St	St	St
901.1	Hexagon head bolt	4.6	4.6	4.6
901.2	Hexagon head bolt	4.6	4.6	4.6

Part list and material specification for standard design				
902.1	Stud	8.8	8.8	A4-70
902.2	Stud	8.8	8.8	A4-70
902.3	Stud	---	8.8	A4-70
902.4	Stud	A4-70	A4-70	A4-70
902.5	Stud	---	8.8	A4-70
903.1	Screwed plug	St	St	St
903.4	Screwed plug	St	St	1.4571

Table 10

Part list and material specification for standard design, continued				
Part No.	**Designation**	**Standard materials**		
		NCLs **NCLos**	**NCLhu** **NCLohu** **NCLbhu**	**NCLh** **NCLoh** **NCLbh**
904.1	Grub screw	A4	A4	A4
904.2	Grub screw	A4	A4	A4
904.3	Grub screw	A4	A4	A4
913	Vent plug	St	St	St
914.1	Inner hexagon cap screw	8.8	8.8	A4-70
914.2	Inner hexagon cap screw	8.8	8.8	8.8
914.3	Inner hexagon cap screw	8.8	8.8	A4-70
920.1	Hexagon nut	8	8	A4
920.2	Hexagon nut	8	8	A4
920.5	Hexagon nut	A4	A4	A4
922	Impeller nut	---	---	---
930.1	Spring washer	FSt	FSt	1.4305
930.2	Spring washer	FSt	FSt	1.4305
930.3	Spring washer	FSt	FSt	FSt
932.1	Circlip	FSt	FSt	FSt
932.2	Circlip	FSt	FSt	FSt
932.4	Circlip	FSt	FSt	FSt
940.1	Key	1.4571	1.4571	1.4571
940.2	Key	1.4571	1.4571	1.4571

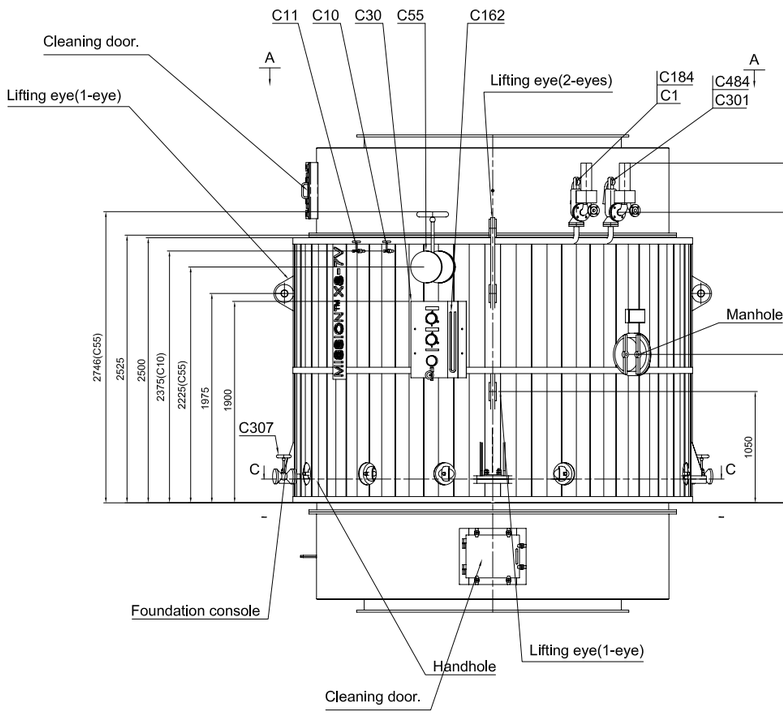
Table 11

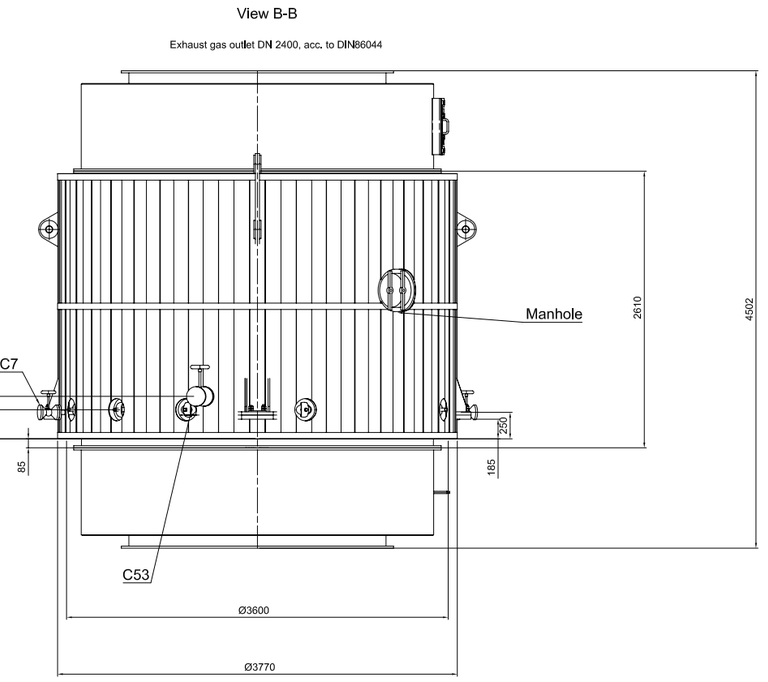
Table of contents

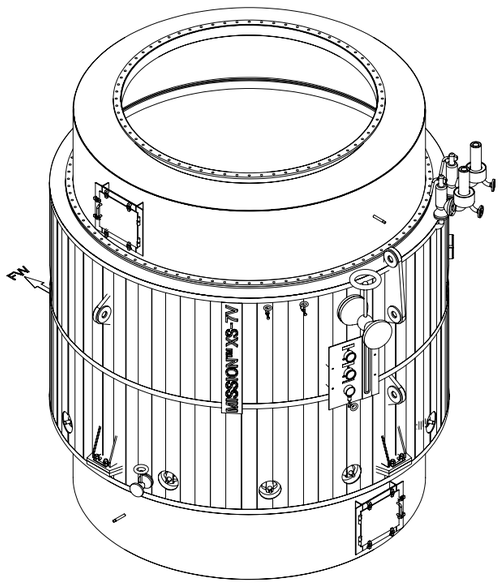
Drawings

11Y_042285 General arrangment.....33-2

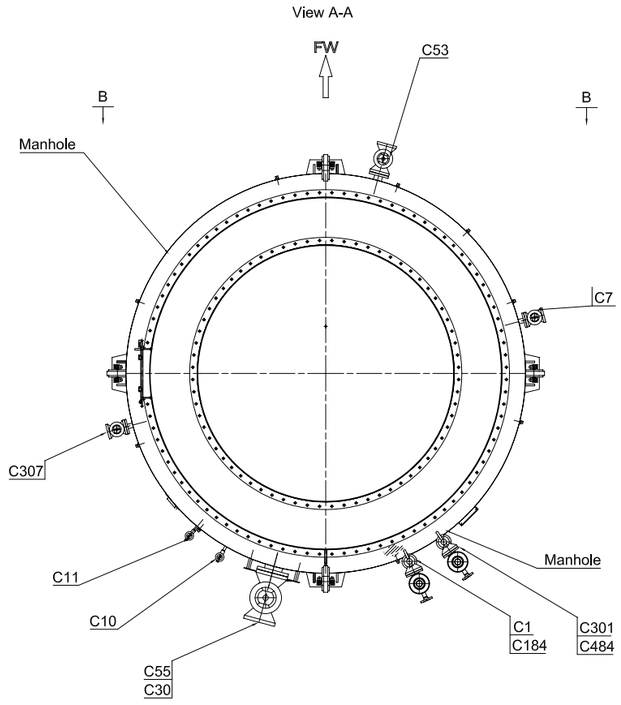
Alteration	Affix	Date	Drawn	Appr.
Internal revision	a	10JYL06	PeA	SAP
Handholes rotated. C7, C53 and C307 moved. 1 lifting eye moved	b	24 Apr. 07	TCG	SAP
Handholes moved. Two handholes added	c	16 AUG. 07	TCG	PH

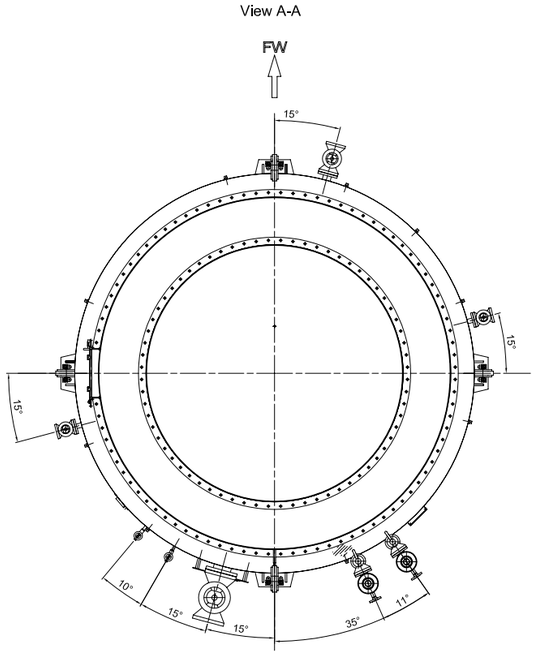


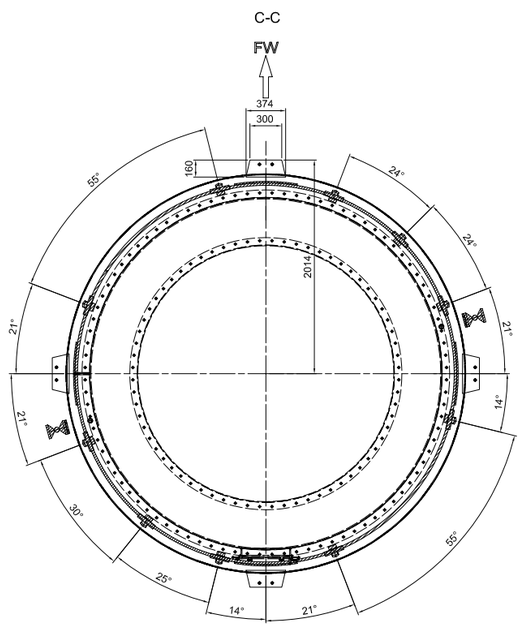


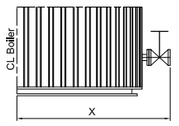


Exhaust gas inlet DN 2400, acc. to DIN86044









TAG No.	X = mm
C184/C484	2230
C7/C307	2130
C10	2050
C11	2050
C53	2240
C55	2430

Size of lifting eye = 31.5 ton

Approx. weight (excl water)	26.2 ton
Approx. weight (Incl water)	39.3 ton

TAG No., see List of Parts.

Dimensions shown without tolerances shall be according to EN 22768-coarse

First angle projection

Costumer	Jiangnan Shipyard				
Society.	GL+CCS	CCS	CCS	CCS	
Newb No.	H2390/91	H2392/93	H2403/04	H2405/06	
Project No.	051868-01-2/02-2	051868-03-2/04-2	051868-05-2/06-2	051868-07-2/08-2	
Boiler No.	18119/120	18121/122	18123/124	18125/126	

RQ No.	RQ051868
Config No.	CF1
Boiler	

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First Date:

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Title: MISSION™ XS-7V

Vertical smoke tube boiler

3500 Kg/h 10 barg OD3600

General arrangement

Drawn	PeA	Date	10/07/2006
Appr.	SAP	Date	10/07/2006
Weight		Scale:	1:20
		Size	A0
Article/Drawing No:			Index
11Y:042285			c

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8000000011	Remote start/stop box	34-33

Type:

- Safety valve, full lift
- 25.912

Size:

- Nominal diameter: DN 32/50

Application:

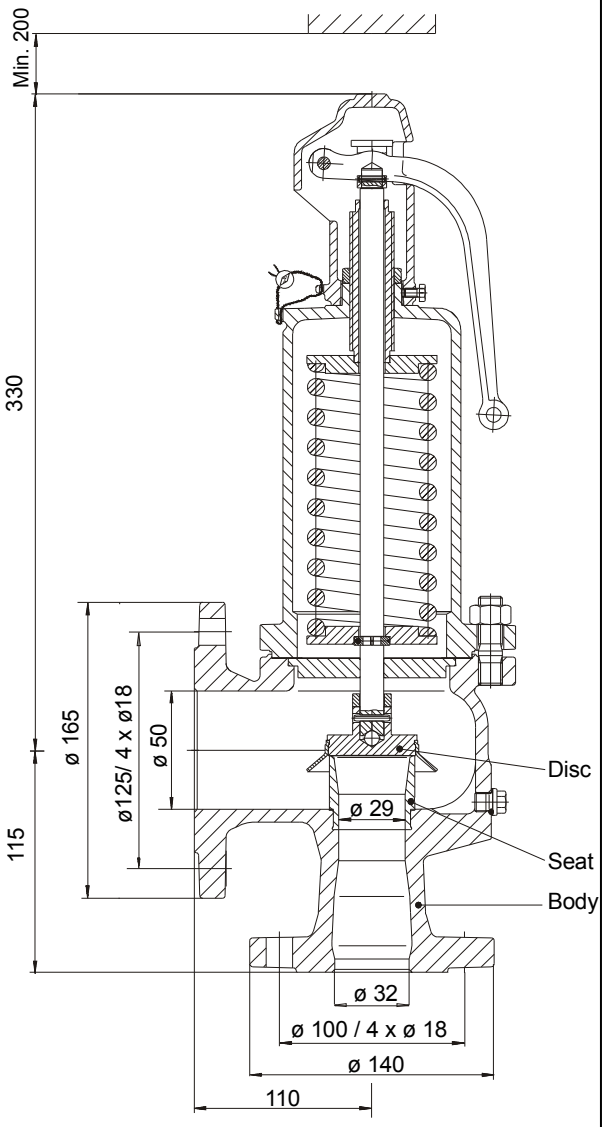
- To blow off saturated steam, air or water

Material:

- Body: GGG 40.3
  DIN-Material No.: 0.7043
- Seat: X6 Cr Ni Mo Ti 17122
  DIN-Material No.: 1.4571
- Disc: X35 Cr Mo 17
  DIN-Material No.: 1.4122.05

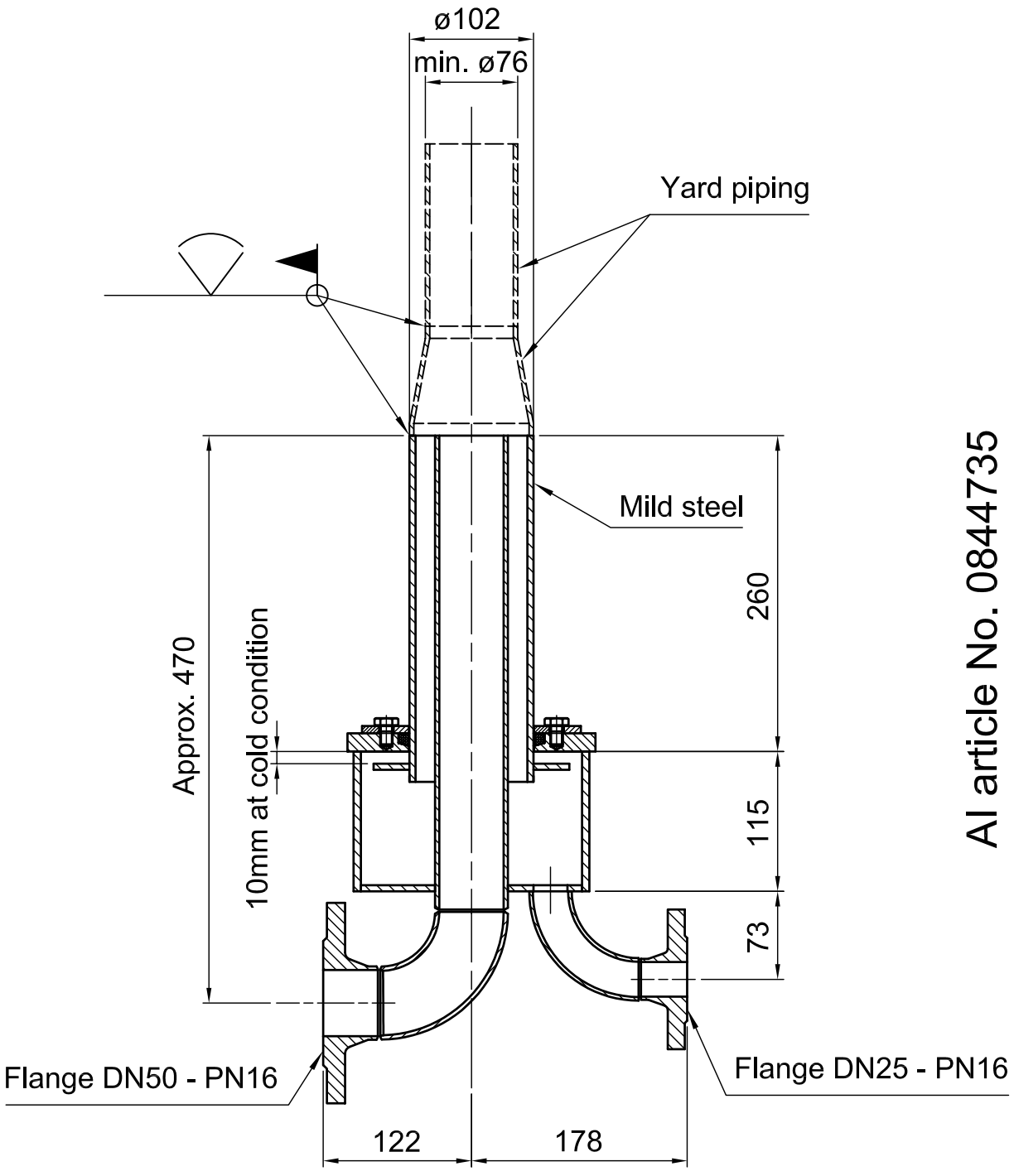
Technical data:

- Nominal pressure: PN 40/16
- Weight: 14 kg
- Flanges according to DIN
- Inlet: DN 32, PN40
- Outlet: DN 50, PN16



Type No.: 6040 **Version: A.2**	**Safety valve, DN 32/50, PN 40/16**	**2611171**

Description	Index	Date	Drawn	Appr.
Drain connection changed to flange	a	020702	JNJ	JA
Sealing ring added	b	041104	JA	BZ



AI article No. 0844735

AALBORG INDUSTRIES

Plot Date:

Title:
Expansion joint with sealing ring
STANDARD
For safety valve DN32/50, PN16 outlet flange
General arrangement

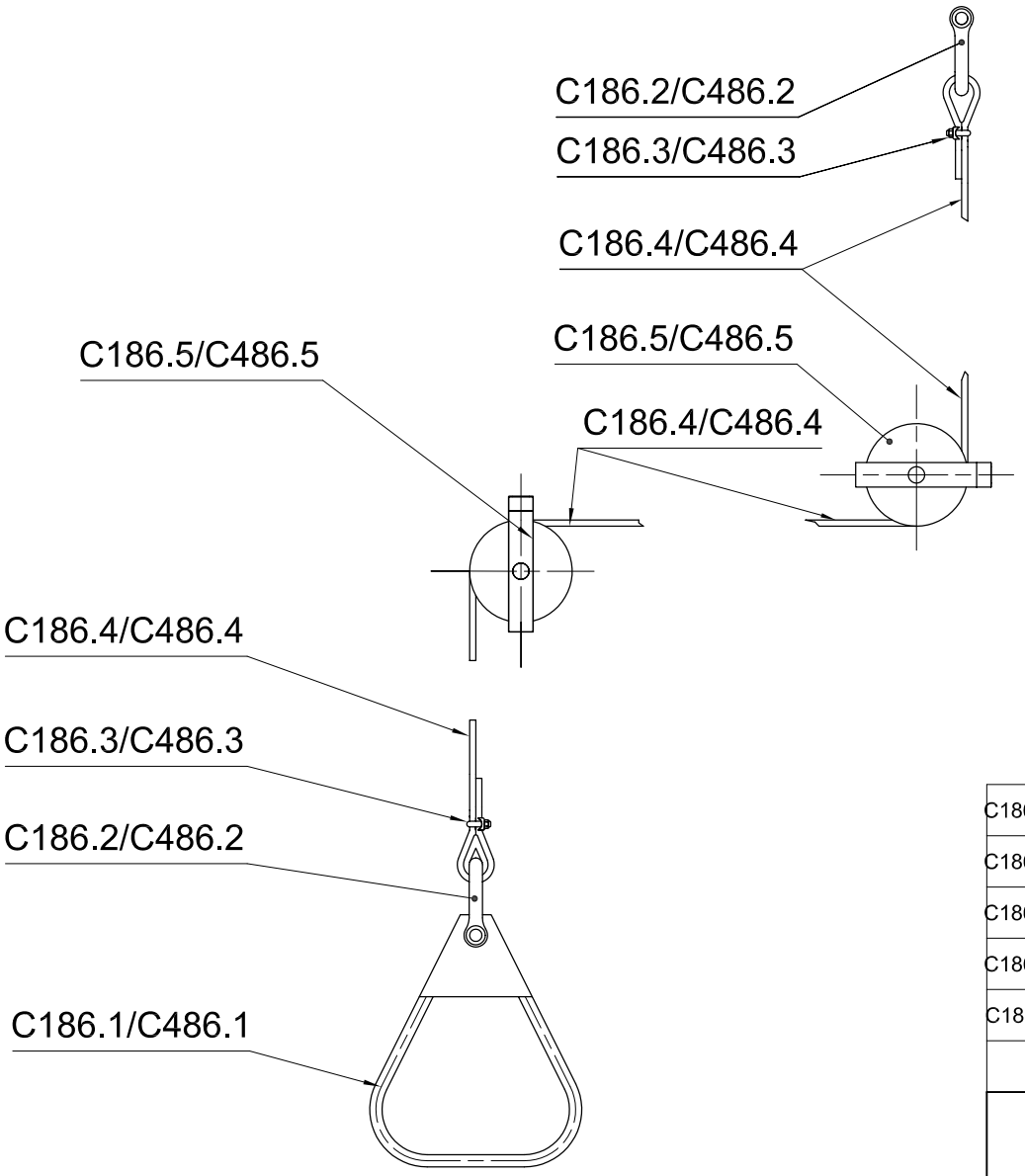
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Drawn	Date
MRJ	20.09.2000
Appr.	Date
LD	30.11.2000

Weight	Scale:	Size
20 kg	1:5	A4R

Article/Drawing No:	Index
85Y :013421	b

Description	Index	Date	Drawn	Appr.



C186.5/C486.5	Pulley Hot-dip galvanized ø50 mm vertical	2	Steel		4337301
C186.4/C486.4	Wire stainless steel ø3 mm Specified in metre	8	AISI 316		4551052
C186.3/C486.3	Wire clip Hot-dip galvanized 3 mm	2	Steel		4576110
C186.2/C486.2	Shackle Hot-dip galvanized 3/16"	2	Steel		4573311
C186.1/C486.1	Handle ø6x261	1			6451004
Tag No.	Designation Dimension	Pcs.	Material code Material type	Cert.	Article No. Detail drawing No.

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Title:

STANDARD

Remote pull for safety valve

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Drawn: JA	Date: 040608	
Appr.: BZ	Date: 040608	
Weight	Scale: 1:1	Size: A3
Article/Drawing No: K03 : 032121		Affix

Type:

- Stop globe valve
- Orientation: straight
- 3540

Size:

- Connection, nominal: DN 32

Pressure rating:

- Pressure, nominal:PN 25

Connection type:

- Connection type: flanges according to DIN

Application:

- For steam and/or water flow

Material:

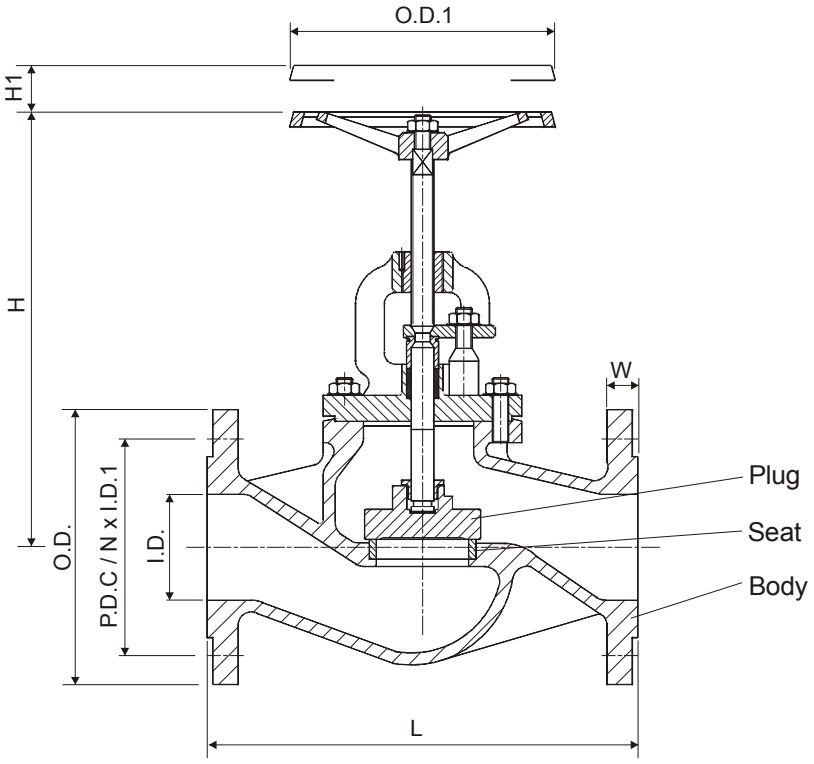
- Body: GGG 40.3
- Body material code: No. 0.7043
- Seat: H1Cr18Ni9Ti
- Plug: 2Cr13

Technical data:

- Weight:9.6 kg

Dimension:

- L = 180
- H = 230
- H1 = 9
- W = 18
- I.D. = ø32
- O.D. = ø140
- O.D.1 = ø140
- P.D.C. = ø100
- N x I.D.1 = 4 x ø18



Type No.: 6010 **Version: A.2**	**Stop valve, straight, DN 32, PN 25**	**6010000233**

Type:

- Stop check globe valve, screw down non return
- Orientation: straight
- 3542

Size:

- Connection, nominal: DN 32

Pressure rating:

- Pressure, nominal:PN 25

Connection type:

- Connection type: flanges according to DIN

Application:

- For steam and/or water flow

Material:

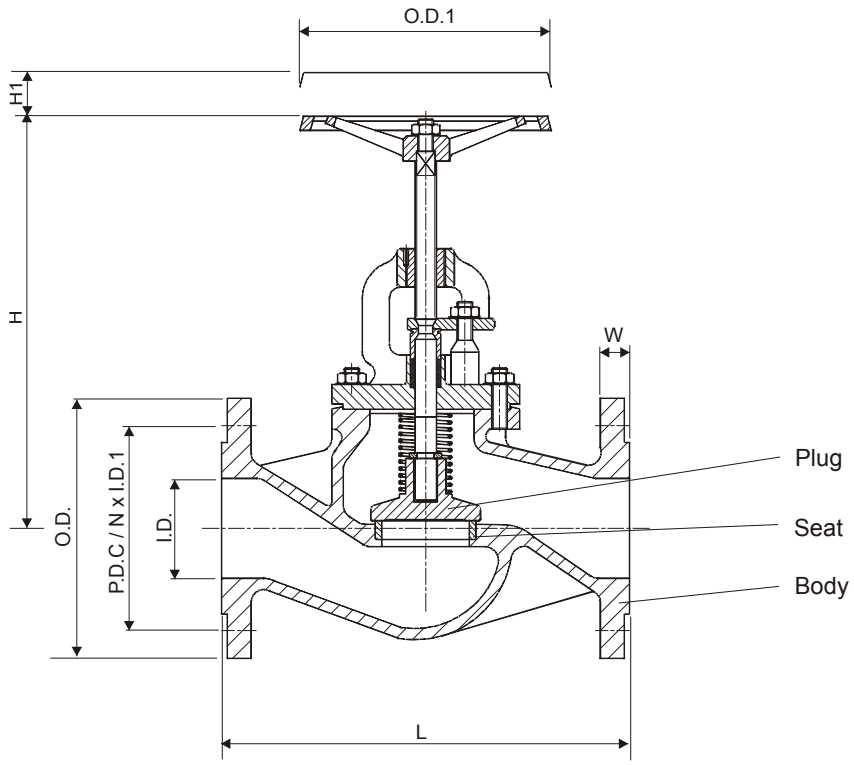
- Body: GGG 40.3
- Body material code: No. 0.7043
- Seat: H1Cr18Ni9Ti
- Plug: 2Cr13

Technical data:

- Weight:9.6kg

Dimension:

- L = 180
- H = 230
- H1 = 9
- W = 18
- I.D. = ø32
- O.D. = ø140
- O.D.1 = ø140
- P.D.C. = ø100
- N x I.D.1 = 4 x ø18



Type No.: 6030 **Version: A.2**	**Stop valve, straight, non return, DN 32, PN 25**	**6030000073**

Type:

- Instrument stop cone valve, straight, with security plate

Size:

- G ½" x ø 12
- Nominal diameter: DN 8

Application:

- For steam, water and/or air

Material:

- Body: C 22.8

DIN- Material No. 1.0460

- Seat: X20 Cr13

DIN- Material No. 1.4021

- Needle tip: X35 CrMo17

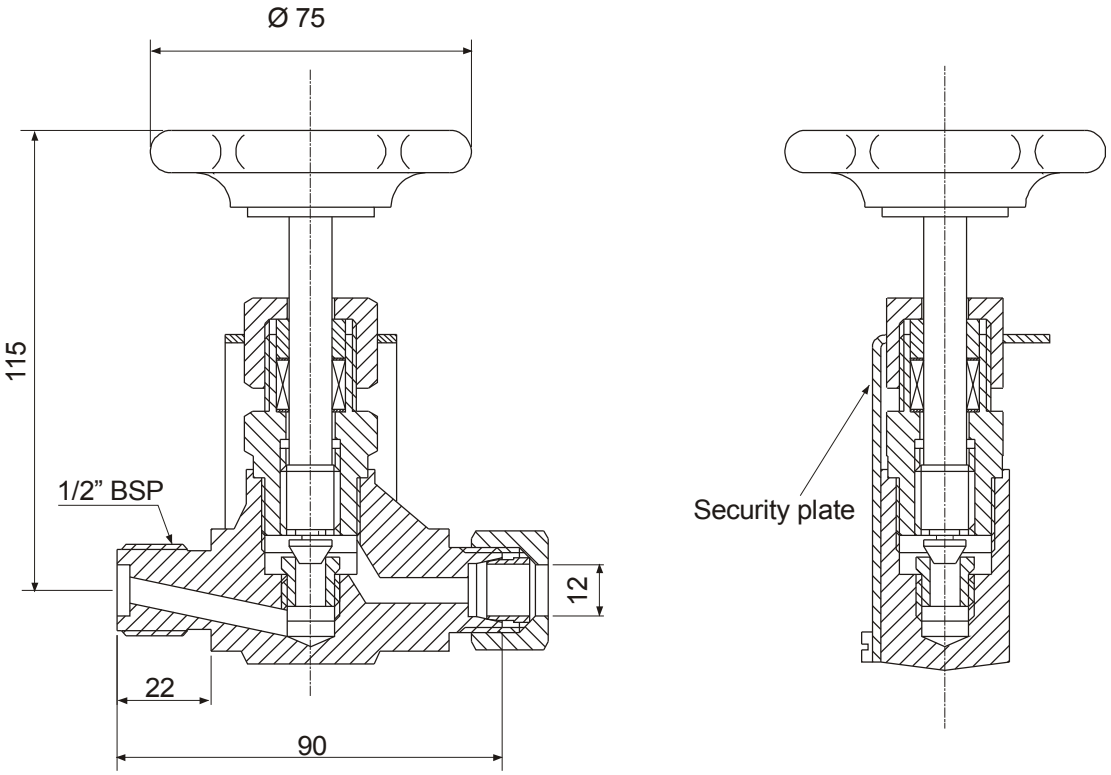
DIN- Material No. 1.4122

Technical data:

- Nominal pressure: PN 160
- Inlet: G ½" male DIN

19207, form R

- Outlet: For steel tube ø 12
- Weight: 0.8 kg



Type No.: 6220 **Version: A.2**	**Stop valve, straight, DN 8, PN 160**	**6220000002**

Type:
- Stop globe valve
- Orientation: straight
- 3540

Size:
- Connection, nominal: DN 65

Pressure rating:
- Pressure, nominal:PN 25

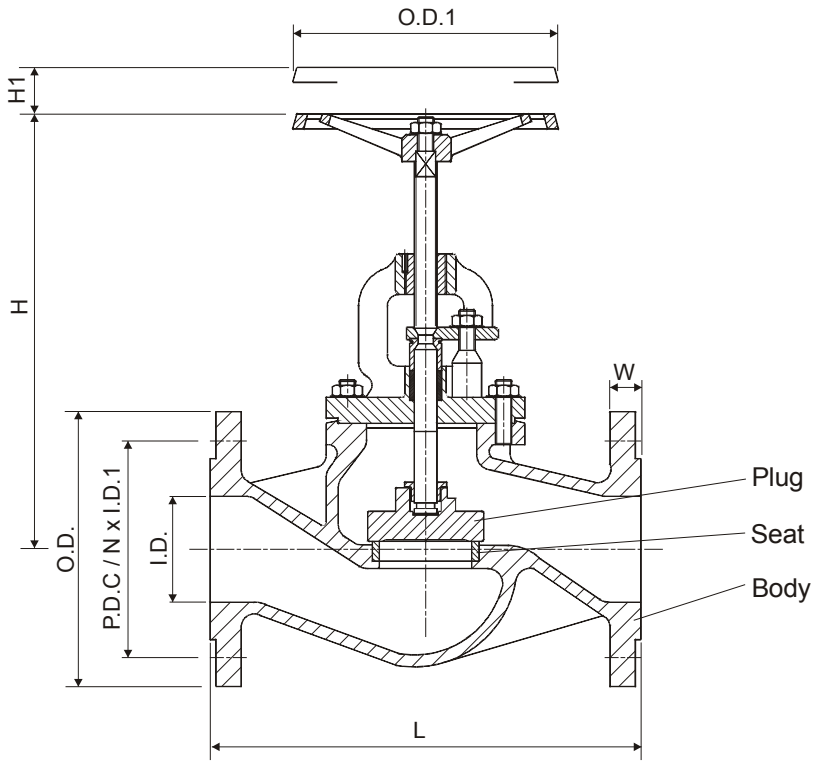
Connection type:
- Connection type: flanges according to DIN

Application:
- For steam and/or water flow

Material:
- Body: GGG 40.3
- Body material code: No. 0.7043
- Seat: H1Cr18Ni9Ti
- Plug: 2Cr13

Technical data:
- Weight:21 kg

Dimension:
- L = 290
- H = 308
- H1 = 18
- W = 22
- I.D. = ø65
- O.D. = ø185
- O.D.1 = ø180
- P.D.C. = ø145
- N x I.D.1 = 8 x ø18



Type No.: 6010 **Version: A.2**	**Stop valve, straight, DN 65, PN 25**	**6010000236**

Type:

- Stop globe valve
- Orientation: straight
- 3540

Size:

- Connection, nominal: DN 150

Pressure rating:

- Pressure, nominal:PN 25

Connection type:

- Connection type: flanges according to DIN

Application:

- For steam and/or water flow

Material:

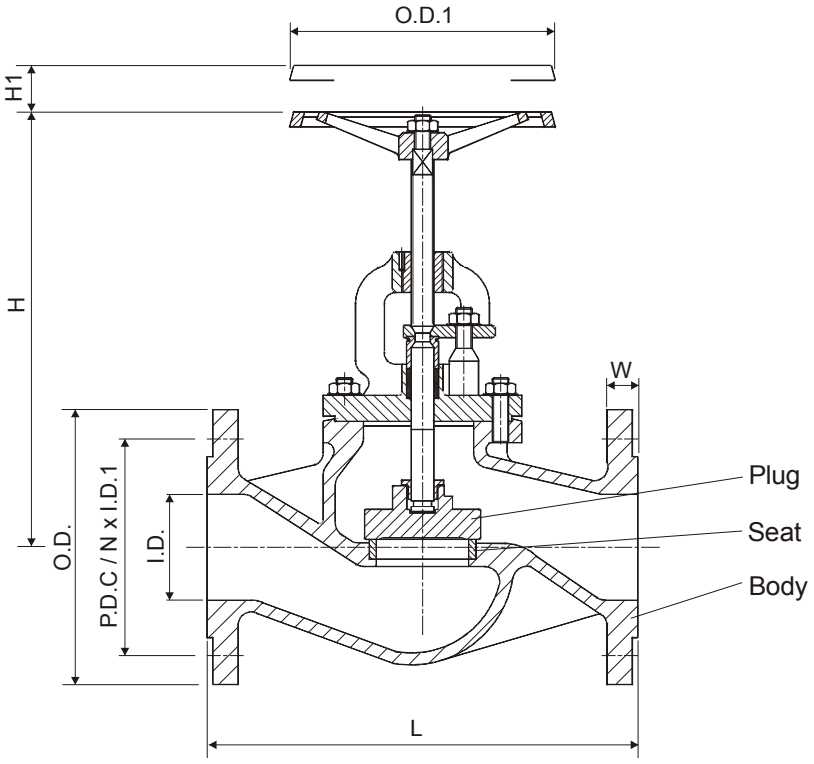
- Body: GS-C25N
- Body material code: No. 1.0619.1
- Seat: H1Cr18Ni9Ti
- Plug: 2Cr13

Technical data:

- Weight:88 kg

Dimension:

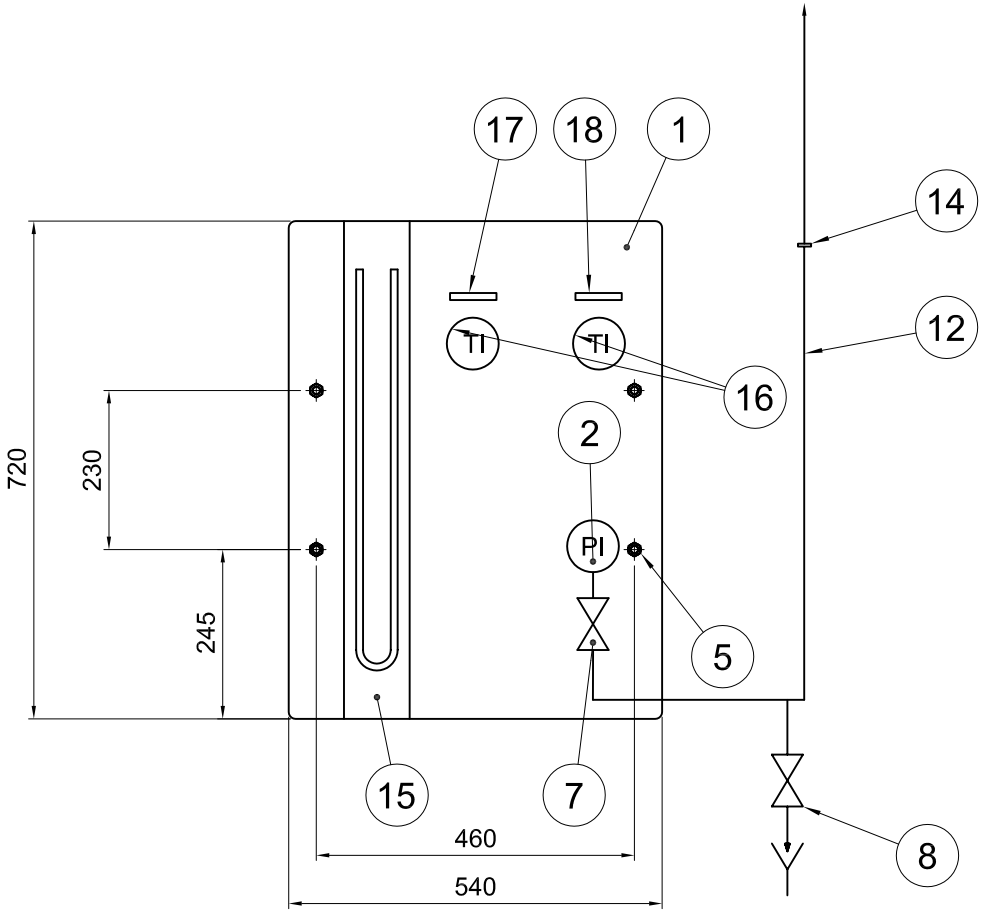
- L = 480
- H = 505
- H1 = 42
- W = 28
- I.D. = ø150
- O.D. = ø300
- O.D.1 = ø350
- P.D.C. = ø250
- N x I.D.1 = 8 x ø26



Type No.: 6010 **Version: A.2**	**Stop valve, straight, DN 150, PN 25**	**6010000240**

Description	Index	Date	Drawn	Appr.

Costumer	Jiangnan Shipyard				
Society.	GL+CCS	CCS	CCS	CCS	
Newb No.	H2390/91	H2392/93	H2403/04	H2405/06	
Project No.	051868-01-2/02-2	051868-03-2/04-2	051868-05-2/06-2	051868-07-2/08-2	
Boiler No.	18119/120	18121/122	18123/124	18125/126	



Item	Designation / Dimension	Pcs.	Material code / Material type	Cert.	Article No. / Detail drawing No.
19	Connector for temperatur	2	STEEL		8500000085
18	Sign "EXHAUST GAS OUTLET 125x30 t=1	1			8570000094
17	Sign "EXHAUST GAS INLET 125x30 t=1	1			8570000095
16	TI, 0-400 °C ø100 0-400 °C ø100	2	AISI 304	3.1	8080000017
15	PI, 400 mm (200-0-200)	1			8050000052
14	Coupling 12 mm 12 mm	1			2452212
12	Copper pipe ø12/manifold with fittings ø12	1			4000000455
8	Inst. stop valve 3/8" 3/8" PN100	1			2573307
7	Pr. gauge valve 1/2" 1/2" PN400	1	DIN 17243 2.2	3.1, 3.1B	2541002
5	BEN FOR MANO.PL. L=180MM	4			2914901
2	PI, ø160 0-16/1.6 bar/kg 0-16/1.6 bar/kg/MPa BSP 1/2"-m	1			6632998
1	Plate for gaugeboard 720X540X6mm	1			2914947

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Title:

GAUGE BOARD

0 - 16 bar

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Drawn	Date
TCG	19 Jun. 07
Appr.	Date
Weight	Scale: 1:7.5 / Size A3
Article/Drawing No: 61Z : 047034	Affix

Type:

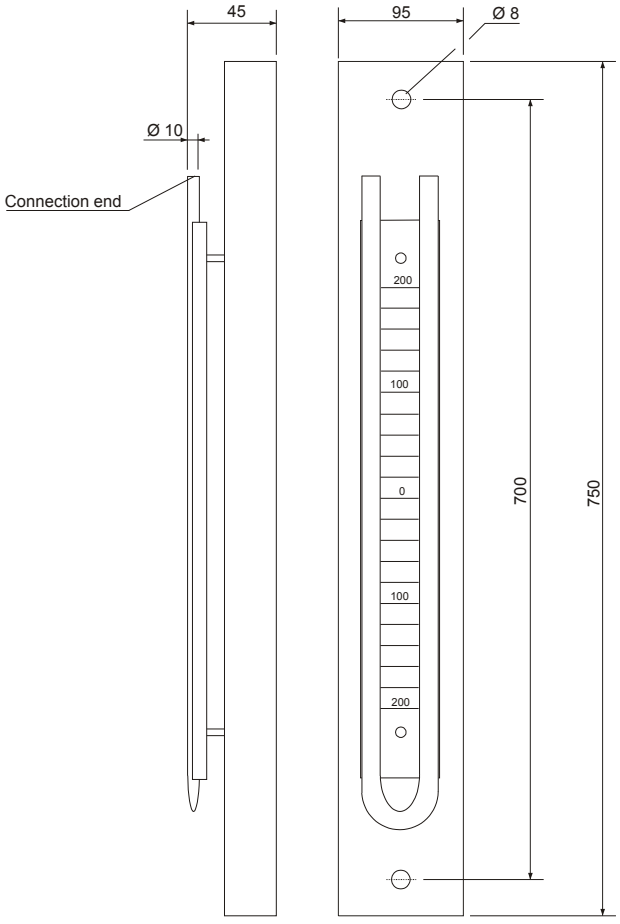
- Differential, U-tube 400 mm
- 1221 M-400-W/M

Application:

- For determining velocity and static pressure, leakage, fan and blower efficiency, filter resistance and differential gas pressures.

Material:

- U-tube: Shatter proof clear butyrate tubing
- Base plate: Wood



Technical data:

- Range: 200-0-200 mm H_2O

Accessories:

- Two plastic carrying plugs
- Two flexible plastic tubing connectors for attachment of 3/16" tubing
- One ¾ ounce bottle of fluorescein green dye concentrate gauge fluid

Type No.: 8050 **Version: B.1**	**Pressure gauge, U-tube 400 mm**	**6499731**

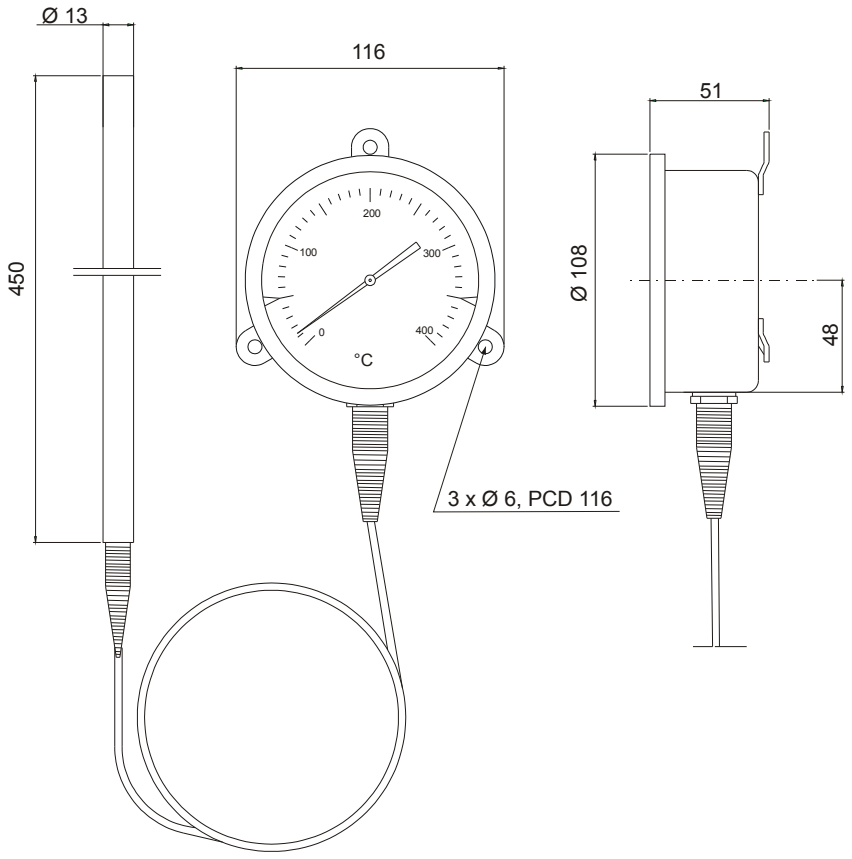
Type:
- Temperature gauge

Size:
- Ø 100

Application:
- For marine applications

Material:
- Case: AISI 304 natural
- Probe: AISI 316
- Window: Acrylic
- Liquid filling: Silicone

Technical data
- Measuring range: 0 to 400°C
- Capillary tube: 6 m
- Connection: None (smooth sensor), connector supplied separately
- Ambient temperature: -40 to +100°C



Type No.: 80808 **Version: A.2**	**Temperature gauge**	**8080000017**

Type:

- U-tube manometer, 400 mm
- 1221 M-400-W/M

Application:

- For determining velocity and static pressure, leakage, fan and blower efficiency, filter resistance and differential gas pressures.

Material:

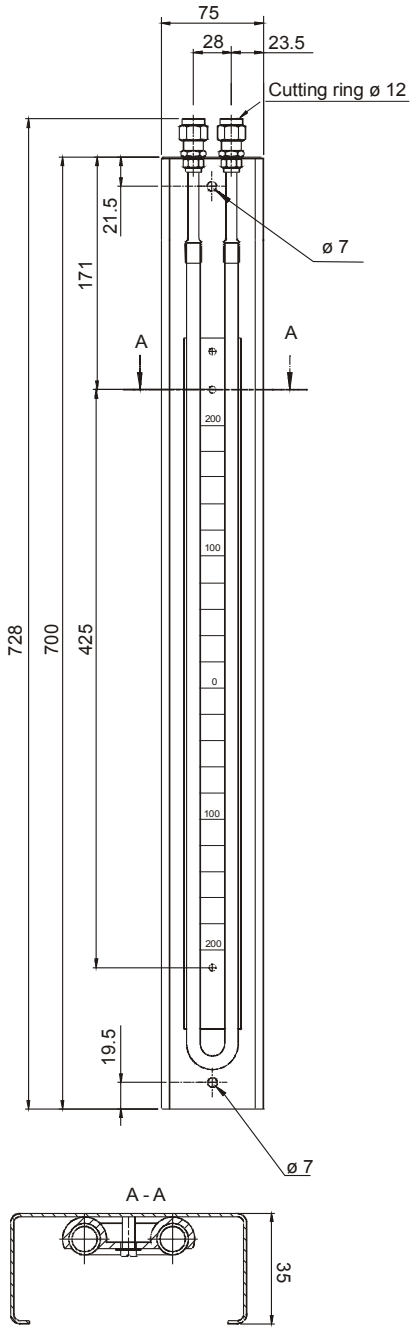
- U-tube: Shatter proof clear butyrate tubing
- Base plate: Aluminium

Technical data:

- Range: 200-0-200 mm H_2O

Accessories:

- One ¾ ounce bottle of fluorescein green dye concentrate gauge fluid



Type No.: 8050 **Version: A.2**	**U-tube manometer, 400 mm**	**8050000052**

Type:

- Instrument stop needle valve, straight

Size:

- 3/8" BSP
- Nominal diameter: DN 10

Application:

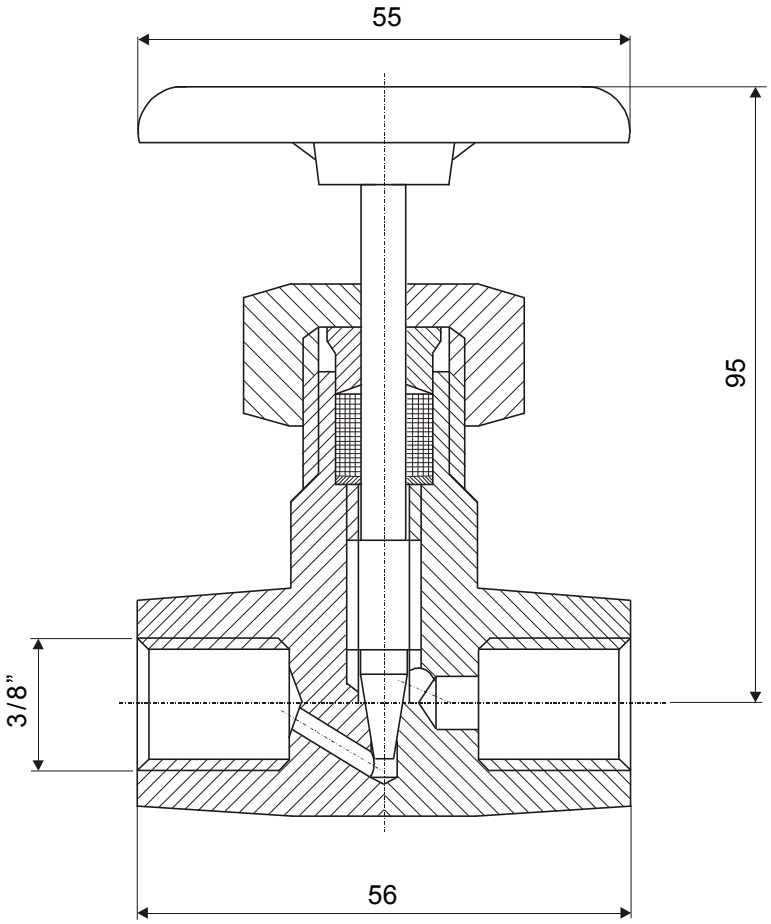
- For steam, water and/or air

Material:

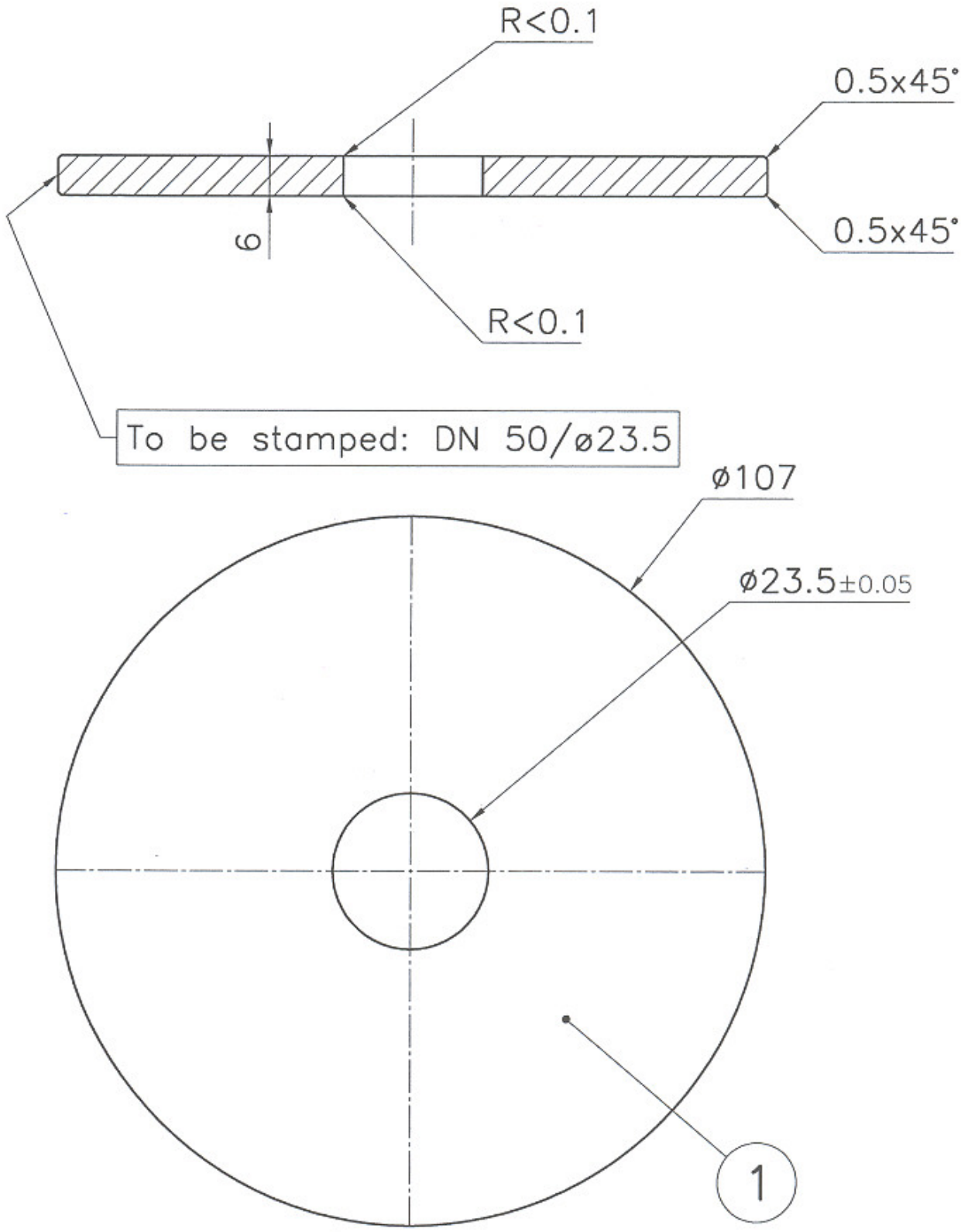
- Body: brass
- Spindle: brass
- Packing: PTFE
- Hand wheel: steel

Technical data:

- Nominal pressure: PN 100
- Working pressure: 25 bar
- Weight: 0.32 kg
-



Type No.: 6220 Version: A.2	**Instrument stop valve, straight, DN 10, PN 100**	**2573307**



Item	Designation	Pcs.	Dimension	Material	Article No.
1	Plate	1	ø107x6	AISI 316	

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Title:

Orifice DN 50/ø23.5

Drawn: MSO	Date: 991220	
Appr.: MRJ	Date: 991220	
Weight	Scale: 1:1	Size: A4R
Article/Drawing No:		Affix

Type:

- Stop globe valve, straight with throttling plug and locking device
- 35.006RK

Size:

- Nominal diameter: DN 32

Application:

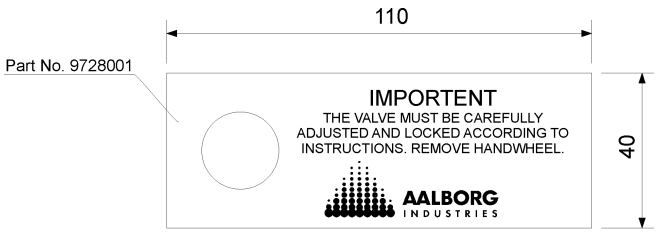
- For steam and/or water flow

Material:

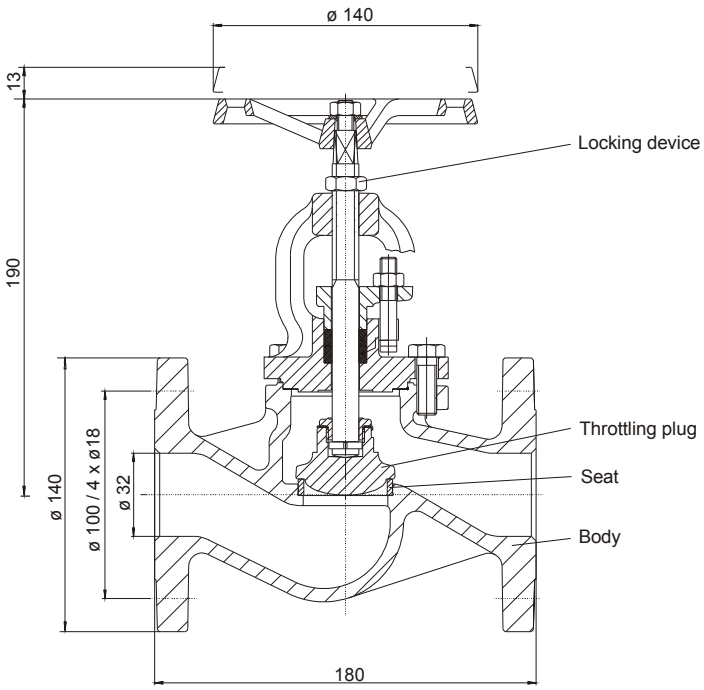
- Body: GS-C25N
  DIN -Material No. 1.0619.01
- Seat: X5CrNiNb 19 9
  DIN -Material No. 1.4551
- Disc: X20 Cr13
  DIN -Material No. 1.4021.05

Technical data:

- Nominal pressure:PN 40
- Weight:8.0 kg
- Flanges according to DIN



Warning sign for valve (supplied loose)



Type No.: 6010 **Version: A.2**	**Stop valve, straight with locking device, DN 32, PN 40**	**6010000041**

Type:

- Differential pressure switch

Size:

- DN 100

Application:

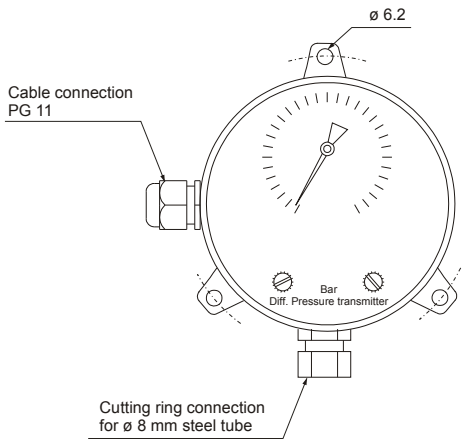
- The differential pressure switch is a combination of the indicating and switching instrument for differential pressure measurements

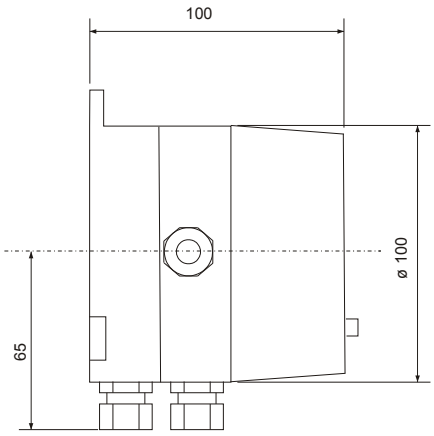
Material:

- Case: Stainless steel
- Cover: Macrolon

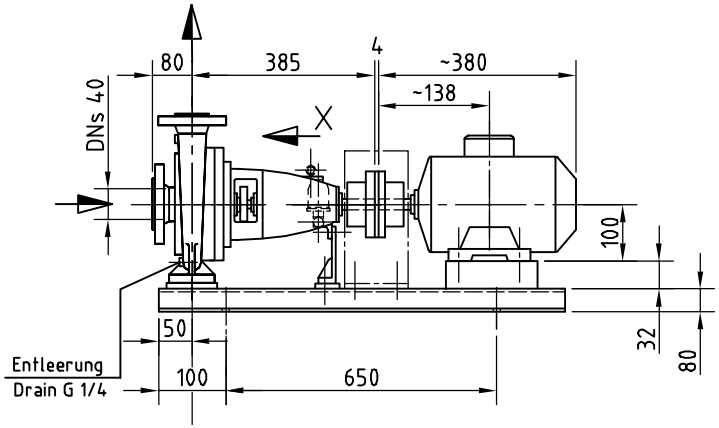
Technical data:

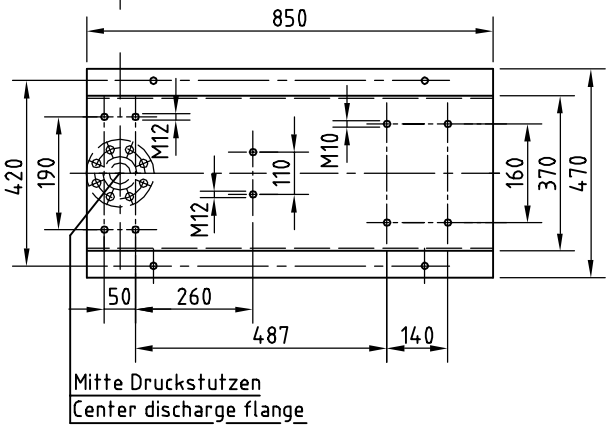
- Ranges: 0 – 1 bar
- Max. static pressure: 16 bar
- Max. pressure load: One-sided overpressure protected up to nominal pressure on both side of diaphragm, partial vacuum protected.
- Ambient temperature: -10° to +70°CMedia temperature: +70°C
- Protection: IP54 according to DIN 40050
- Mounting: Vertical, connection downwards
- Accuracy: ±2.5% of full scale
- Zero adjustment: Located on dial
- Switching element: 2 micro switches with external adjustment
- Hysteresis:
  $U_{max.}$ = 250V_{AC}
  $I_{max.}$= 5 A
- Load:
  $P_{max\ .}$ = 250 $V_{A\ C}$
  $U_{max\ .}$=30V_{DC}
  $I_{max\ .}$=0.4 A
  $P_{max\ .}$=10w
- Pressure connection: 1/4" BSP female, cutting ring connection for 8 mm steel tube
- Cable: 1 m

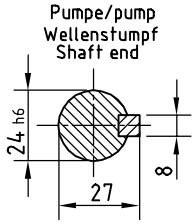


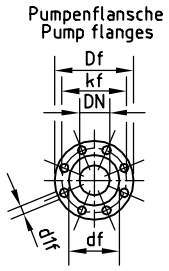


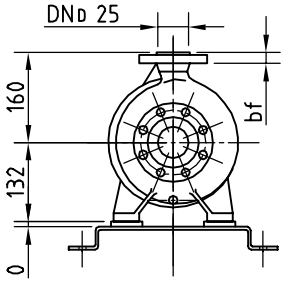
Type No.: 8040 Version: A.2	**Differential pressure switch**	**8040000004**

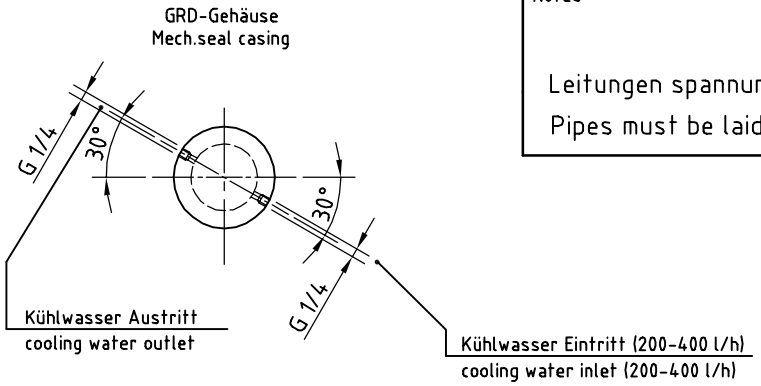












Ansicht in Richtung " X "
View in the direction " X "

Best. Nr.. P.O. No.:	
Pos. - Nr.: Item.- Nr.:	
Kunde : Customer:	
Pumpen Nr.: Ser.No.:	
Pumpentype : Pump type :	NCL s 26/170
Ausführung : Design :	D Re
Motor :	ABB/100L/3,7kW/IP55
Rahmengröße : Base plate :	HP 2
Kupplung : Coupling :	B 80

Pumpenflansche
Pump flanges

Datum/Date : 07.06.2004

DN	Df	kf	bf	df	d1f	zf
DIN 2534 PN 25						
25	115	85	18	68	14	4
40	150	110	21	88	18	4

Erstellt : handled by : Gr.

Geprüft : Approved :

Bemerkung :
Notes :

Leitungen spannungsfrei anschließen !
Pipes must be laid stress - relieved !

DICKOW - Chemie - Normpumpe nach EN 22 858
DICKOW Standard chemical pump acc. to EN 22 858
mit HP - Platte / with Base plate bent formed

Type NCL

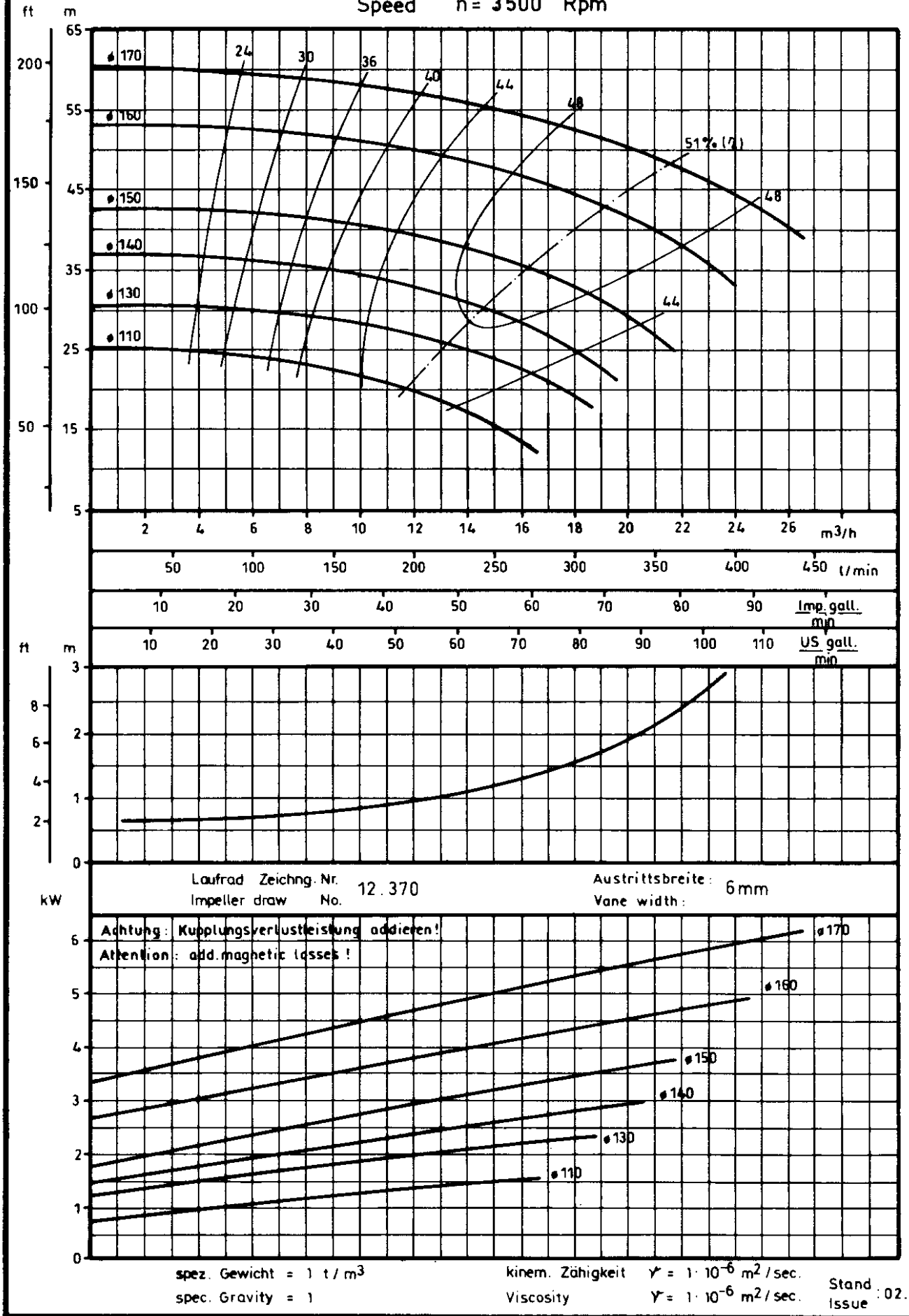
PB 04178654/55

Chemie-Normpumpen / Standard chemical pumps

Type NM 26/170

Drehzahl n = 3500 min^{-1}

Speed n = 3500 Rpm



spez. Gewicht = 1 t / m^3

spec. Gravity = 1

kinem. Zähigkeit $\nu = 1 \cdot 10^{-6}$ m^2 / sec.

Viscosity $\nu = 1 \cdot 10^{-6}$ m^2 / sec.

Stand Issue: 02.93

Schnittzeichnung / Sectional drawing

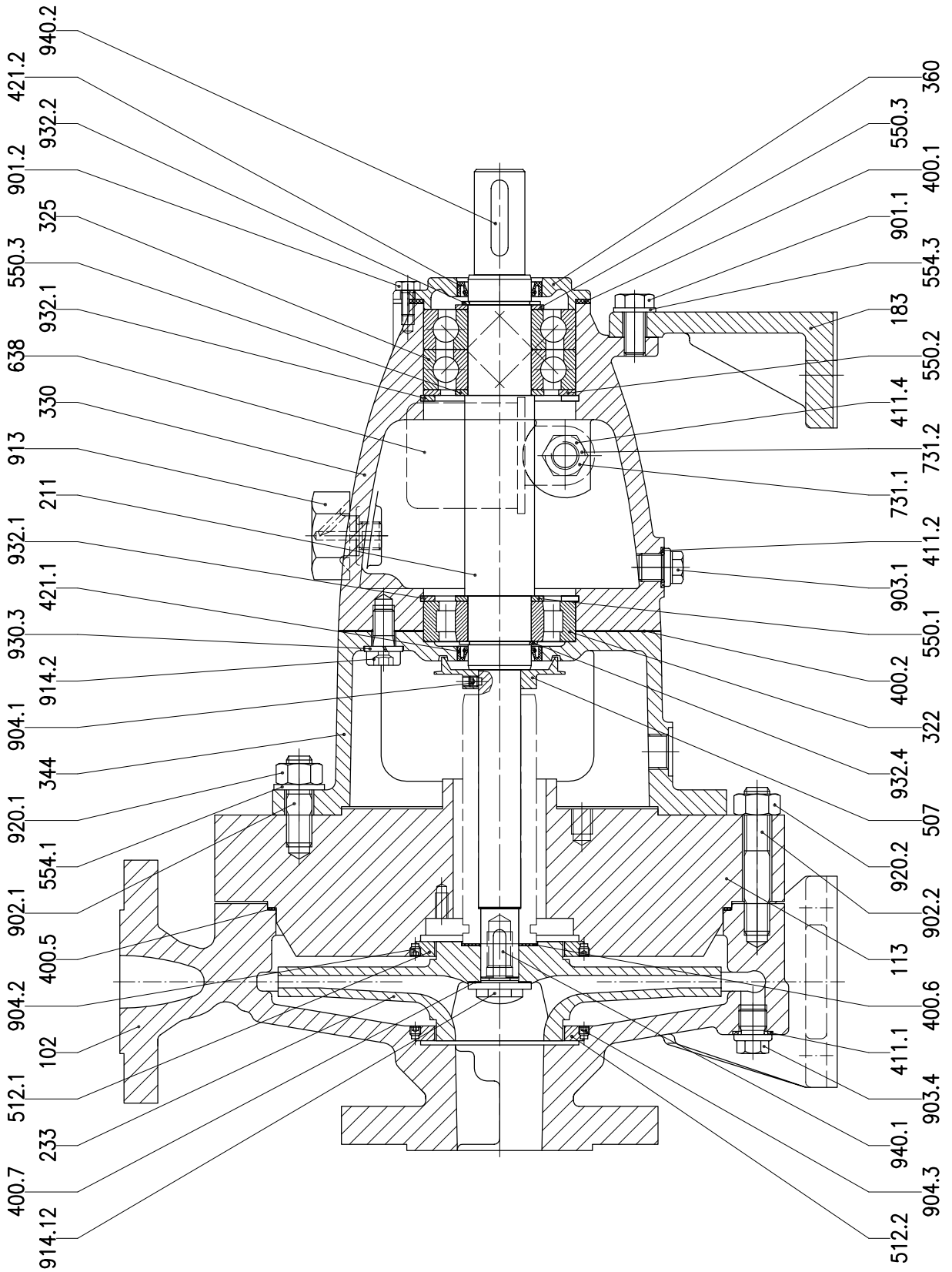
Type NCL 0

54.NCL.88

Stand: Issue: 15.07.2004

Für Gleitringdichtungen gilt das Schnittbild und Teileverzeichnis der betreffenden GLR–Dichtungsbaugruppe 14.NC.1–.....

When mechanical seal is used please apply to sectional drawing of the according mechanical seal group 14.NC.1–...



Parts List

for Type: **NCL - bearing frame 0**

102	Volute casing
113	Intermediate casing
183	Support foot
211	Pump shaft
233	Impeller
322	Roller bearing
325	Angular ball bearing
330	Bearing bracket
344	Bearing bracket lantern
360	Bearing cover
400.1	Gasket
400.2	Gasket
400.5	Gasket
400.6	Gasket
400.7	Gasket
411.1	Joint ring
411.2	Joint ring
411.4	Joint ring
421.1	Seal/bearing cover
421.2	Seal/bearing cover
507	Deflector
512.1	Wear ring
512.2	Wear ring
550.1	Disc
550.2	Disc
550.3	Disc
554.1	Washer
554.3	Washer
638	Constant level oiler
731.1	Pipe union
731.2	Pipe union
901.1	Hexagon head bolt
901.2	Hexagon head bolt
902.1	Stud
902.2	Stud
903.1	Screwed plug
903.4	Screwed plug
904.1	Grub screw
904.2	Grub screw
904.3	Grub screw
913	Vent plug
914.2	Inner hexagon cap screw
914.12	Inner hexagon cap screw
920.1	Hexagon nut
920.2	Hexagon nut
930.3	Spring washer
932.1	Circlip
932.2	Circlip
932.4	Circlip
940.1	Key
940.2	Key

Issue: 15.07.04

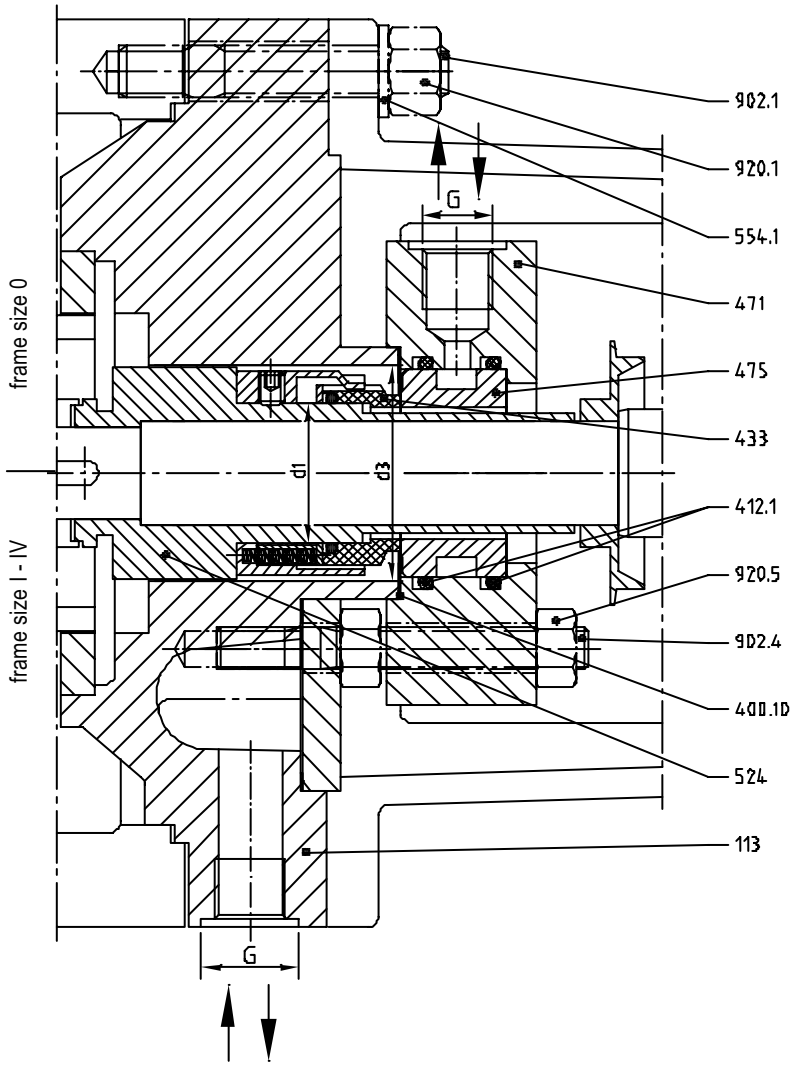
Drawing No.

54.NCL.88

Single balanced mechanical seal (Hot water design)
Brand BURGMANN, H75G15
Design "Re" with cooled stationary seal ring

1. SECTIONAL DRAWING and PARTS LIST

Bill of material 23.NC.271



Picture of intermediate casing not obligatory

113	Intermediate casing
400.10	Gasket
412.1	O-ring
433	Mechanical seal
471	Seal end plate
475	Seal ring
524	Shaft sleeve
554.1	Washer
902.1	Stud
902.4	Stud
920.1	Hexagon nut

Materials: seal faces Carbon / SiC, O-rings EP-Caoutchouc

dimensions in mm

Frame size	0 / 20	I / 25	II / 32	III / 42	IV / 53
Seal size	Ø 22	Ø 28	Ø 32	Ø 43	Ø 55
d_1	Ø 26	Ø 33	Ø 38	Ø 48	Ø 60
d_3	Ø 44	Ø 51	Ø 65	Ø 75	Ø 95
G	G 1/4	G 3/8	G 3/8	G 3/8	G 3/8

2. TECHNICAL SPECIFICATION

Operating: Dead end, no product circulation.
Cooled seal ring (at frame size I-IV, additional cooling of the intermediate casing).

Cooling water l/h						
Frame size		0 / 20	I / 25	II / 32	III / 42	IV / 53
T_E	30°C	200	200	250	250	300
T_E	60°C	400	400	500	500	600

Operating limits: Temperature max. 190°C (463K)
Seal pressure max. 35 bar (consider allowable casing pressure)

Application: Hot water

3. OPERATING AND MAINTENANCE

Technical details and instructions given in the manual of the seal manufacturer must be observed.

4. TROUBLE SHOOTING

4.1 Mechanical seal is leaking after start-up

Symptom: Minor leakage during start-up, temperature at seal end plate is normal.
Recommend. Keep pump running, seal leakage should stop after a certain time of operation.

Symptom: Leakage through elevated temperature at seal end plate
Problem: Excessive temperature at seal end plate is caused by high friction between the seal faces. Seal faces are destroyed by abrasives in the pumped liquid or by corrosion.
Remedy:: Disassemble mechanical seal, check seal faces, rework or replace if necessary. If solids are found during disassembly, pump and plant must thoroughly be flushed.

Symptom: Leakage still existing after some time of operation, temperature at seal end plate is normal.
Problem: With the temperature at seal end plate being normal, it can be assumed that the seal faces are in good order and the leakage is caused by the elastomeres of the seal (O-rings, collars, conical rings etc).
Remedy: Disassemble mechanical seal. Inspect the elastomeres for damage or deformation. Check chemical resistance. Replace if necessary.

Symptom: Steam penetrates when handling hot water.
Problem: Elevated temperature between the sliding faces causes vapourization of the the pumped liquid.
Remedy: Check the circulation of cooling water at water cooled mechanical seals.

4.2 Frequent seal failures through leakage

Problem: Abrasive particles destroy the seal faces.
Remedy: Apply wear resistant seal faces (e.g. SiC/SiC), change operation method, for example API 610, plan 31/32. Install double back-to-back seal with barrier fluid.

5. DISASSEMBLY

1. Disassemble bearing bracket unit, clamp it in vertical position. Remove impeller according to the operating manual of the respective pump type.
2. Remove shaft sleeve 524 together with mechanical seal 433 by puller. Remove the mechanical seal from the shaft sleeve.
3. Loosen and remove adapter nut 920.1 together with the washers 554.1
4. Loosen connection between intermediate casing 113 and bearing bracket lantern (use threaded holes for jack screws in bearing bracket lantern). Remove intermediate casing carefully to avoid damage of the stationary seal ring 475. Place the unit on a working table.
5. Loosen and remove adapter nuts 920.5 from seal end plate 471.
7. Remove the seal end plate from its centring.
8. Dismantle seal ring 475 and O-ring.

Attention ! O-rings of EP-Caoutchouc must not get in contact with mineralic grease or oil.

6. INSPECTION

Metallic seal parts must be free of corrosion or any mechnical damages. Replace if necessary. Change seal rings always in pairs if chemical attack or grooves are visible on the faces.
Replacement of elastomeres and gaskets is generally recommended in the course of inspection.

7. REASSEMBLY

After inspection and replacement of unusable parts, reassembly is to be performed as described in section 5 but in reverse manner. The following must be considered:

Absolute cleanliness and care are essential when fitting mechanical seals. Dirt and damage to seal faces or elastomeres jeopardize a seal's function. Any protective covering on the faces of a new seal must be removed without trace. Never put lubricant onto the seal faces – mount them only in a completely dry dustfree and clean state.

8. SUITABILITY IN HAZARDOUS AREAS, ACC. TO EC-DIRECTIVE 94/9/EG

Technical details and instructions given in the manual of the seal manufacturer must be observed.

Type:

- Pressure gauge valve needle straight.

Size:

- 1/2” x 1/2”

Application:

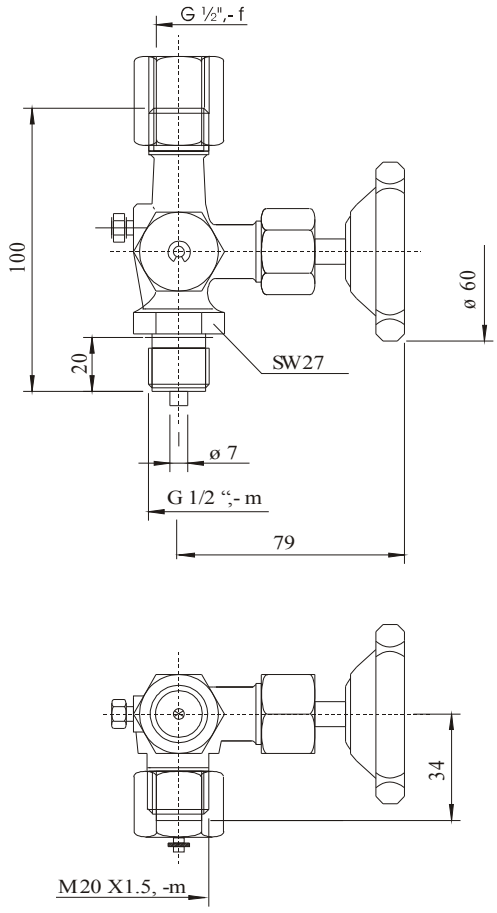
- For instrument connections

Material:

- Body: C22.8
- DIN-material No. 1.0460

Technical data:

- Nominal pressure: PN 400
- Test connection: M20 x 1.5 mm threaded male
- Weight: 0.4 kg



Type No.: 6210 **Version: A.2**	**Needle valve, straight, ½" x ½", PN 400**	**2541002**

Type:

- Pressure gauge, type P1116

Size:

- ø 63

Application:

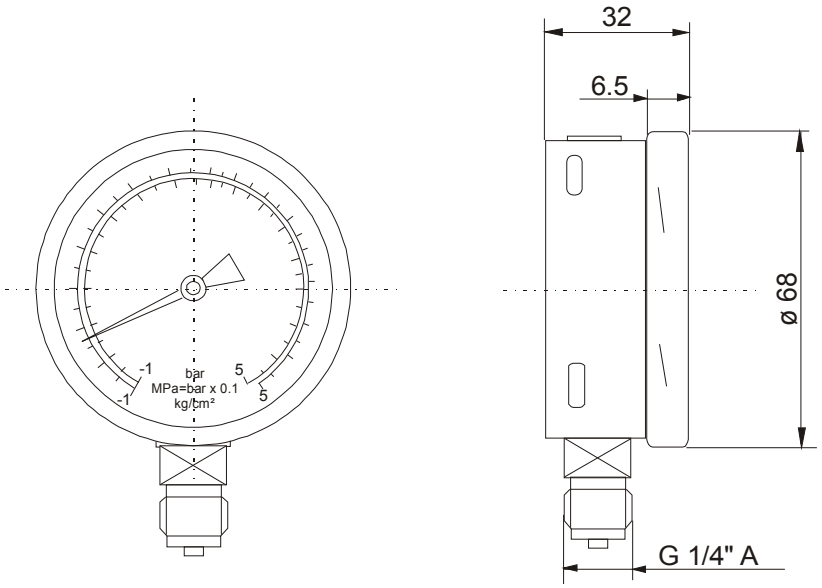
- For all gaseous and liquid media

Material:

- Case: Stainless steel
- Socket: Cu-alloy
- Liquid filling: Glycerine

Technical data:

- Connection: G 1/4”-m
- Measuring unit: bar – Mpa - kg/cm²
- Measuring range: -1 to +5 / - 0.1 to +0.5 / -1 to +5
- Pressure utilisation:
  Static pressure: 75% of $P_{max.}$
  Dynamic pressure: 66% of $P_{max.}$
- Operating temperature: -20 to +80°C
- Accuracy: EN 837 Class 1,6



Type No.: 8050 Version: A.2	**Pressure gauge, ø 63**	**6633118**

Type:

- Pressure gauge, type P1116

Size:

- ø 63

Application:

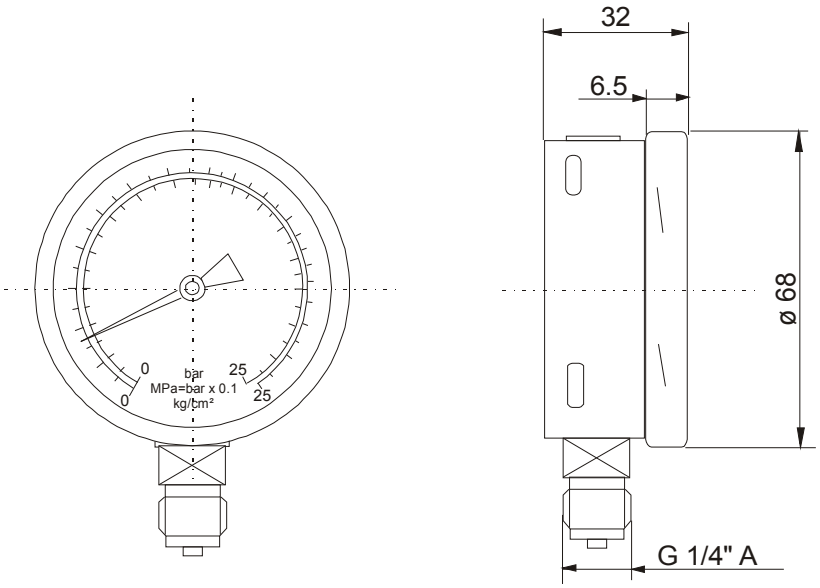
- For all gaseous and liquid media

Material:

- Case: Stainless steel
- Socket: Cu-alloy
- Liquid filling: Glycerine

Technical data:

- Connection: G 1/4”-m (1/4 BSP)
- Measuring unit: bar – Mpa – kg/cm²
- Measuring range: 0 – 25 / 2.5 / 25
- Pressure utilisation:
  Static pressure: 75% of $P_{max.}$
  Dynamic pressure: 66% of $P_{max.}$
- Operating temperature: -20 to +80°C
- Accuracy: EN 837 Class 1,6



Type No.: 8050 Version: B.1	**Pressure gauge, ø 63**	**6633121**

Type:

- Control globe valve, straight with pneumatic actuator and I/P positioner
- 23.470, DP 33

Size:

- Nominal diameter: DN 80

Application:

- For cooling, water, steam, brine and/or gas flow

Material valve:

- Body: GGG 40.3
  DIN -Material No. 0.7043
- Seat: X20 Cr13
  DIN –Material No. 1.4021.05
- Plug: X20 Cr13
  DIN –Material No. 1.4021.05
- Stuffing box: PTFE V-ring unit(-10°C to + 220°C)

Technical data, valve:

- Nominal pressure: PN 25
- Positioning ratio: 50:1
- Flow characteristic: Equal percentage
- Standard k_v value:63 m³/h
- Stroke:30 mm
- Plug type: Parabolic shaft guided
- Flanges according to DIN

Technical data, actuator:

- Spring range:1.5 – 3.0 bar
- Design closing pressure: 15.1 bar
- Diaphragm area:400 cm²
- Filling volume: 2.3 l
- Max air pressure: 6 bar
- Action: Normally closed valve on air failure

Technical data, I/P positioner:

- Air connection: G ¼”
- Inlet air supply: 1.4 to 7 bar, instrument air
- Air inlet consumption in stable state: < 3.6 x 10^{-2} Nm³/h
- Cable inlet: M20 x 1.5
- Input signal: 4-20 mA
- Ambient temperature: -30°C to +80°C
- Protection: IP65

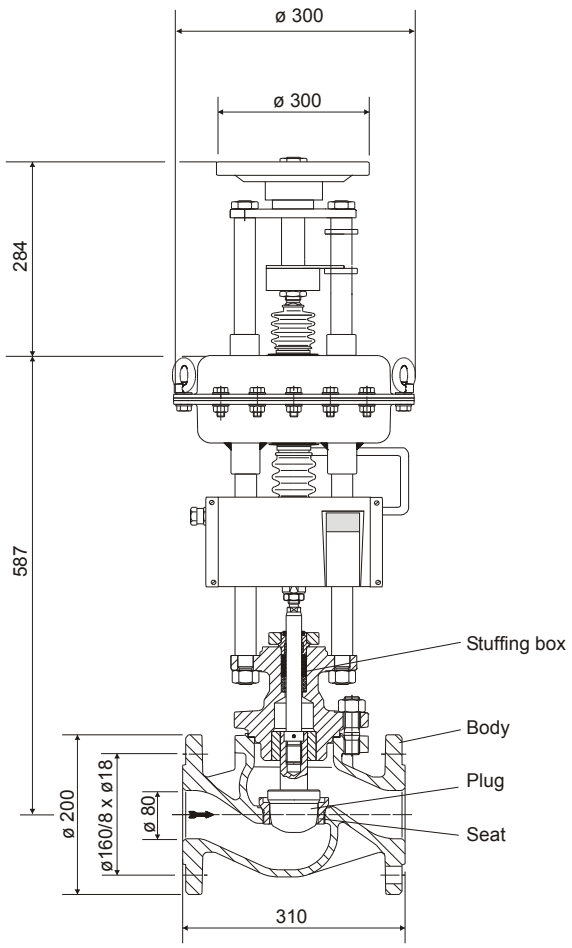
Technical data unit:

- Design closing pressure: 15.1 bar
- Weight: 60 kg

Installation:

- Only as shown in the picture

Type No.: 6050 **Version: A.2**	**Pneumatic control valve, DN 80, PN 25, with DP actuator and I/P positioner**	**6050000247**



Type No.: 6050 **Version: A.2**	**Pneumatic control valve, DN 80, PN 25, with DP actuator and I/P positioner**	**6050000247**

Type:

- Filter regulator with automatic drain

Size:

- Connections ports 1/4” BSP
- Gauge ports 1/8” BSP

Application:

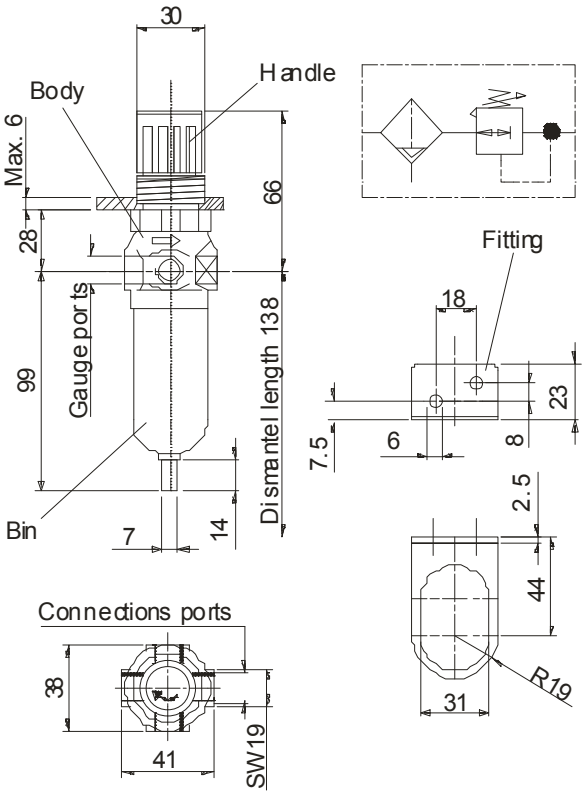
- Instrument air for regulating pressure

Technical data:

- Medium: instrument air only
- Max. inlet pressure: 17 bar
- Operating temp.: –20 °C to + 65 °C
- Filter element: 5 µm
- Recommend pressure regulating range: 0.14-7.0 bar
- Pressure gauge: 0 – 10 bar
- Weight: 0.4 kg

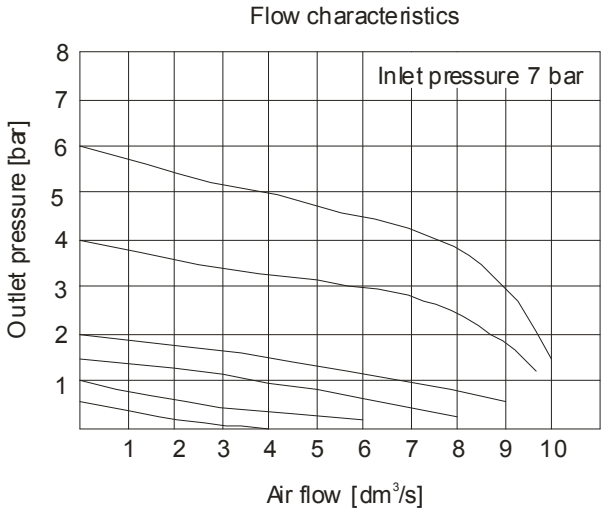
Material:

- Body: Steel
- Bin: Steel
- Handle: Acetal





Type No.: 8000 Version: A.2	Filter regulator with automatic drain	2915101



Type No.: 8000 **Version: A.2**	**Filter regulator with automatic drain**	**2915101**

Type:

- Remote emergency stop system box, included PG-gland cable connection

Application:

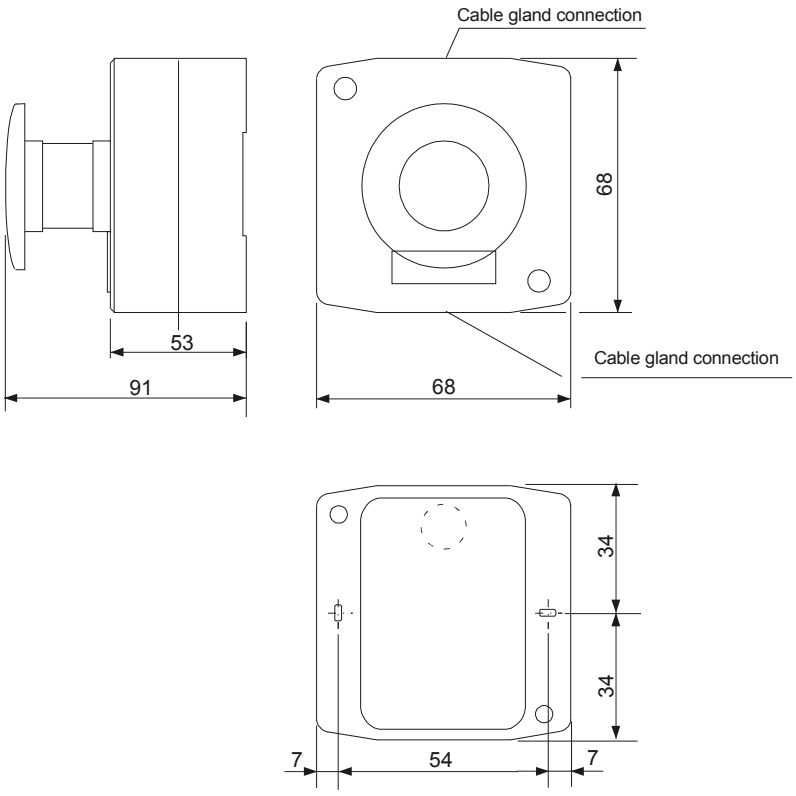
- For emergency stop

Material:

- Polycarbonate
- Colour: Front RAL 7035
- PG-gland: Brass

Technical data:

- Cable glands: M 20
- Ambient temperature: - 25°C to + 70°C
- Protection: IP 65



Type No.: 8000 **Version: A.2**	**Remote emergency stop**	**8000000016**

Type:

- Remote start/stop box

Application:

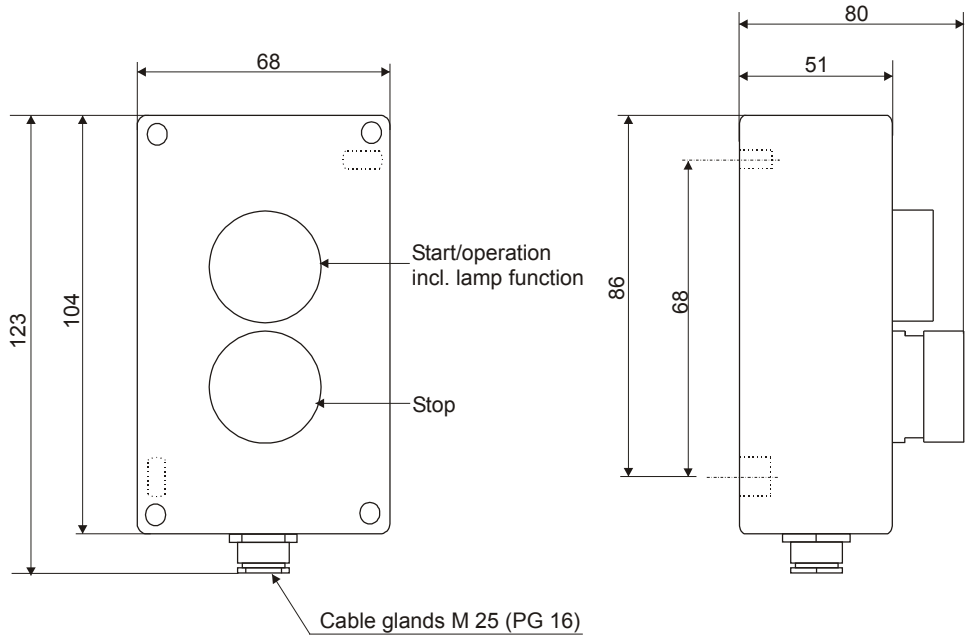
- For start/operation and stop of pumps

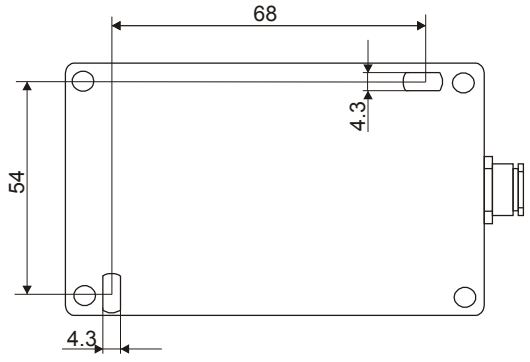
Material:

- House: Polycarbonate
- Colour: Front RAL 7035
- Back RAL 7021

Technical data:

- Nominal operating condition:
  A 600: Ue = 600 V and Ie = 1.2 A or
  Ue = 240 V and Ie = 3 A or Ue = 120 V
  and Ie = 6 A
- Protection: IP 65
- Temperature: -25ºC to +70ºC
-





Type No.: 8000 Version: A.2	**Remote start/stop box**	**8000000011**

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MISSION control system

SD9306_05 Touch control system.....35-2

Touch control system

1 General

The MISSION™ Control Touch control system is designed to provide safe and functional operation of the boiler plant both at the boiler and from a remote location such as the engine control room. The general design is a common panel solution. Each panel is capable of controlling one oilfired boiler and one exhaustgas boiler and consist of a local control part and a power part integrated into one panel. The panel is locally controlled by means of a touch screen in the front of the panel.

Figure 1 illustrates a typical configuration for a boiler system. The example shown is for a MISSION™OS boiler plant with a MISSION™ XS exhaustgas boiler. The control system is constructed in a similar way for other single boiler installations.

The communication between the common paneland touch screen is achieved through a 2-wire RS485 network. The cable type is a twisted pair with shield. The 2 x 0.5-1.5 mm^2 cable should not exceed 1000 metres in total length.

Illustration of the control system

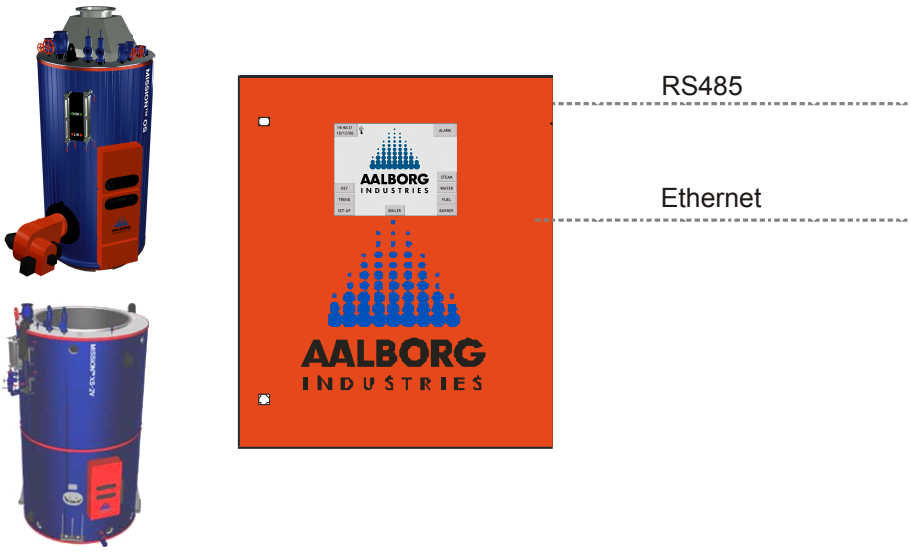


Figure 1 **contouch_01x0195512en.wmf**

Common panel

The common panel holds two MISSION™ controllers, communication interface, relays, flame monitoring equipment, water level control equipment, switches for emergency operation but also power supply systems, motor starters and optional compo-

nents like smoke density monitoring system, salinity alarm equipment, oil detection equipment, etc.

The cabinet gives an IP 55 insulation class and can be located in ambient temperatures between 0-55ºC with a relative humidity up to 90%. The maximum vibration level is 100 Gal at 10-30 Hz. And the power supply is 115 or 230 V AC, 45-65 Hz. The maximum power consumption of the local panel is approximately 50 VA.

The two MISSION™ controllers constitute a computerised control and monitoring system. The panels are equipped with a number of digital and analogue input/output connections. These input and output connections are handled by the CPU, which operates the panels. An EPROMcontains the programme, and a E^2PROM stores specified plant data.

One of the controllers handle is the local controller and handles the oilfired boiler if present. The other controller is the common controller and handles common tasks such as E.g. control of the fuel oil- or feed water pumps if provided.

The complete boiler system can be operated from the controllers inside the local panel with or without the touch screen in service. By use of the soft keys placed to the left of the display, the burner can be operated in manual mode, and shut downs/alarms can be acknowledged. The soft keys placed to the right of the display give access to the menu structure. The actual menu levels or menu item lines are displayed on the four line Liquid Crystal Display (LCD). Figure 2 illustrates the interface on the controllers.

It is also via these controllers that the basic configuration of the system is done during commissioning. Access to a number of different parameters, settings, etc. is limited by password entering. This secures the operation from unintentional entering and modification, which might cause damage to the boiler plant. The password routine is divided into two steps. The entering of the common user password provides access to the most common menu items, and the super user password, which is only known by Aalborg Industries, provides access to the more vital functions.

Illustration of the controller interface



Figure 2 **contouch_02x0197680en.wmf**

Monitoring and control from the touch screen

The control system is provided with a touch screen with a graphic user interface for a clear view of the boiler operation. This touch screen can be installed anywhere, as long as the length of the cables does not exceed 1000 metres. The boiler plant can be moni-

tored and operated from the touch screen as well as from the local panels. Furthermore, trend curves for the plant can be viewed and alarms can be acknowledged.

In Figure 3 the main screen of the touch screen is shown. By use of the touchscreen, shut downs/alarms can be acknowledged from the bell-button in the upper right corner. The buttons on the right side of the display give access to detailed information on the steam system (and exhaustgas boiler if present), feed water, fuel system, and burner operation. From the buttons on the left side of the touch screen, key lock, trend curves and the set-up menu can be accessed. The button [BOILER] gives access to an overview of the operation of the boiler system.

Illustration of the main page of the touch screen

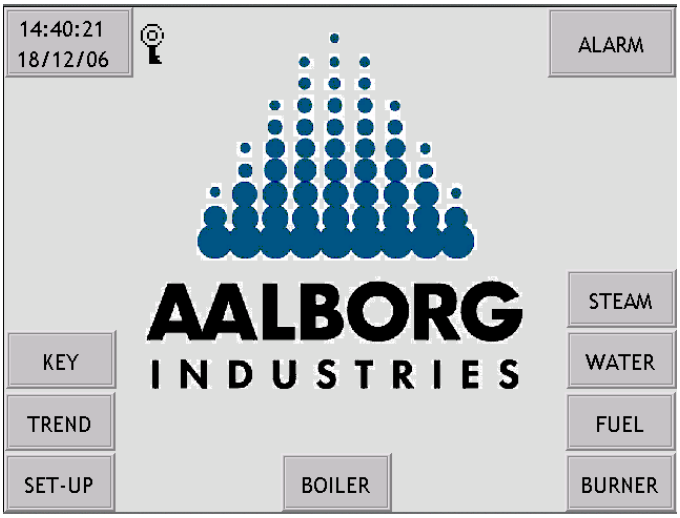


Figure 3 **contouch_03x0197690en.wmf**

A password system provides the logged-on user with permissions/restrictions and ensures that no parameters can be changed by unauthorised personnel.

Mod-bus interface

An optional communication interface via Modbus protocol (RS485) to other systems on board the ship can be provided (see).

The Modbus interface feature offers external control and monitoring of a limited number of parameters in the boiler control system from an external operating place such as e.g. the cargo control room.It is possible to control and/or monitorparameters such asboiler operation mode, state (stopped, starting, purge, etc.), manual start/stop and load, selection of master/slave boiler, inert gas mode (if provided), boiler/system pressure, and water level.

If Modbus is selected, Aalborg Industries supplies a complete address list and a separate communication port on the touch screen including a 9-pin DB9 plug.

Remote desktop

The system supports remote desktop using a web browser.Communication is carried out over an ordinary Ethernet network (see Figure 1) using an Ethernet cable with RJ45 connectors (not supplied by AI).

With the remote desktop feature it is possible to remote control the touch display seeing the same picture as on the actual touchscreenand using the computer mouse as input device instead of ones finger.

For details please refer to the document “Touch Remote Desktop”.

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Operation of the panels

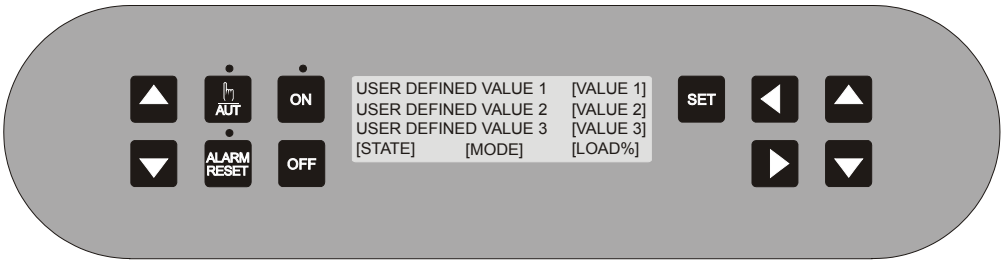
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Operation of the panels

1 General

The MISSION™ Control Touch (MCT) control panel is usually equipped with both a local controller and a common controller. The local controller controls the oil fired boiler and burner operation, and the common controller controlscommon items and accessories such as fuel oil pumps, feed water pumps, exhaustgas boilers, salinity, etc. On MCT systems normal operation will be carried out from the touch screen but for system configuration or in case the touch screen breaks down operation is carried out from the controllers. Figure 1 illustrates the local controller and the operation of the soft keys.

Illustration of a controller



Manual increase of the burner load. This facility is only available in manual operation mode. Or manual increase of other remote control settings = 1.

Manual decrease of the burner load. This facility is only available in manual operation mode. Or manual decrease of other remote control settings = 1.

Selection between automatic and manual operation mode. The yellow LED above the soft key shines in manual operation mode.

Acknowledgment of alarms and shut downs. Low frequent flashes on the red LED above the soft key indicate alarms, and high frequent flashes indicate shut downs/ burner cut-off.

Starts the burner in manual operation mode. The green LED above the soft key flashes. When a feedback signal for combustion air fan running is received, the LED shines.

Stops the burner in manual operation mode. The green LED above the "ON" soft key is switched off simultaneously.

Entering of different menu items for modification of settings, parameters, etc. Password entering is required when this soft key is used.

Moves further out of a branch in the menu structure and changes digit position towards left.

Move further into a branch in the menu structure and changes digit position towards right.

Moves upwards in the menu structure and increases to a higher value.

Moves downwards in the menu structure and decreases to a lower value.

BOILER PRES	0.0 BAR
F.OIL TEMP	0 °C
F.OIL PRES	0.0 BAR
STOPPED [IG]	0%

Display for surveillance of operation, servicing, and modification.
The display is a 4-line display with maximum 20 characters in each line.
If the sign IG is indicated the boiler plant is operating in inert gas mode.
If the sign ⊐ is indicated the boiler plant is stopped by an external stop.
If the sign ⊓⊸ is indicated the key operation lock is opened.

Figure 1 **om9306_58_unisabx0062900en.wmf**

By use of the soft keys placed to the left of the display, the burner can be operated in manual mode, and shut downs/alarms can be acknowledged. Furthermore, a number of remote controls (e.g. oil pressure, water level, etc.) can be operated/controlled from here provided the actual remote control setting is selected to "1" in the menu structure. The soft keys placed to the right of the display give access to the menu structure. The actual menu levels or menu item lines are displayed on the four line crystal display (LCD).

The menu structure for the local and power panels can be found elsewhere in this manual.

The communication between the panels included in a boiler plant is achieved through wire connections.

2 Operating examples

In this section a number of operating examples are illustrated. The operating principles in the examples shown are identical for all other boiler and burner types. This means that regardless of the parameter, setting, etc., which should be entered or modified, the procedure for operating the panels is the same.

Examples No. 2 to No. 5 imply that the key operation lock is unlocked. If this is not the case then please refer to example No. 1 or the specific instruction for unlocking the key operation lock.

The following operating examples are shown:

- Operating example No. 1:
- Unlock of the key operation lock for local panel 1. See Figure 2 and Figure 3.
- Operating example No. 2:
- Change of burner operation mode from stopped mode to automatic mode. See Figure 15, Figure 5, and Figure 6.
- Operating example No. 3:
- Change of set point for low steam pressure alarm. See Figure 7, Figure 8, and Figure 9.
- Operating example No. 4:
- Inspection of the shut down list. See Figure 10, Figure 11, and Figure 12.
- Operating example No. 5:
- Manual start and stop of the burner. See Figure 15 and Figure 15.

Example No. 1: unlock the key operation lock

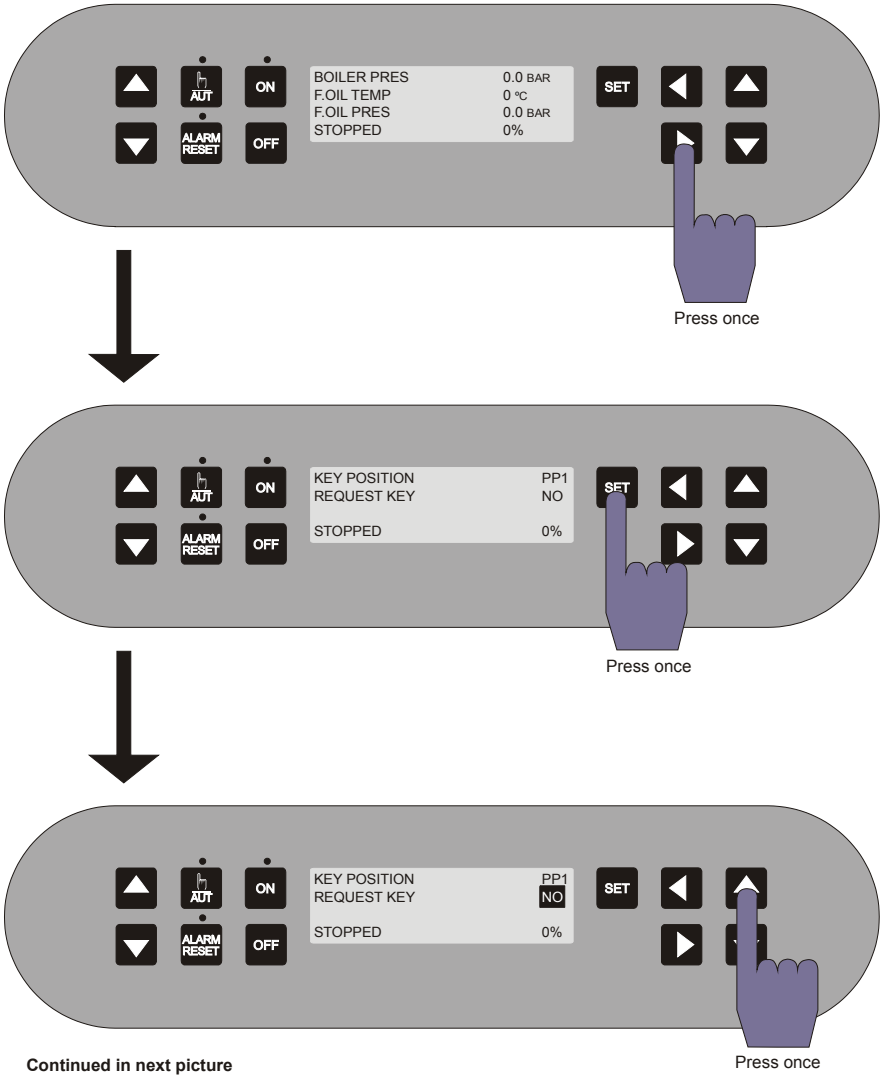


Figure 2 **om9306_58_unisabx0063020en.wmf**

Example No. 1: unlock the key operation lock (continued)

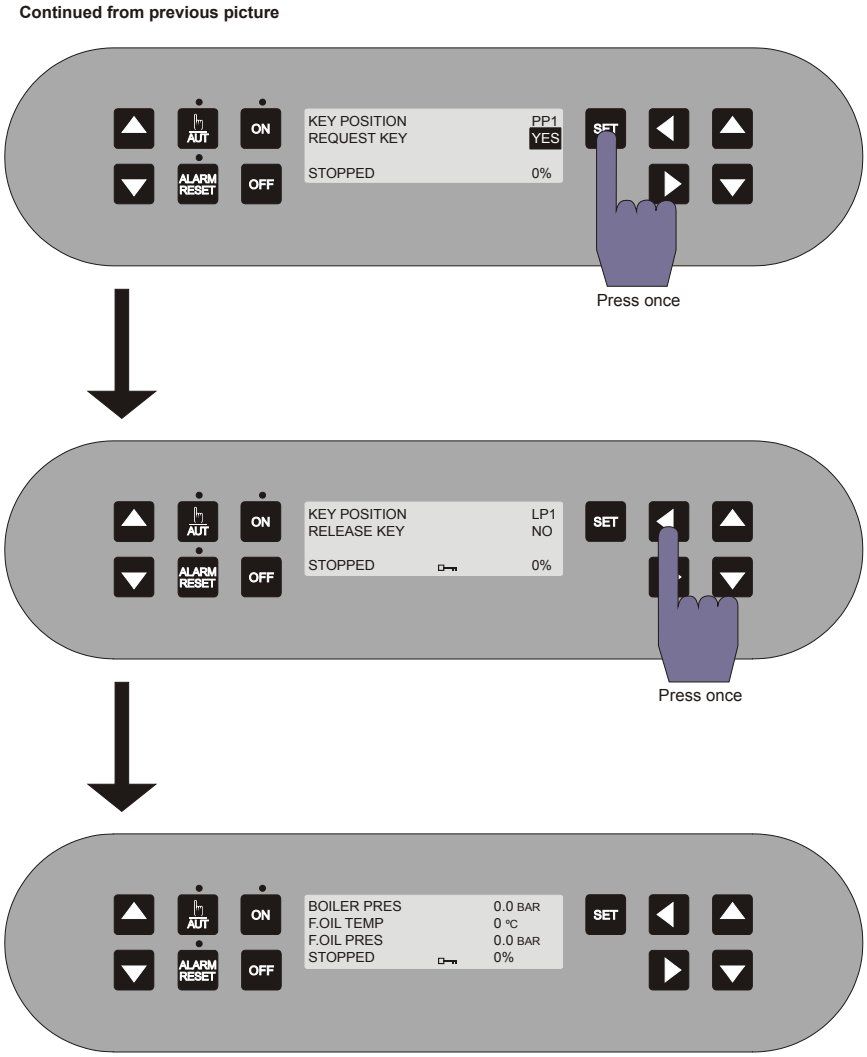


Figure 3 **om9306_58_unisabx0063030en.wmf**

Example No. 2: Change of operation mode

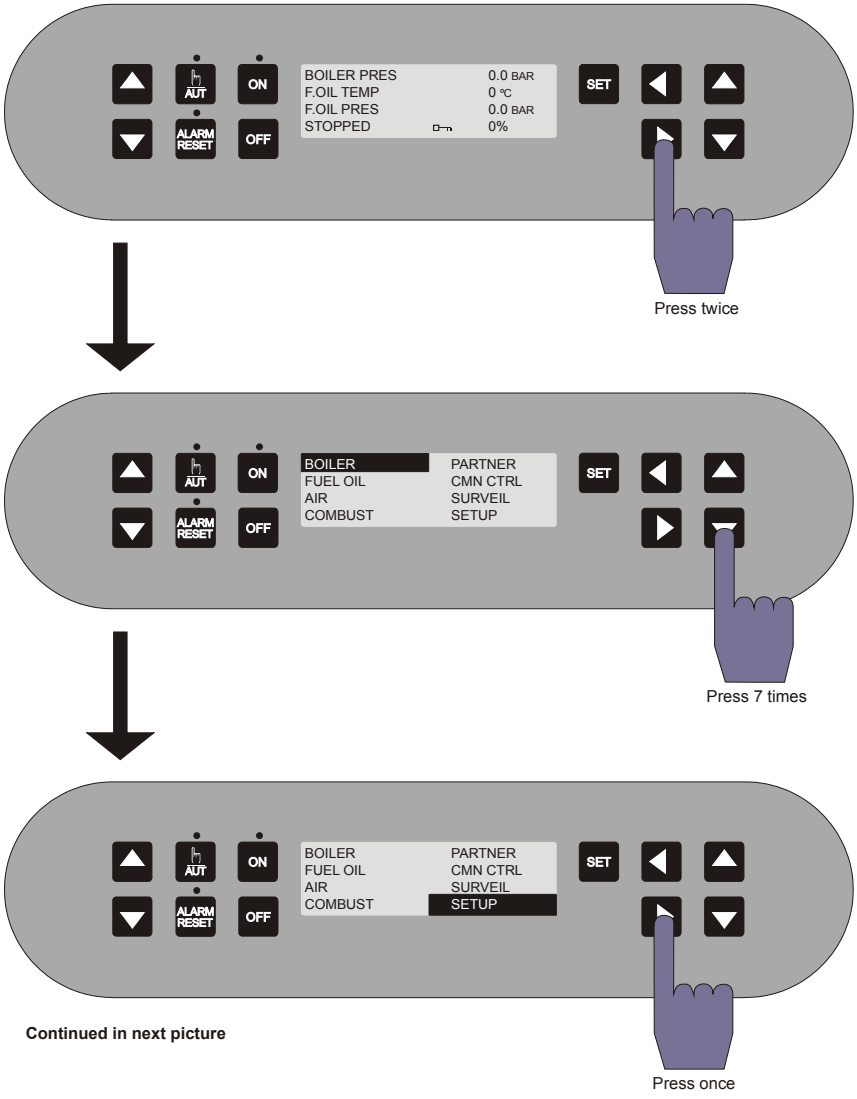


Figure 4 **om9306_58_unisabx0062910en.wmf**

Example No. 2: Change of operation mode (continued)

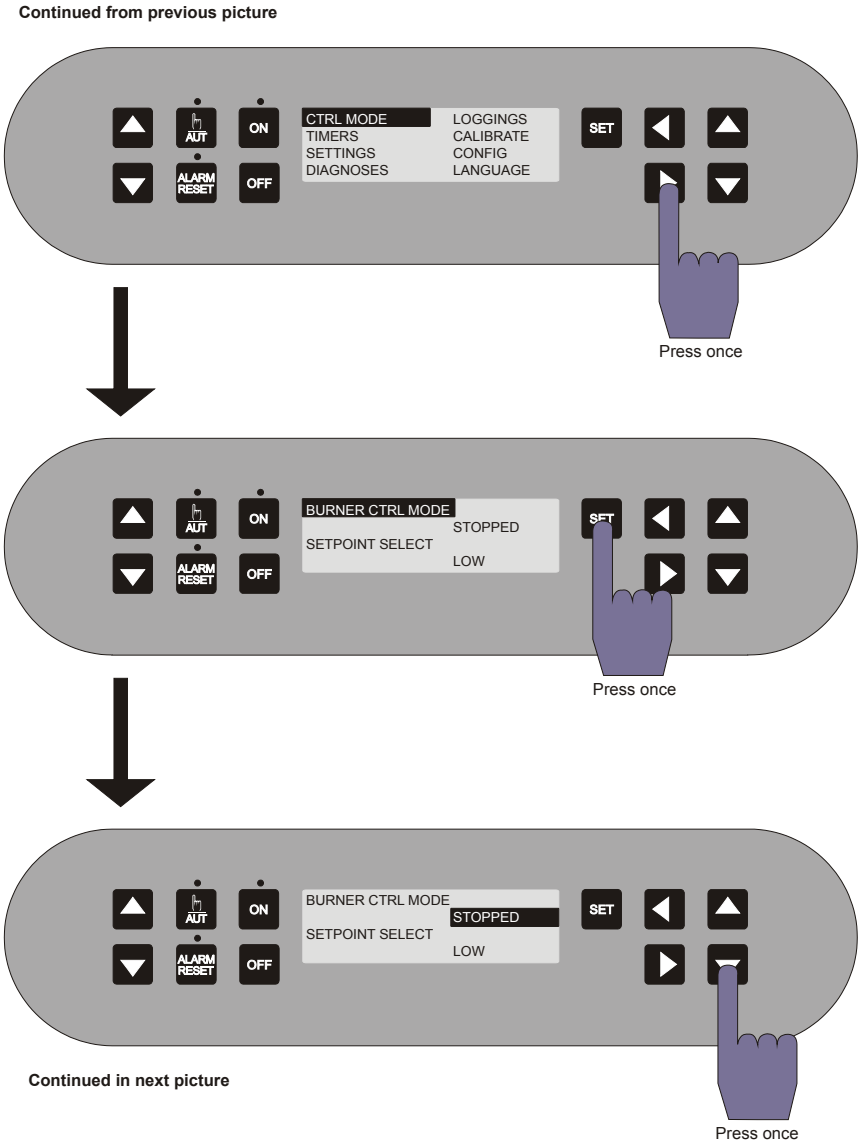


Figure 5 **om9306_58_unisabx0062920en.wmf**

Example No. 2: Change of operation mode (continued)

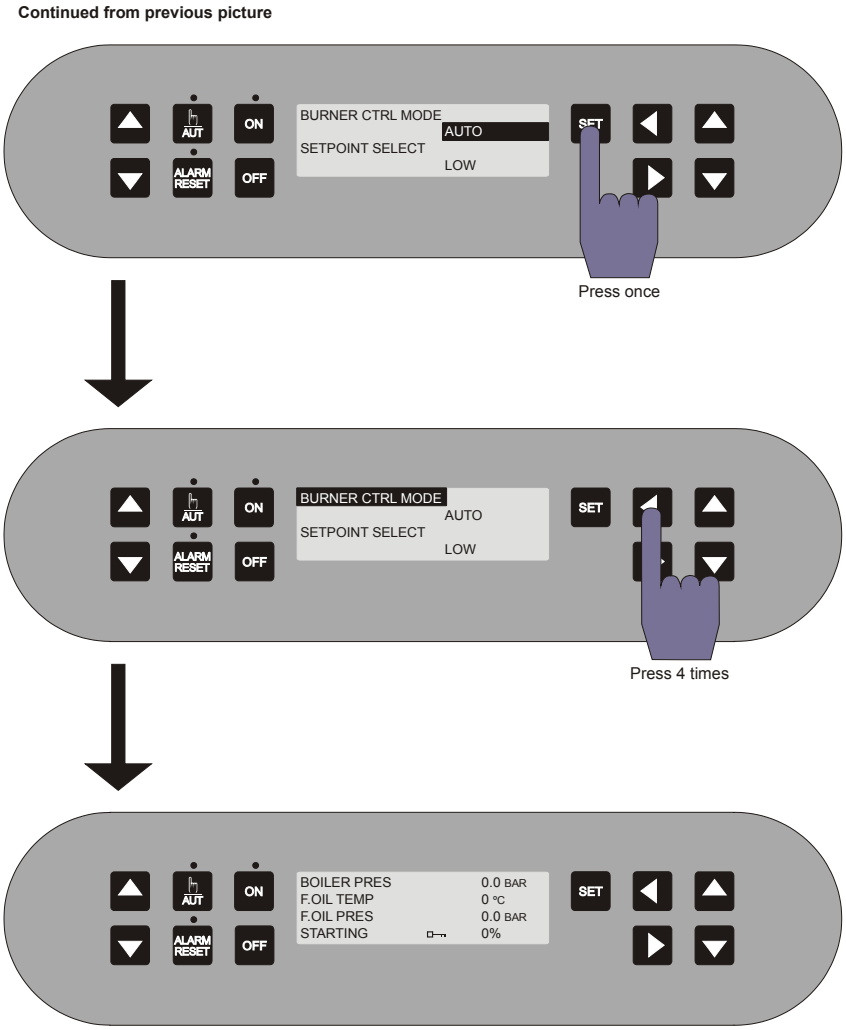


Figure 6 **om9306_58_unisabx0062930en.wmf**

Example No. 3: Change of set point

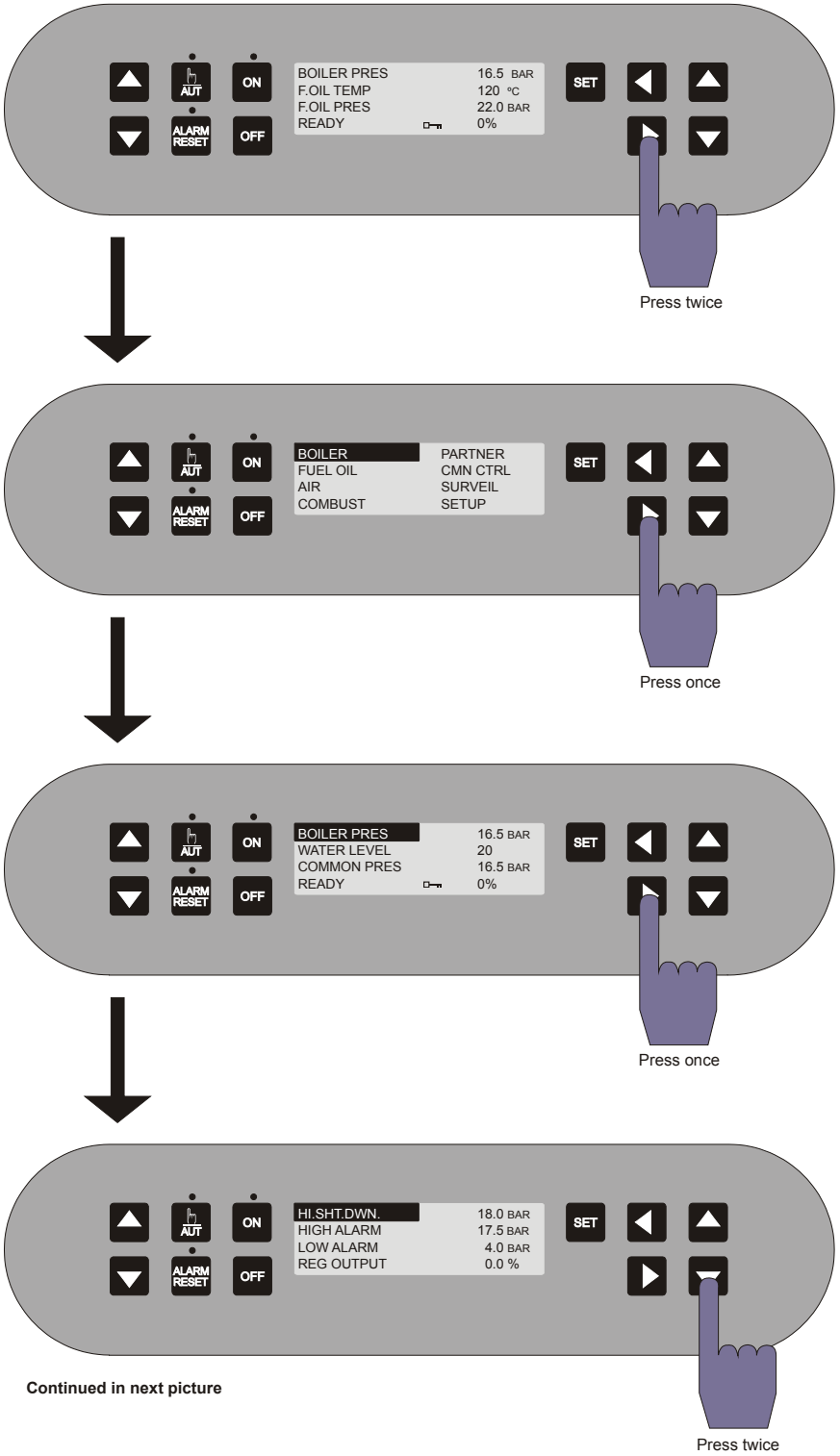


Figure 7 **om9306_58_unisabx0062940en.wmf**

Example No. 3: Change of set point (continued)

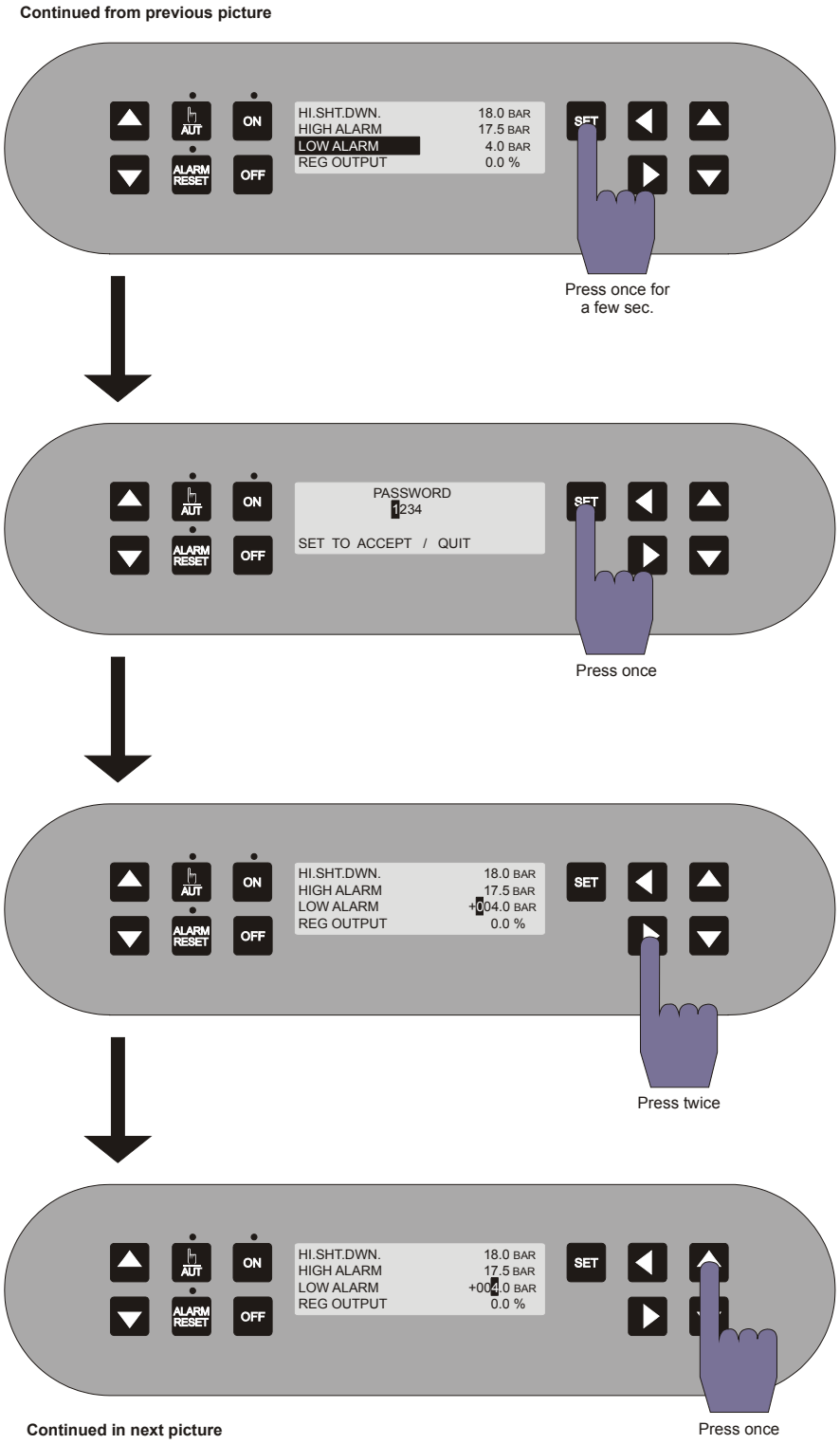


Figure 8 **om9306_58_unisabx0062950en.wmf**

Example No. 3: Change of set point (continued)

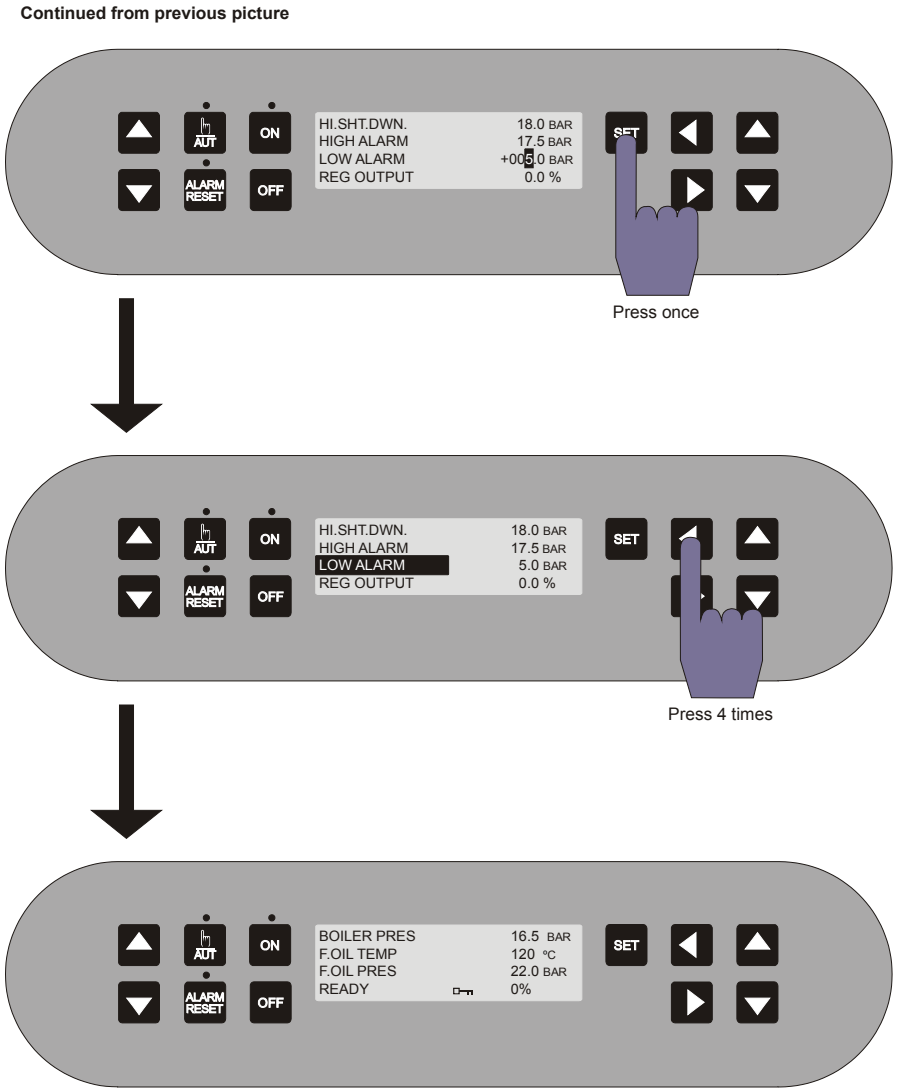


Figure 9 **om9306_58_unisabx0062960en.wmf**

Example No. 4: Inspection of the shut down list

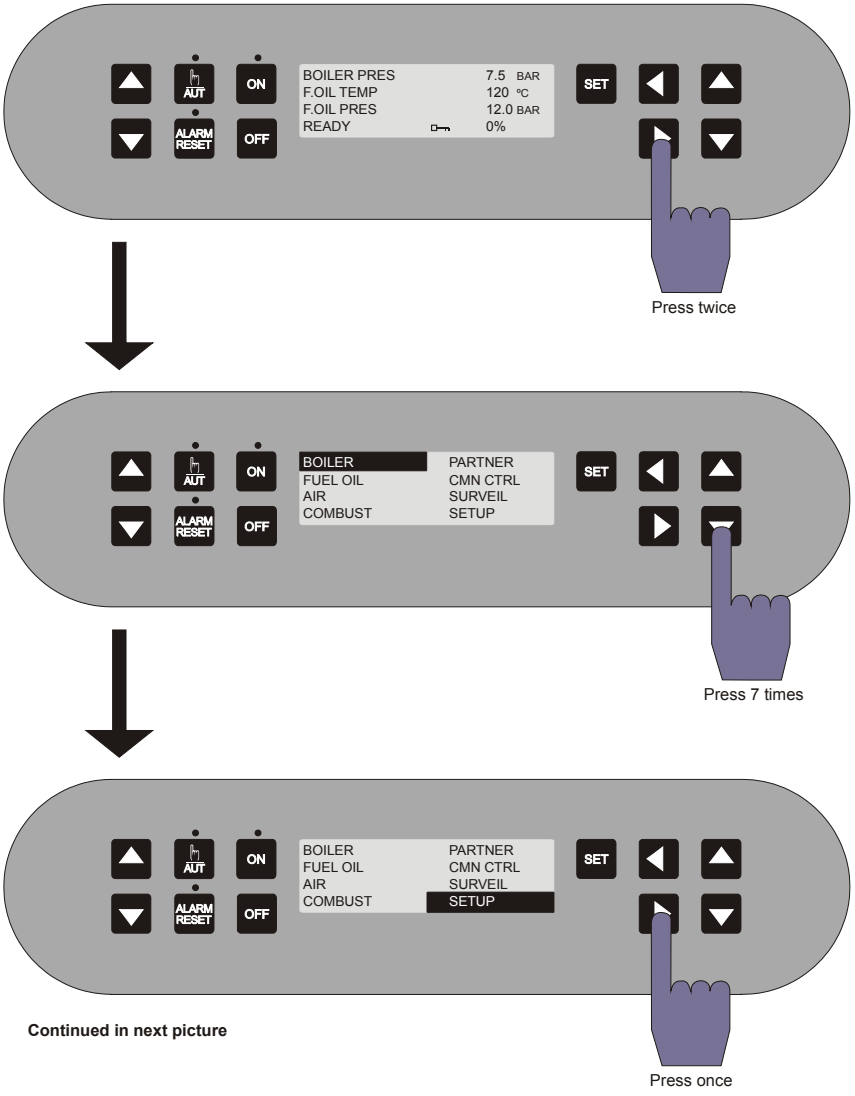


Figure 10 **om9306_58_unisabx0062970en.wmf**

Example No. 4: Inspection of the shut down list (continued)

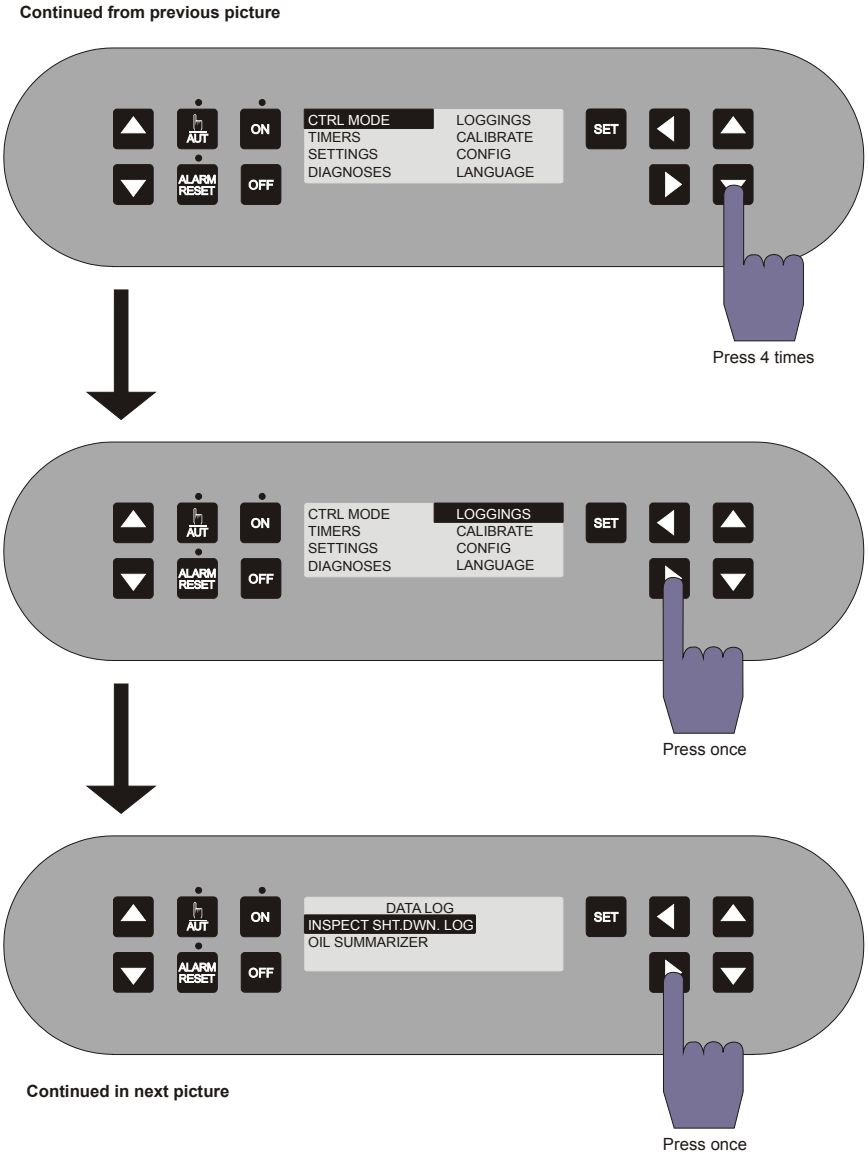


Figure 11 **om9306_58_unisabx0062980en.wmf**

Example No. 4: Inspection of the shut down list (continued)

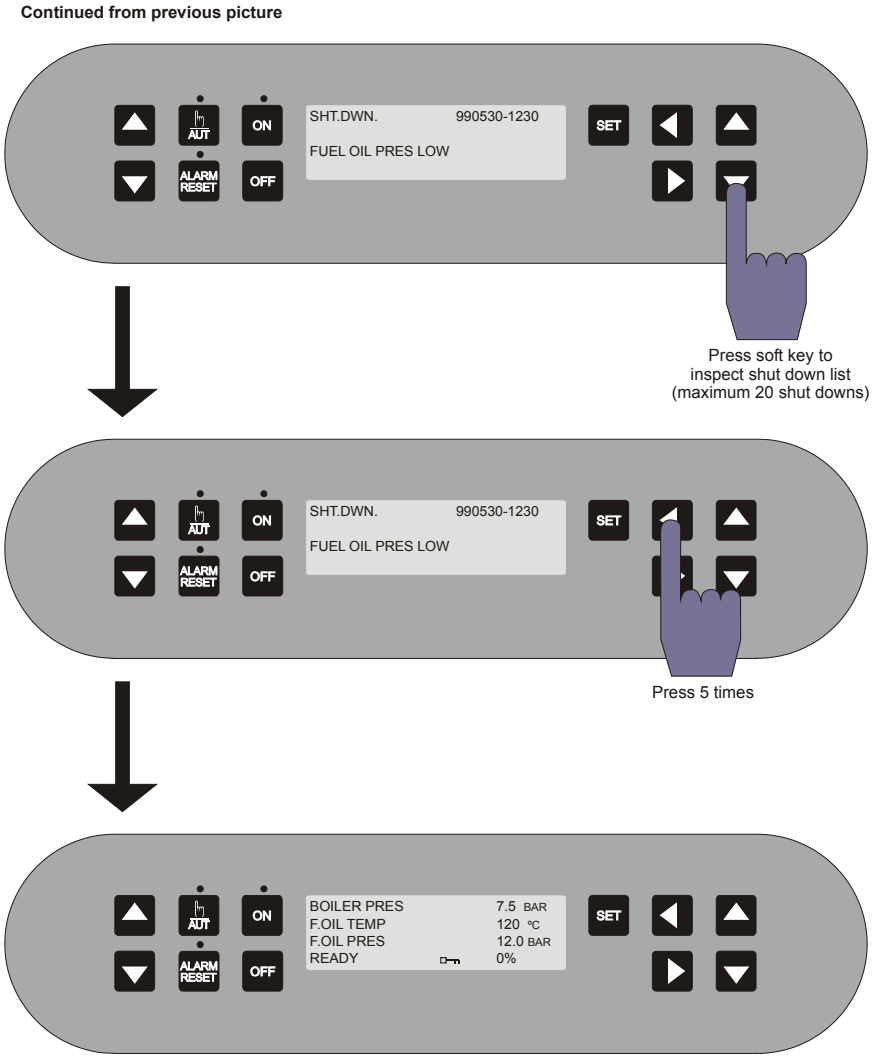


Figure 12 **om9306_58_unisabx0062990en.wmf**

Example No. 5: Manual start/stop

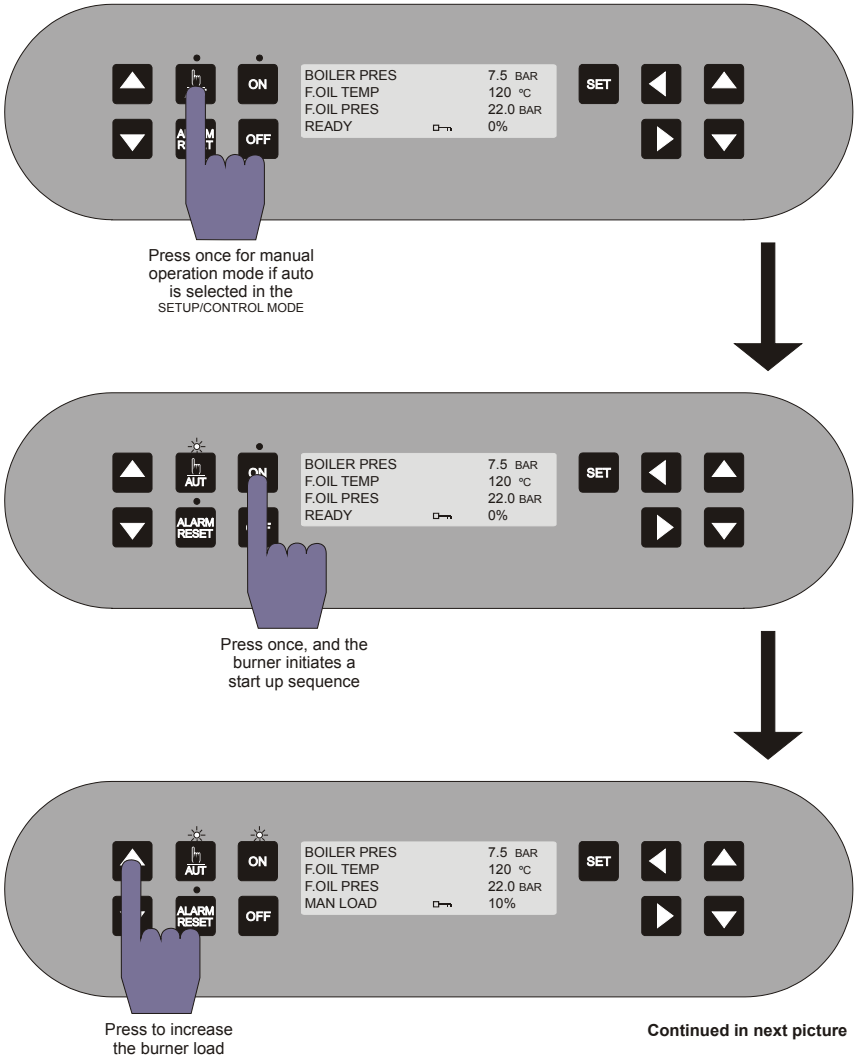


Figure 13 **om9306_58_unisabx0063000en.wmf**

Example No. 5: Manual start/stop (continued)

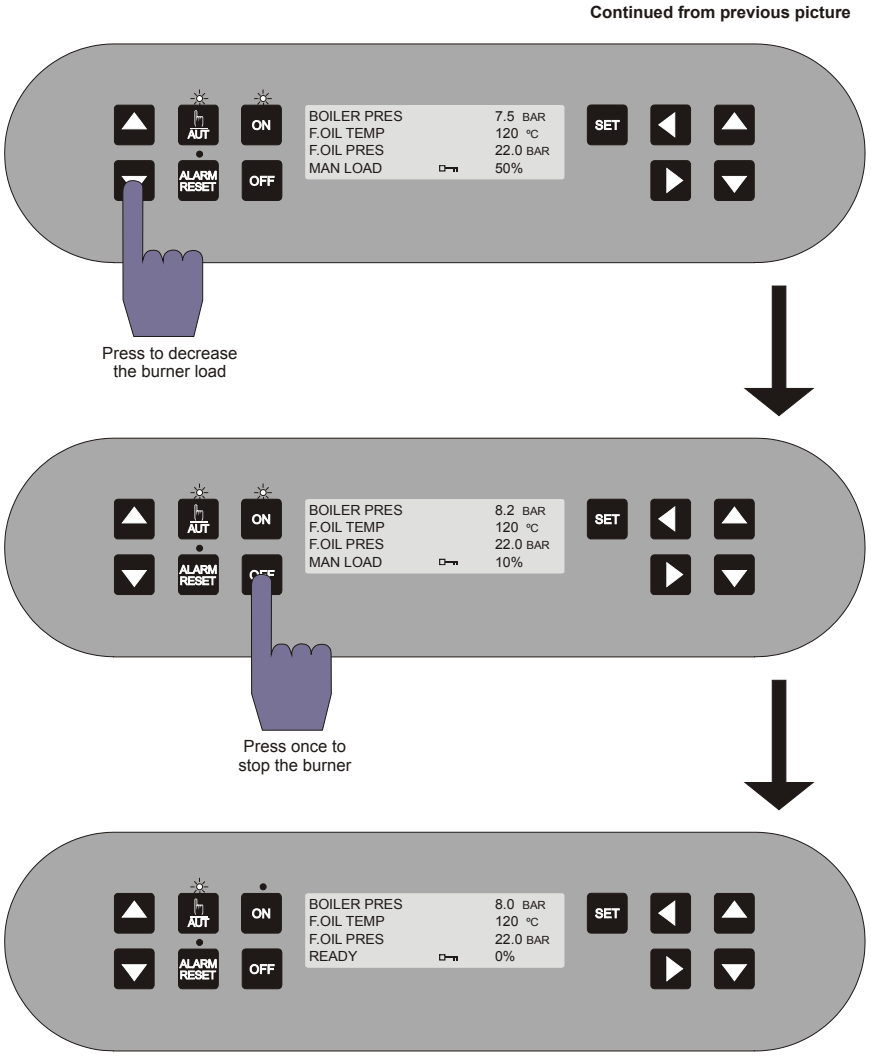


Figure 14 **om9306_58_unisabx0063010en.wmf**

Operation of the touch screen

1 General

The control system is equipped with a touch screen, where the system can be controlled and overviewed from. The boiler operation, which can be performed from the local panel(s) can also be performed from the touch screen. Operation by use of the local panels can be found elsewhere in the manual. Figure 1 illustrates the main picture of the touch screen.

Main picture of touch screen

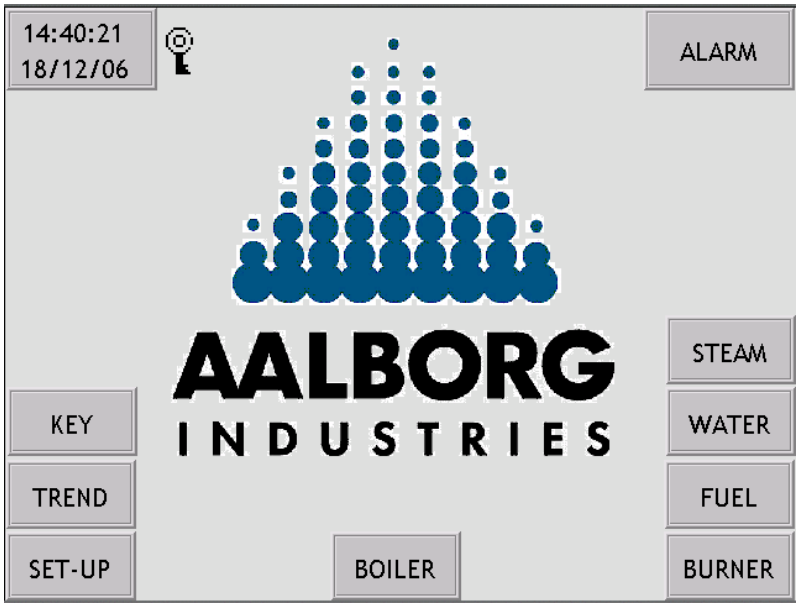


Figure 1 **om9306_57_pic_0x0062860en.wmf**

[ALARM]: The alarm button in the upper right corner is accessable from any screen view. This button gives access to acknowledge alarms and view the alarm list.

[STEAM] The steam button gives access to an overview of the steam system, to set alarm limits, to control the feedwater pumps and to access an overview of the exhaustgas boiler if present.

[WATER] The water button gives access to an overview of the feedwater system, to set the alarm limits, and to control the feedwater pumps.

[FUEL] The fuel button gives access to an overview of the fuel system, to set the alarm limits, and to control the fuel pumps.

[BURNER] The burner button gives access an overview of the burner system including fans and to set alarm limits.

[BOILER] The boiler button gives access to an overview of the performance of the boiler system. Alarm limits for the system can be set.

[KEY] The key button gives access to get and release the key for operation.

[TREND] The trend button gives access to trend curves of the performance of the boiler system.

[SET-UP] The set-up button gives access to the set-up menu, e.g. timers, plant limits, and diagnostic information. This menu is described elsewhere in the manual.

The key in the top left corner indicates if present that the user has unlocked the system and therefore can modify different parameters.

2 Operating examples

In this section a number of operating examples are illustrated. The examples show a generic boiler with a KBP burner attached but the operating principles are identical for all other boiler and burner types. This means that regardless of the parameter, setting, etc., which should be entered or modified, the procedure for operating the touch screen is the same.

Examples No. 2 to No. 5 imply that the key operation lock is unlocked. If this is not the case then please refer to example No. 1 or the specific instruction for unlocking the key operation lock.

The following operating examples are shown:

- **Operating example No. 1:**
- Unlock of the key operation lock for touch screen. See Figure 2 for a general method and Figure 3 for a shortcut in parameter menues.
- **Operating example No. 2:**
- Change of burner operation mode from stopped mode to automatic mode. See Figure 4 and Figure 15.
- **Operating example No. 3:**
- Change of set point for low steam pressure alarm. See Figure 6 and Figure 7.
- **Operating example No. 4:**
- Inspection of the shut down list. See Figure 8.
- **Operating example No. 5:**
- Manual start and stop of the burner. See Figure 15 and Figure 15.

Example No. 1: unlock the operation lock

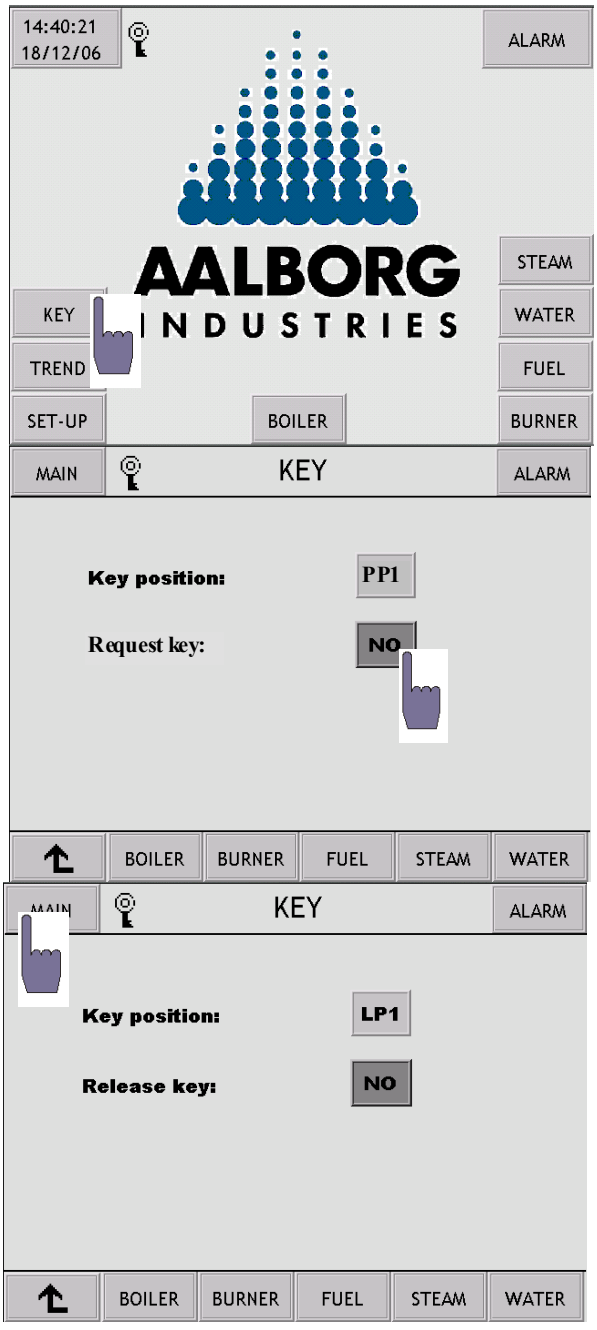


Figure 2 **contouch_108x0200400en.wmf**

Example No. 1: unlock the operation lock in a parameter menu

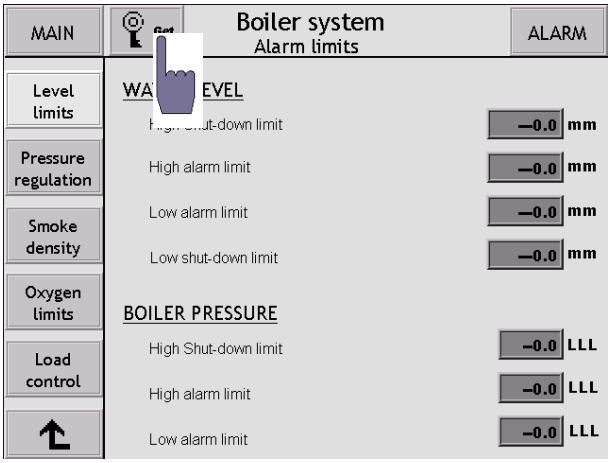


Figure 3 **contouch_116x0200480en.wmf**

Example No. 2: change of operation mode

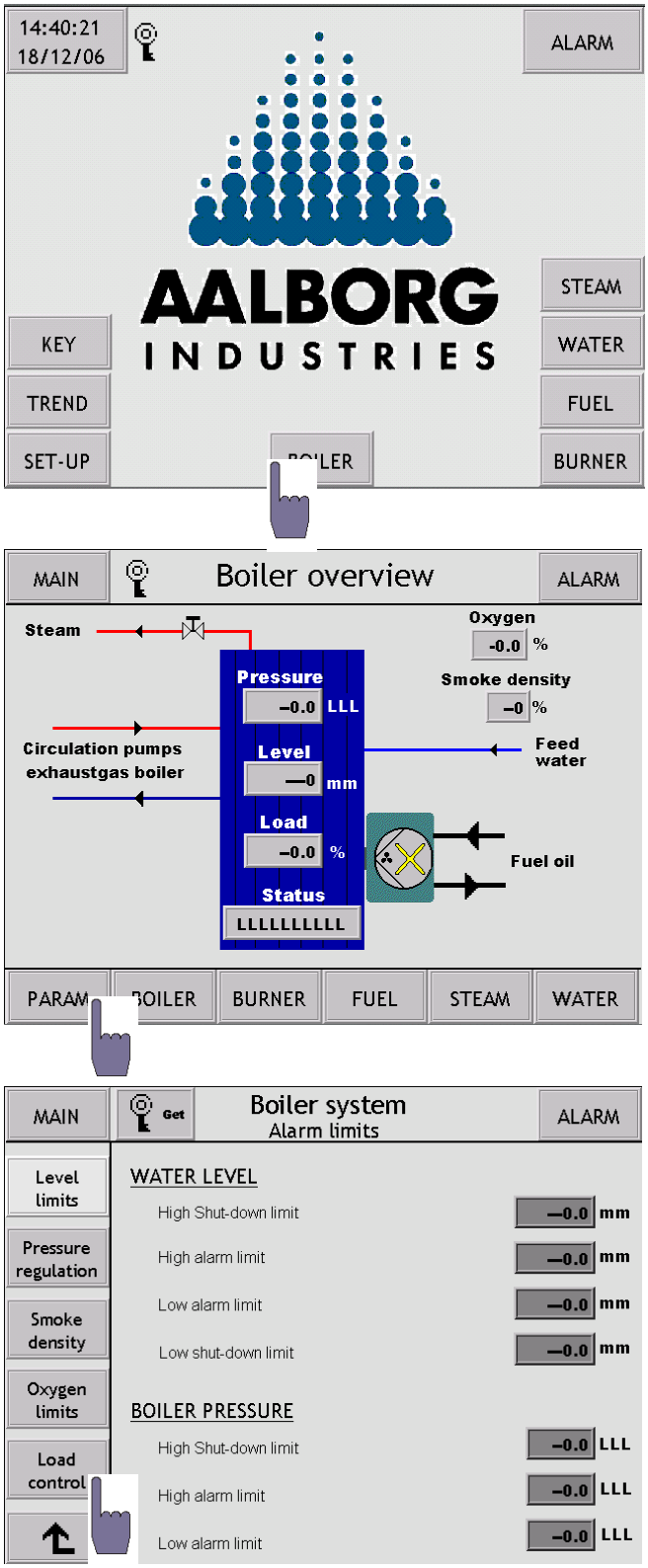


Figure 4 **contouch_109x0200410en.wmf**

Example No2: change op operation mode (contionued)

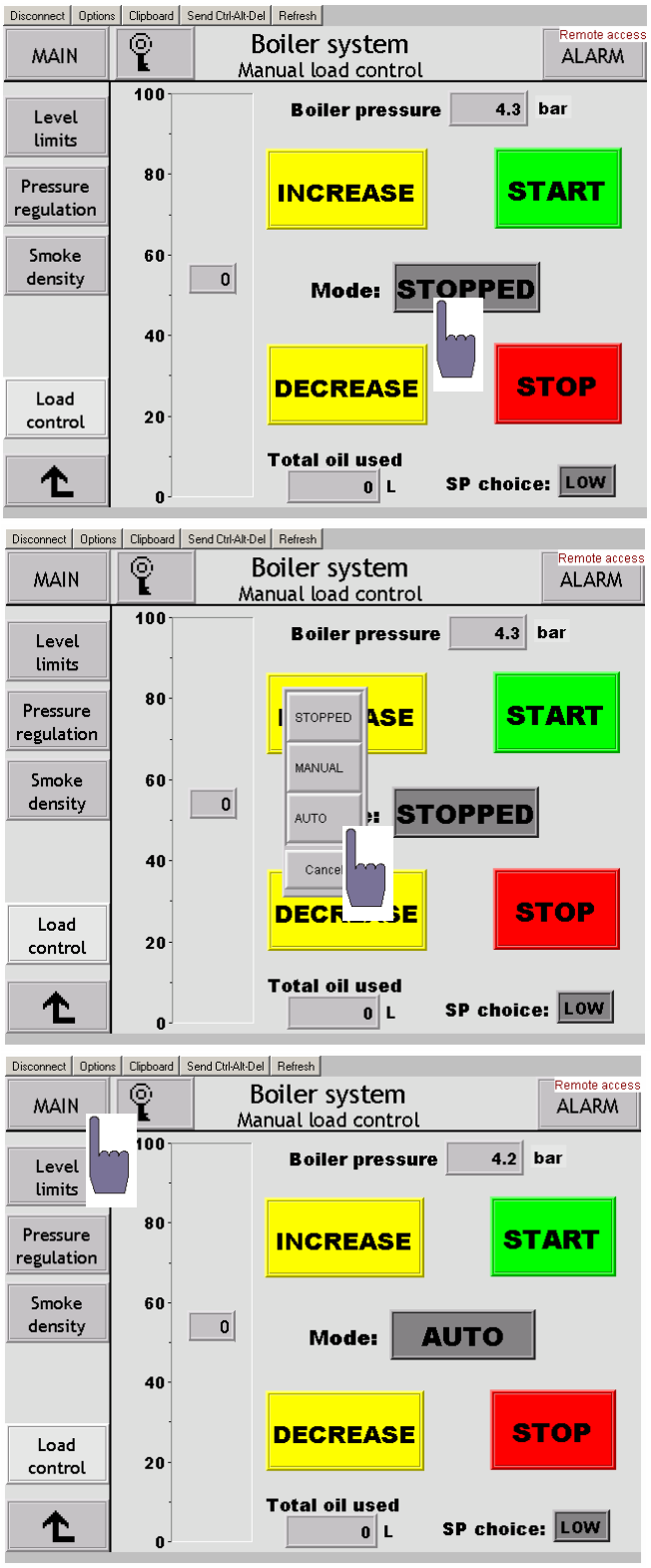


Figure 5 **contouch_110x0200420en.wmf**

Example No. 3: change of set point

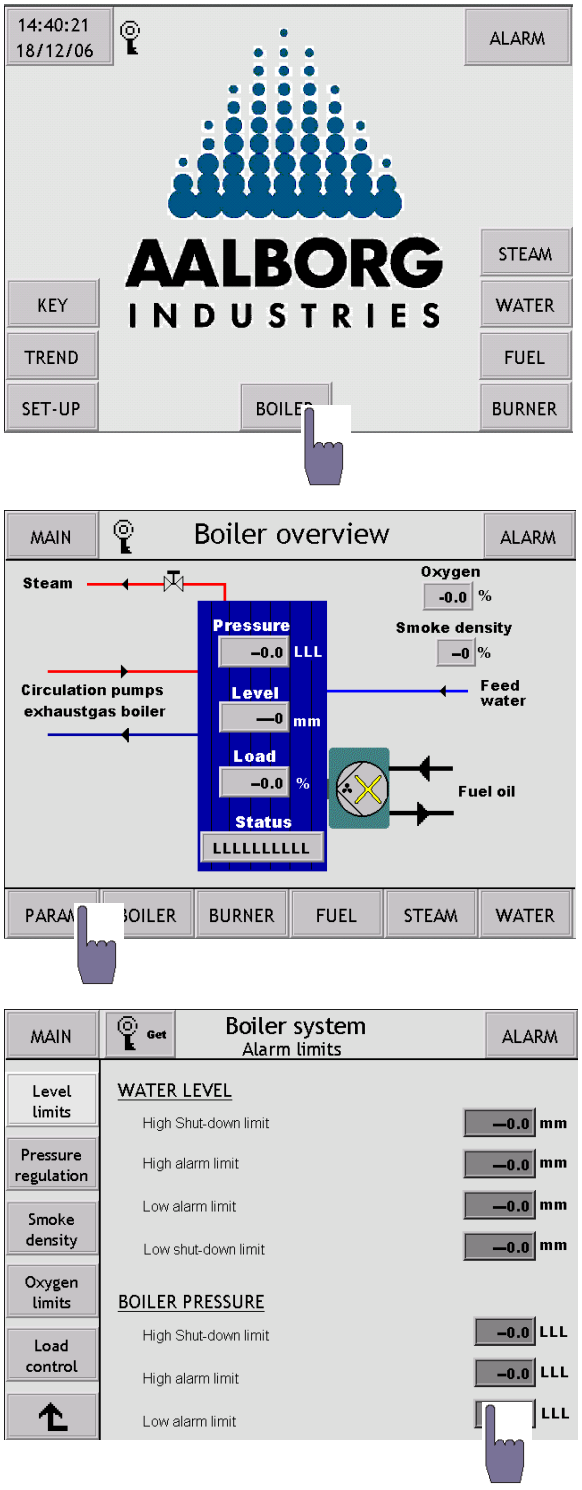


Figure 6 **contouch_111x0200430en.wmf**

Example No. 3: Change of set point (continued)

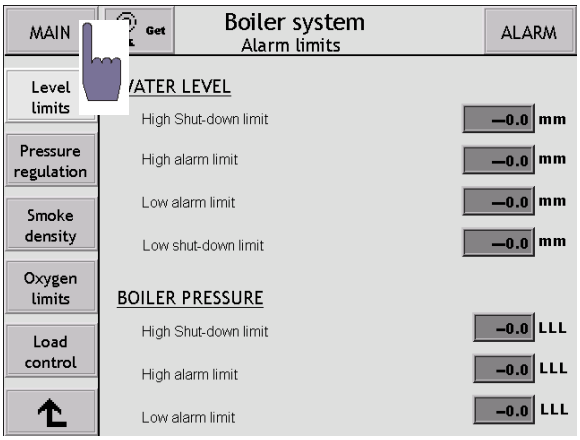


Figure 7 **contouch_112x0200440en.wmf**

Example No. 4: Inspection of the shut down list

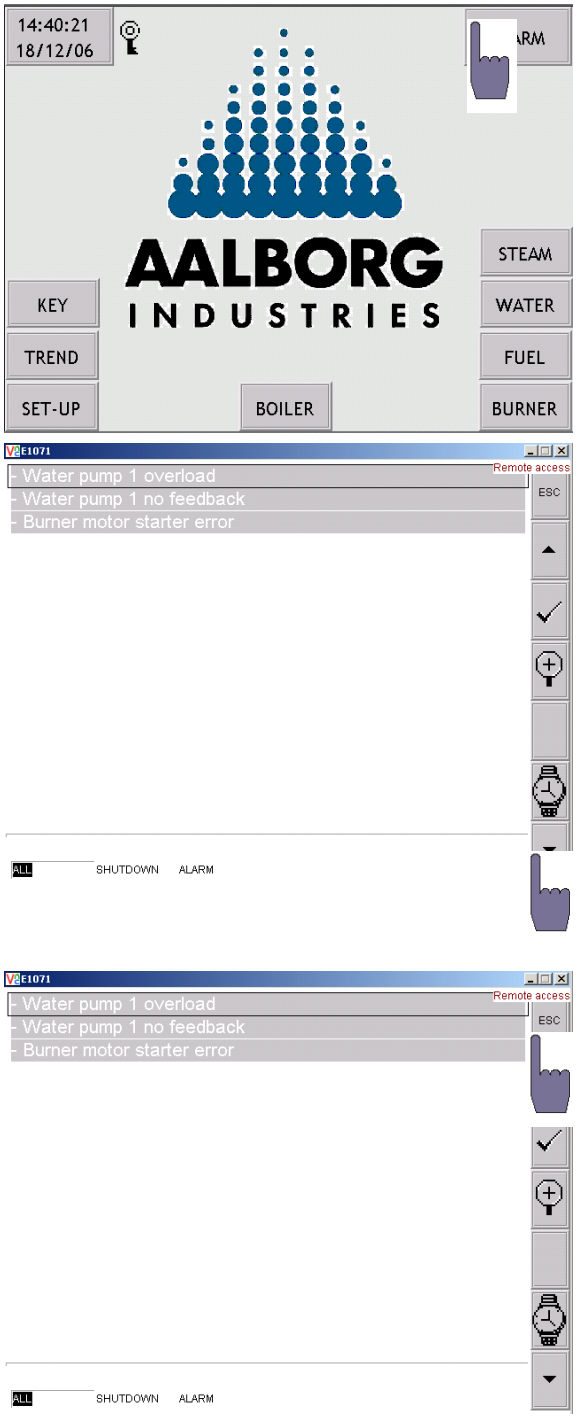


Figure 8 **contouch_113x0200450en.wmf**

Example No. 5: Manual start/stop

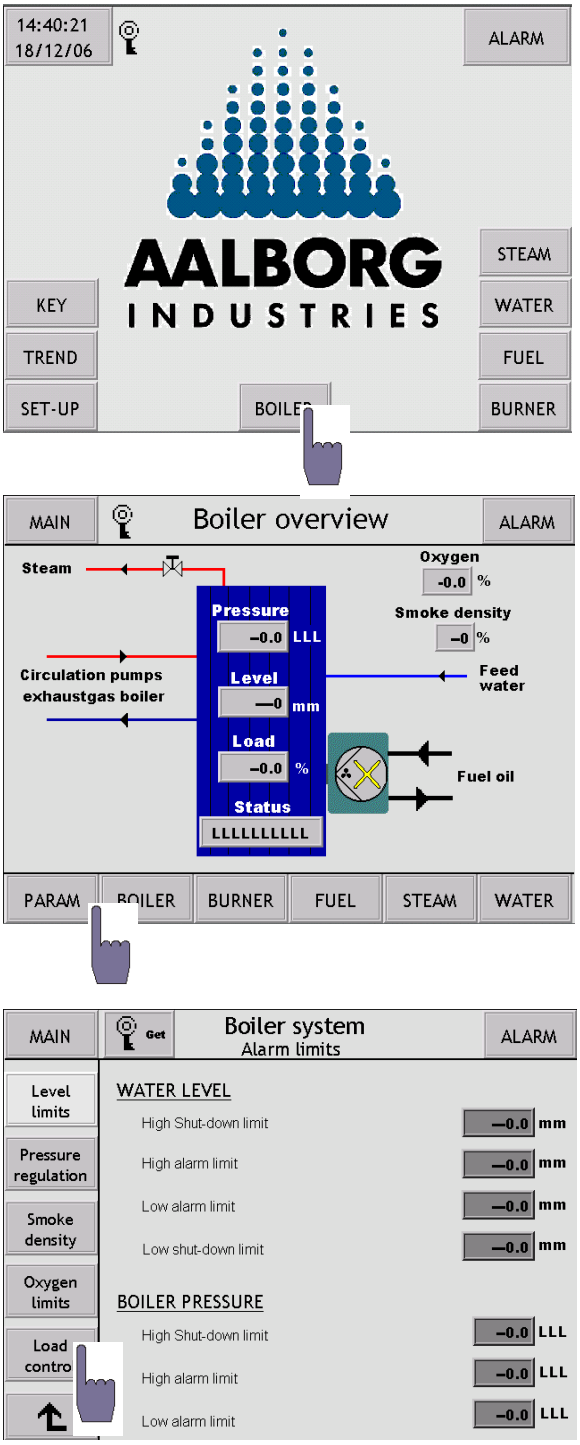


Figure 9 **contouch_114x0200460en.wmf**

Example No. 5: Manual start/stop (continued)

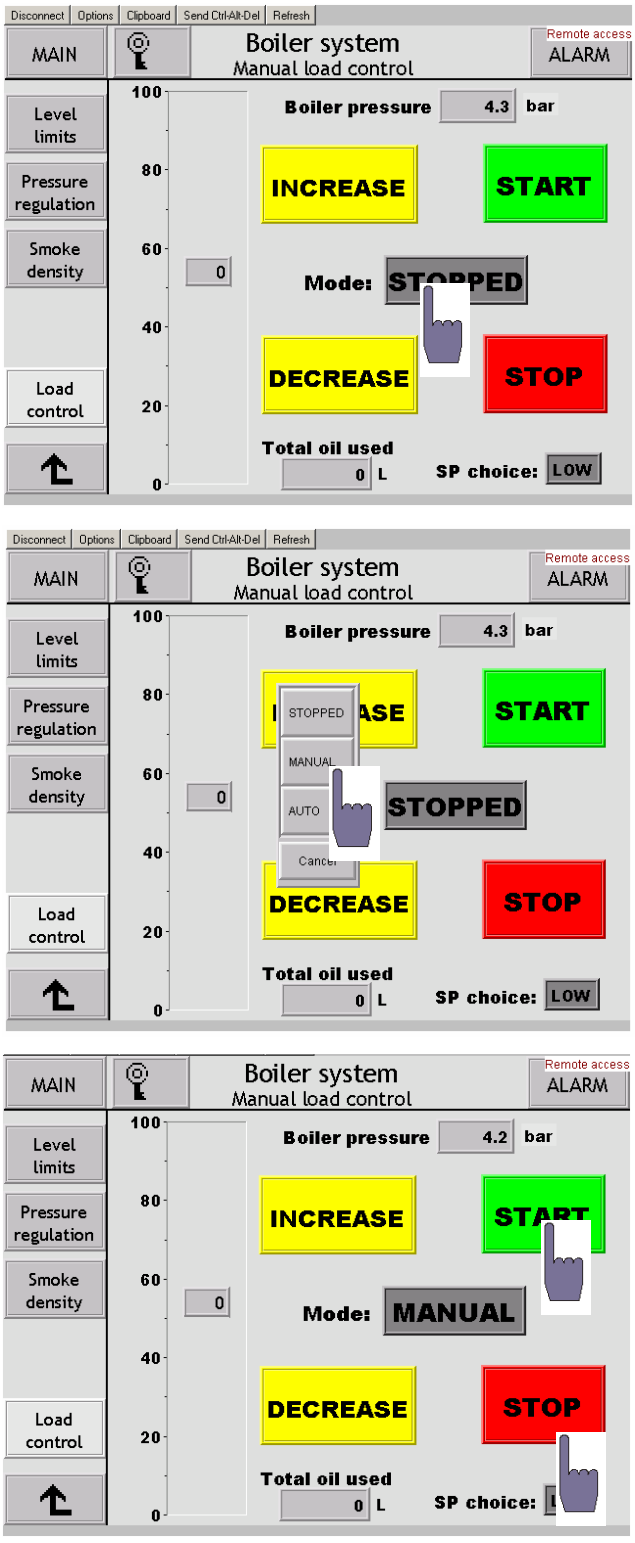


Figure 10 **contouch_115x0200470en.wmf**

Key operation lock

1 General

In the following the key operation lock system for the control system is described with regard to function and operation.

1.1 Function

Operation of the boiler plant must be performed from the local panel(s) or the PC, if provided. To ensure that operation of the boiler plant can only take place from one place at the time, the control system is provided with a key operation lock system. This prohibits unintentional alterations of settings, parameters, etc., which might cause damage to the complete boiler plant. Even though the control system is locked, it still controls the boiler plant automatically, and complete monitoring is also possible. Only the operation of the boiler plant is limited.

However, it is possible to change between manual and automatic operation modes on the local panel provided that the burner has been set to "AUTO" operation.

1.2 Operation

When the control system is powered up, the operation of the boiler plant is as default set for key operation lock position to power panel 1. But as all operation of the boiler plant must be performed from a local panel or PC, the system is locked. To unlock the operation of the control system, the position of the key operation lock must be changed. The key operation lock can be in one of the following positions:

- PP1 (power panel 1)
- LP1 (local panel 1 – this is also the position when using the touchscreen)
- LP2 (local panel 2, in twin boiler plants)
- PC (computer, in boiler plants with steam atomising burners)

In order to operate the boiler plant, the key operation lock must be opened on either one of the local panels, on the touch screen, or on the PC. Then operation can take place from the opened place (local panel 1, local panel 2, touch screen, or PC). Please note that an operation place can only be selected if the position of the key operation lock is at PP1 (power panel 1).

1.2.1 Operation from a local panel

Step A: When the front menu is displayed on the local panel press the ► soft key once, and the menu for the key operation lock appears in the local panel display. The top menu line shows the actual position of the key, and in the next line an opening of the key can be requested on the actual panel.

Step B: Press the SET soft key, and the black bar will be placed in the [NO] position.

Step C: Press the ▲ soft key, and [YES] appears in the position of the black bar.

Step D: Press the SET soft key again, and the actual local panel will be active for operation. The display of the actual key position in the top menu line changes to the actual local panel (LP1 or LP2).

An unlocked local panel is also indicated by a key symbol in the bottom menu line.

1.2.2 Operation from the touch screen

The key status is always indicated in the top left part of the picture. When a key is shown, the system is unlocked. If the key is not shown or blinking (warning the user when in a parameter menu), the system is locked. There are two ways of unlocking the system when using the touch panel.

Method 1 - Advanced:

Step A: This method can e.g. be used for checking who currently holds the key. In the mainpictureof the touch panel press the [KEY] button in the left side of the screen, and the menu for the key operation lock appears in the display. Illustrated in Figure 1

Step B: The top field indicates current key position. The buttom key (dark grey) indicates if the system is unlocked. [Yes] means that it is unlocked and [NO] means the system is locked. By pressing the button one can toggle between the two.

Method 2 – quick access:

Step A: This method is useful when setting parameters (requiring the key). To avoid having to leave the current parameter picture to unlock the system one can instead just press the key to toggle the status. Illustrated in

Notice that as the key is being retrieved, the button says “get” to indicate to the user that the system is working.

Illustration of key operation - method 1

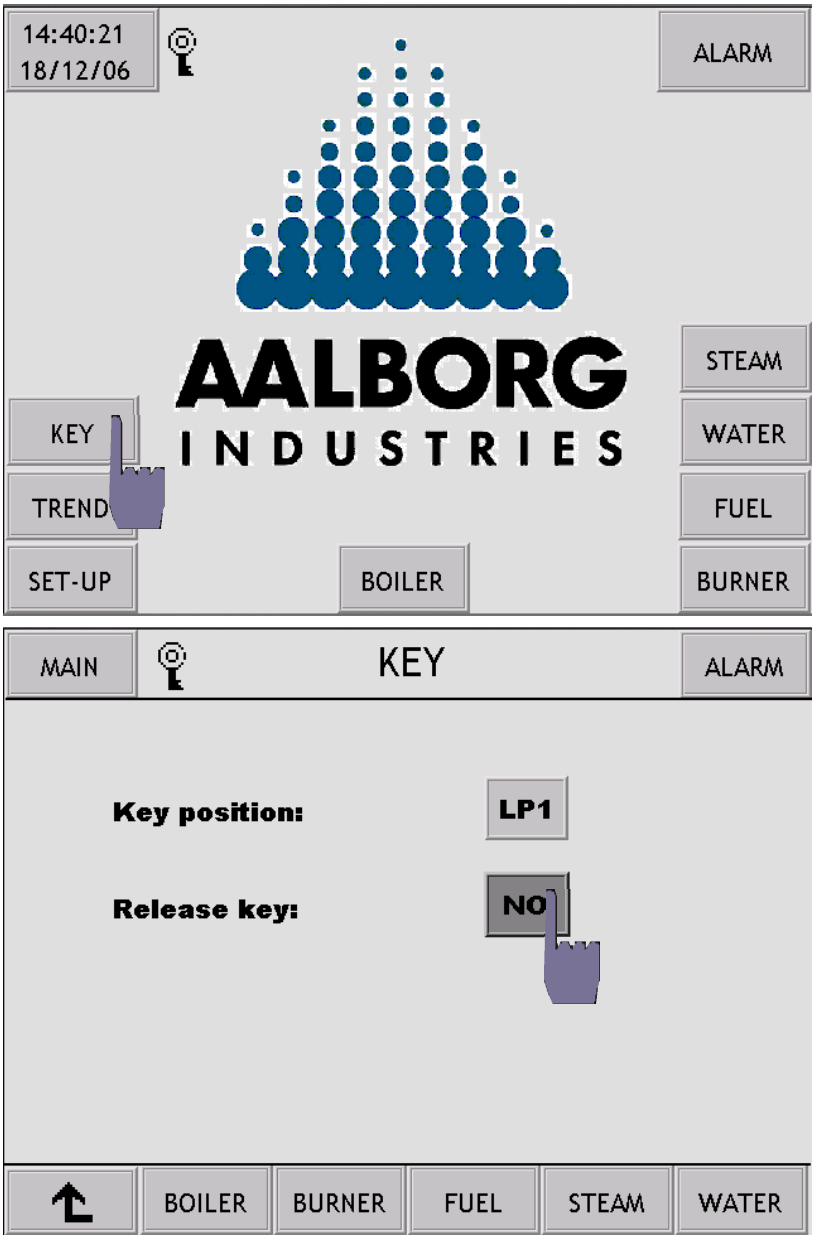


Figure 1 **contouch_106x0197660en.wmf**

Illustration of key operation - method 2

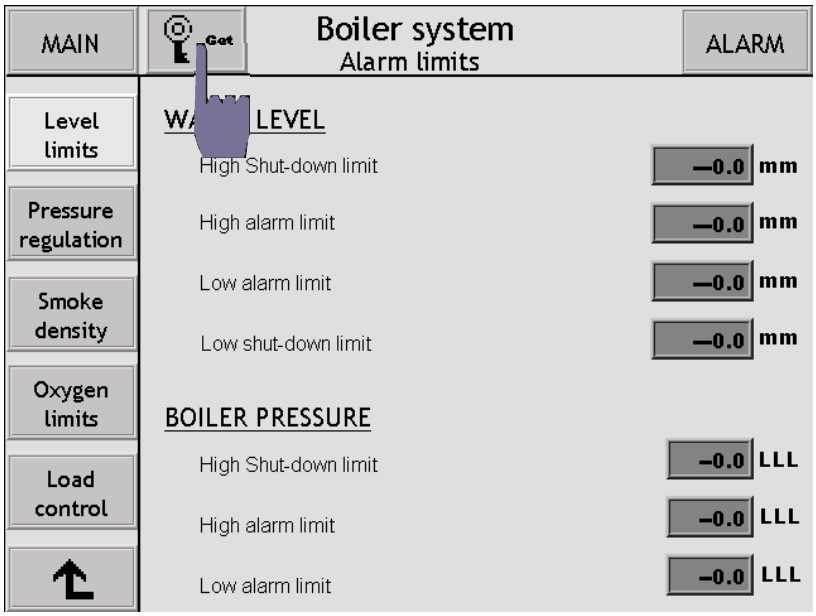


Figure 2 **contouch_107x0197670en.wmf**

Note: If any operation has not taken place within one minute, the key operation lock automatically changes back to PP1 (power panel 1). A new unlocking procedure must be performed before any operation can take place. Please note that the time period for automatic change back to PP1 can be set to a different value in the timer set-up menu. The name of the timer is "KEY HOLD".

1.2.3 Operation from a PC

When operation from a PC should be performed, the key operation lock must be opened on the PC. If the key operation lock is not opened, it is still possible to open all sub-menus and dialog boxes, but it is not possible to perform any changes of settings, parameters, operation modes, etc. For PC monitoring and control systems using Windows 3.11 buttons are faded out and thereby inactive. For PC systems using Windows 2000 a dialog box for key request pops-up.

The number of key operation locks depends on the number of configured boiler systems for the actual plant, e.g. one MISSION™ OL boiler and one MISSION™ OC boiler will include two key operation locks.

Step A: For PC systems using Windows 3.11 place the cursor on the padlock (brown colour) located in the right side of the PC screen and click once on the mouse. The symbol changes from a locked padlock to an open padlock. Furthermore, the colour changes from brown to green.

Step B: For PC systems using Windows 2000 click the access field located in the address/icon bar and request the key operation lock in the dialog box which pops-up. The colour of the access field changes from white to green.

Note: It might be necessary to enter the user ID and pass code before the key operation lock can be changed. By requesting the lock, the operator will be asked for the entering of user ID and pass code.

Step C: Operation of the boiler plant can now take place from the PC.

Note: If any operation has not taken place within one minute, the key operation lock will automatically change back to PP1 (power panel 1). A new unlocking procedure must be performed before any operation can take place. Please note that the time period for automatic change back to PP1 can be set to a different value in the timer set-up menu on the local panel(s). The name of the timer is "KEY HOLD".

1.3 Commissioning

In order to ease the commissioning work the key operation lock system is provided with a feature which makes it possible to operate the control system from all operation places. In the menu SETUP/CONFIG/BURNER OPTION on the local panel the key operation lock can be disabled "DISABLE KEY". Thus with the key operation lock disabled on the local panel(s), operation can be carried out from all operation places. E.g. in a twin boiler plant with steam atomising burners and no touchscreen, operation can take place from LP1 (local panel 1), LP2 (local panel 2), and the PC (computer). However, the time period for non-operation of the local panel is still active. So it might be advisable to set this time hold period to a higher value during commissioning. The time period value can be changed in the SETUP/TIMERS/TIMER SETUP/SURVAILLANCE menu and the name of the timer is "KEY HOLD". After commissioning the timer must be set back to its original value.

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Commissioning and service

OM9306_59 Commissioning and service.....37-2
OM9306_56 Monitoring and control via touch screen.....37-20

Commissioning and service

1 General

The following sections describe some of the parts provided in the controller and the actions which must be performed when the controller is commissioned or serviced.

The controller is designed as a computerised control and monitoring unit which provides the boiler plant with the necessary functions to have a safe and reliable operation. The main parts of the controller consist of:

- The cabinet.
- The keyboard with soft keys for operation and entering the menu structure.
- The four line crystal display (LCD).
- The relay print, which includes the battery, relays, fuse, and connections for wiring, power supply, and communication.
- The DI relay print for additional digital input connections.
- The CPU print, which includes the CPU, EPROM, and EEPROM. The CPU print is fitted onto the relay print.

Each MISSION™ Control Touch (MCT) panel consists of a local controller and a common controller. For double boiler plants only one of the panels hold a common controller though.

Figure 1 shows the keyboard and display, and Figure 2 shows the inside of the controller (local controller).

Please note that the operation of the soft keys and the structure of the menus are not described in this chapter, but can be found elsewhere in the instruction manual.

Illustration of the keyboard and display

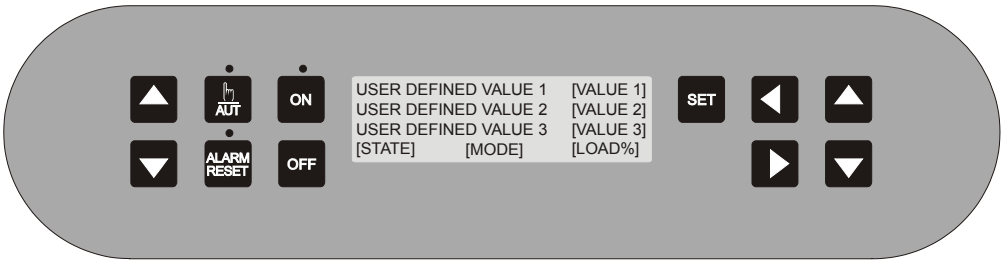


Figure 1 **om9306_59_unisabx0063040en.wmf**

Illustration of the inside of the controller

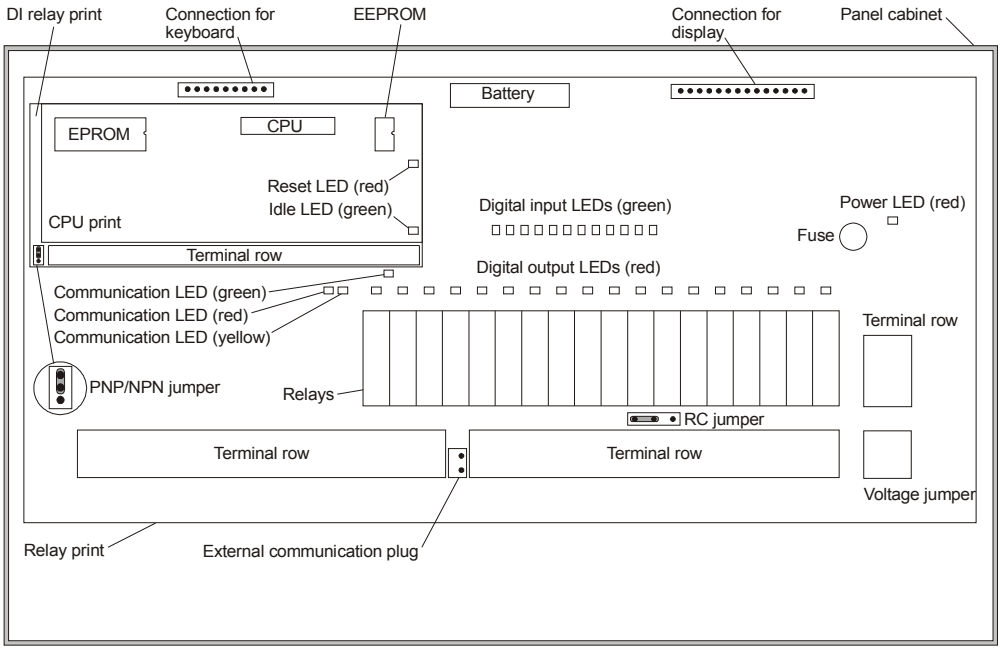


Figure 2 **om9306_59_unisabx0063050en.wmf**

The technical data for the controlleris:

Power supply: 115/230 VAC, 45-65 HZ

Voltage tolerance: +10 to -15%

Consumption: 50 VA

Ambient temperature: 0-55ºC (operation)

Humidity: 20-90% relative humidity (not condensing)

Density: IP 54

Vibration: maximum 100 Gal at 10-30 Hz

1.1 Light diodes

Both the relay print and CPU print are equipped with a number of light diodes (LEDs). The LEDs can be used during commissioning or servicing to determine the state of the input/output signals, communication signals, etc. When the hinged door is open, the LEDs can be inspected. The printed circuit boards are equipped with the following LEDs:

- Digital input (12 LEDs, green).
- Digital output (18 LEDs, red).
- Communication (3 LEDs, red, yellow, and green).
- Supply (1 LED, red).
- CPU (2 LEDs, red and green).

The position and identification of the LEDs are shown in Figure 2.

Digital input

The green LEDs are marked from DI1 to DI12. The attached functions appear from the electrical diagrams. When a specific LED is illuminated, the input is active.

Digital output

The red LEDs are marked from DRL1 to DRL18. The attached functions appear from the electrical diagrams. When a specific LED is illuminated, the output is active.

Communication

When the panel communicates with other panels, the LEDs flash irregularly. The red LED indicates that the panel is transmitting information, and the green LED indicates that information is received.

Supply

This LED flashes briefly when the power supply to the panel is switched on. During normal operation the light is off. If the LED makes repeated flashes, it may be an indication of a power supply error.

CPU print

The green idle LED (ACT1) flashes irregularly when the power supply to the panel is on. A constant light or no light indicate malfunction.

The red reset LED (RST1) is normally not illuminated. The LED is only illuminated for a brief moment when the CPU restarts the programme. This only occurs when the power supply to the panel is switched on.

2 Commissioning of the panels

This instruction deals primarily with the initial work procedures which must be performed to obtain a functional control system.

Note: Only qualified and skilled personnel are permitted to commission the panels.

Prior to the initial commissioning precaution must be taken to avoid an unintentional start of the boiler plant when the power supply to the control system is switched on. This means that the power supply to motors, fans, pumps, etc. must be switched off.

Manually operated oil valves, which connect the oil system to the burner, should also be closed.

Warning: The panels contain live parts making it absolutely necessary that the service engineer complies with the safety regulations prescribed on site. Failure to do so may cause damage to equipment and affect personal safety. Even though the power supply to the panels is switched off, some of the terminals may still be live.

In the following sections it is assumed that the key operation lock has been unlocked before any operation, alterations, etc. of the menu structure settings are performed.

2.1 Initial start-up

On delivery from Aalborg Industries the electrical wiring inside the control panel is completed. This also means that the electrical wiring, power supply, and data communication cable between the terminal rows of the control panels and the controllers are connected. Even though the internal wiring has been completed, some additional checks regarding the controllers must be carried out. These procedures, among others, are described in the following sections.

Some of the work procedures require visual checks inside the controllers. Therefore access to the controllers should be provided by opening the hinged door.

2.2 Connection of the external wires

Prior to commissioning the connection of the external wires must be completed on site in accordance with the electrical diagrams. This means that wires from pump motors, transmitters, switches, regulating valves, etc. should be connected to the terminal rows of the control panel.

During this work the power supply for the complete boiler plant must be switched off. Furthermore, it must be ensured that no outside voltage is applied to the digital input connections of the control panel.

If and when functional errors of connected electrical equipment are established prior to or during the actual commissioning of the boiler plant, the fault must be corrected.

Functional errors might be present as a result of incorrect electrical wire connections. If this is the case, the wires should be rearranged either at the terminal rows of control panel or at the specified electrical equipment.

2.3 Check the setting of the jumpers

2.3.1 Check the bridge connection of the terminal row

Check that the controllers are provided with a bridge connection between terminal 137 and 139.

2.3.2 Check the setting of the RC jumper

The controllers are capable of operation in different modes (RC mode or non-RC mode). This is achieved by means of the RC jumper. The jumper position that must be applied for boiler plants can be seen in Figure 2.

2.3.3 Check the setting of the PNP/NPN jumper

When the control system should handle signals from a pick-up sensor/measuring transducer (e.g. oil flow signals) the PNP/NPN signal jumper must be set in the correct position. The jumper position that normally must be applied for boiler plants can be seen in Figure 2.

2.3.4 Check the external communication plug

The external communication plug is not used for boiler plants and should therefore not be connected.

2.4 Installation of the data communication cable

The communication between controllers is achieved through a 2-wire RS485 network. To obtain a correct function of the data communication between the controllers, the communication cable must be connected according to the electrical wiring diagrams. Please see the electrical drawings for details.

As indicated in the electrical wiring diagrams, the communication cable must be connected in a string line from controller to controller. This applies both for the two conductors and the screening. The total length of the cable must not exceed 1,000 m.

When the data communication cable is installed, and the power supply to the controller is switched on, the function can be checked. The communication LEDs placed inside the controller must flash irregularly. If this is not the case, the data communication string should be carefully examined, and the error corrected. The position of the LEDs can be seen in Figure 2.

2.5 Connection of the power supply to the controllers

Before the power supply to the controllers is switched on, it must once again be ensured that the boiler plant is not unintentionally started.

Step A: Check that the EPROM, EEPROM, and CPU are inserted in the CPU-print for all included controllers.

Step B: Switch on the power supply to one of the controllers.

Step C: Check that the power LED and reset LED flash briefly when the power supply is switched on.

Step D: Check that the idle LED and communication LEDs flash irregularly after the power has been switched on.

Step E: Carry out the same procedures for all other included controllers.

2.6 Commissioning of the EPROM

When the control system is commissioned or the software is upgraded to a different version number, the control system must be configured to fit the task. The items, which must be configured to obtain an operational system, are, e.g. entering of serial number, panel type, burner type, etc. Please note that the version number of the EPROM in all included controllers must be identical. In the following sections the start-up procedure is described in work steps.

2.6.1 Start-up procedure

Step A: When the electrical power to a controller is switched on, a message will be displayed for 2-3 seconds, which indicates version number, date, time, and company names. After this message the controller displays the menu item line "COPY EEPROM [YES]". Please note that this menu item line only appears if the controller already has been started before.The controller is among other things equipped with an EEPROM, which is used to store settings that deviate from the default settings provided in the EPROM (e.g. settings for shut downs, alarms, start/stop set points, etc.). It is therefore important to distinguish between commissioning of the plant and upgrade of the software.When the control system is commissioned for the first time, "NO" should be selected because the EEPROM does not contain any settings which deviate from the default settings. If, on the other hand, the software is upgraded, it might be advisable to select "YES". In this way all settings, which were set at the initial commissioning or at a later point, will be maintained.

Step B: Press the SET soft key for a few seconds. When asked for password, press the SET key once more (entering of super user password is not necessary). Select "YES" or "NO" on the soft keys ▲/▼ and press the SET key again.

Step C: If it is intended to select "YES", this menu item can be skipped by pressing the soft key ◄. This is because the default setting is already "YES". In this way the controller goes directly to the next menu.

Step D: When a selection has been made in the "COPY EEPROM" menu, press the ◄ soft key once, and the controller displays the menu item line "SERIAL NO.".

Step E: Press the SET soft key for a few seconds. Press the SET key once more if password entering is necessary.

Note: Once the super user or common user passwords have been entered, they will be active for ten seconds and one hour respectively. If at some point the main menu has been entered, the active password time is cleared.

Step F: Enter serial number by means of the arrow soft keys. The keys ◄/► are used to change digit position, and the keys ▲/▼ are used to increase or decrease the value. The serial number is optional, but must be selected to another value than zero. Furthermore, each of the controllers included in the plant can contain different serial numbers.

Step G: Press the SET key when the serial number is entered.

Step H: Press the ◄ soft key once to enter the next menu.The displayed menu is the configuration menu where panel type, burner type, burner family, baud rate, and communication are set. The default settings must be changed to fit task.

Step I: With the black bar placed on "PANEL TYPE", press the SET soft key for a few seconds. Enter the super user password and press the SET key once more.

Step J: Select the panel type (LOCAL 1, LOCAL 2, POWER 1, POWER 2, or EGB) by means of the soft keys ▲/▼ and press the SET key again.

Step K: Move the black bar to the menu item line "BURNER TYPE" and press the SET soft key for a few seconds. If necessary, enter the super user password as described previously.

Step L: Select the burner type (KBSD, KBSA, MS, RMS, or KB) by means of the soft keys ▲/▼ and press the SET key again. Please note that if "POWER 1", "POWER 2", or "EGB" have been selected, the burner type should be selected as "NOT DEF".

Step M: Move the black bar to the menu item line "BURNER FAMILY" and press the SET soft key for a few seconds. If necessary, enter the super user password as described previously.

Step N: Select burner family "MULTI" or "ALONE" by means of the soft keys ▲/▼ and press the SET key again. If the plant includes two boilers, and master/slave operation is intended, "MULTI" must be selected.

Step O: Move the black bar to the menu item line "NODE NO.OFFSET" and press the SET soft key for a few seconds. If necessary, enter the super user password as described previously.

Step P: Select the communication channel (1-125) by means of the soft keys ◄/►/▲/▼ and press the SET key again. The node No. offset should be selected to the same value for all included controllers in case of a single boiler plant or a multi boiler plant with common supply systems. For a multi boiler plant with separate supply systems the node No. offset must be divided into groups. This means that all included controllers for the first boiler should have the same identical number and all included controllers for the second boiler should have another identical number.The difference in the number value must always be minimum 12. E.g. if the node number for the first group of controllers is 1, then the second group of controllers must be set to 1 + 12 = 13.

Step Q: Move the black bar to the menu item line "PART NO.OFFSET" and press the SET soft key for a few seconds. If necessary, enter the super user password as described previously.

Step R: Select the partner communication channel (1-125) by means of the soft keys ◄/►/▲/▼ and press the SET key again.The "node No.offset" of the partner boiler panels in a multi boiler plant must be entered in the menu item line. In case of a single boiler plant it is advisable also to enter the node No. offset in this menu item line.

Step S: Move the black bar to the menu item line "BAUD RATE" and press the SET soft key for a few seconds. If necessary, enter the super user password as described previously.

Step T: Select the baud rate (300, 600, 1200, 2400, 4800, 9600, 19200, or 38400) by means of the soft keys ▲/▼ and press the SET key again. The baud rate should be selected to the same value for all included controllers in the plant and as high as possible to obtain a high transmission speed.

Step U: Press the ◄ soft key once. After a few seconds the control system performs an automatic re-start of the system. In this way the changed configuration will be active.

2.6.2 Additional configuration

When the controller is restarted, the front menu is displayed, or if one or more shut downs are present, the shut down list is displayed.

By means of the arrow and SET soft keys the menu items listed in the following work steps should be checked and/or configured. The menu tree and the explanation list found in this manual can be used to guide the operator through the system.

When the additional checks and set-up procedures are performed, the LOCAL 1 controller (or LOCAL 2 controller, if provided) must be used.

Step A: Enter the menu item line "SETUP/CTRL MODE/BURNER CTRL MODE" by means of the soft keys and check/set that the burner is in "STOPPED" mode.

Step B: If "MULTI" was selected in the menu item line "SETUP/CONFIG/PANEL TYPE/BURNER FAMILY", enter the menu item line "SETUP/CONFIG/ BURNER SYSTEM/MASTER-SLAVE". By means of the soft keys set the burner operation to "MASTER or SLAVE".

Step C: Enter the menu item line "SETUP/CONFIG/BURNER OPTION" by means of the soft keys and choose the relevant options for the boiler plant. The actual options included in the boiler plant appear from the flow diagrams and technical data found in the manual.

Step D: Enter the menu item line "SETUP/TIMERS/DATE/TIME" by means of the soft keys and set the date and time.

Step E: Enter all menu items for "REMOTE CTRL" by means of the soft keys and check/set that the remote control output is "0".

This concludes the initial start-up procedure when the EPROM is commissioned or changed.

2.7 Additional start-up procedures

In the following section the actions which must be carried out before the boiler plant is fully operational are briefly described.

2.7.1 Continue with the commissioning process

Before proceeding with the actual commissioning, the instructions for the boiler, burner, and control system should be studied. The instructions should only be considered as a guideline. This is due to the fact that each plant should be commissioned individually to obtain the best burner performance for the specific plant. It is therefore difficult to give an exact commissioning procedure to follow.

Prior to and during the commissioning of the boiler plant a number of settings, timers, parameters, etc. should be checked and adjusted to optimise the function of the plant. Adjustments should be carried out as the optimisation requirements emerge.

By means of the menu tree, the explanation list, sequence diagram, instructions, etc. the commissioning engineer can be guided through the system.

2.7.2 Continue after exchange of EPROM

All vital parameters and settings should be checked prior to start-up of the boiler plant. A new version of the software might contain new or moved menu items, which should be checked and/or set before start-up.

2.8 Commissioning of the EEPROM

The EEPROM does not require any commissioning work because all settings, configurations, etc. are automatically stored in the EEPROM. But in plants which include two identical boilers the commissioning work can be facilitated by copying the contents of an EEPROM to another. The plants in question are, e.g. two MISSION™ OS boilers with two stage pressure atomising burners.

Before the copy procedure is possible, a number of conditions must be fulfilled:

- The boilers, burners, water level control equipment, etc. must be completely identical.
- One of the boilers should be fully commissioned with regard to parameters, settings, values, etc.
- The serial numbers must be different.

If these requirements are fulfilled, the contents of an EEPROM can be copied as described in the following work procedures:

Step A: Switch off the power supply to the controller on the commissioned boiler.

Step B: Remove the EEPROM. See section 3.2 for instruction regarding insertion and removal of an EPROM.

Step C: Switch off the power supply to the controller on the boiler, which should be commissioned, and remove the EEPROM.

Step D: Insert the EEPROM from the non-commissioned boiler into the controller of the commissioned boiler and switch on the power supply.

Step E: If the menu item line "COPY EEPROM [YES]" appears in the display, press the SET soft key for a few seconds. When asked for password, press the SET key once more (entering of super user password is not necessary). Select "NO" on the soft keys ▲/▼ and press the SET key again. In this way the commissioning data, which are saved in the RAM store circuit of the controller, will automatically be copied into the EEPROM.

Step F: Switch off the power supply again and remove the EEPROM from the commissioned boiler.

Step G: Insert the original EEPROM into the controller, which was commissioned first, and switch on the power supply.

Step H: Insert the "copied" EEPROM into the controller of the non-commissioned boiler and switch on the power supply.

Step I: When the menu item line "COPY EEPROM [YES]" appears in the display, press the ◄ soft key a few times and the data of the EEPROM will be copied into the RAM store circuit of the controller.

Step J: When the selection has been made in the "COPY EEPROM" menu, press the ◄ soft key a few times more. The controller displays the menu item "SERIAL NO." Entering of data in this menu item should not be performed until later and should therefore be skipped.

Step K: Press the ◄ soft key one more time. The controller displays the menu item "PANEL SYSTEM". If the boilers are operating as master/slave boilers, the local panels must be set as "LOCAL 1" and "LOCAL 2" respectively. Select "PANEL SYSTEM" and press the ◄ soft key a few times. The control system automatically performs a restart of the system.

Step L: Change serial number as described in section 2.8.2.

In this way the EEPROM of the non-commissioned boiler will now contain the same data as the EEPROM of the commissioned boiler. Please note that during the actual commissioning of this boiler it might be necessary to readjust a number of settings, timers, parameters, etc. to optimise the function of the boiler.

Note: The copying process should not be performed between a local controller and a common controller. If this is done, e.g. copying the contents of an EEPROM from a local controller to the EEPROM from a common controller, the common controller will be configured as a local controller.

2.8.1 Change of serial number

If it is desired to operate the controllers with different serial numbers, which are required when copying an EEPROM, the numbers should be changed on one of the boilers. This can be carried out as described in the following work procedures:

Step A: Enter the menu item line "SETUP/DIAGNOSES/SERIAL NUMBER /SERIAL NO." and press the SET soft key for a few seconds. Enter password and press the SET key once more.

Step B: Enter a new serial number by means of the soft keys ◄/►/▲/▼ and press the SET key again.

Step C: Switch off the power supply to the controller and switch it on again.

Step D: When the menu item line "SERIAL NO." appears in the display, press the SET soft key for a few seconds. Enter password and press the SET key once more.

Step E: Enter the same serial number as before by means of the soft keys ◄/►/▲/▼ and press the SET key again.

The controller is now configured with the same settings, parameters, etc. as before, but with a new serial number.

3 Servicing of the panels

The following instruction describes the work procedures which should be carried out in case some of the main parts of the controller are defective and must be replaced. It is recommended that Aalborg Industries is contacted before changing any of these parts.

Replacement of parts must be performed with the power supply to the controller switched off. Please remember that outside control voltage may be connected. Furthermore, precaution must be taken to avoid an unintentional start of the boiler plant during servicing of the controllers.

3.1 General service notes

The general service notes describe the general initiatives which must be performed whenever parts of the controller are serviced or replaced.

In the following sections references to this section are given. Each time such a reference appears, the service engineer should consult this section for further information.

Step A: Switch off the power supply to the controller.

Note: When replacing the battery the power supply to the controller should remain switched on, if possible.

Step B: Open the door and remove the transparent plate, which covers the printed boards.

Step C: Carry out the necessary work procedures as described in the following sections.

Step D: Mount the transparent plate and door again.

Step E: Switch on the power supply to the controller.

Caution: Electronic parts can be damaged by static electricity. To avoid this, damage precautions must be taken to discharge the static electricity without the current passing through the electronic parts. E.g. touch physically the part, upon which the electronic part is placed, both before and while removing it. And touch physically the metal of the controller cabinet, in which the electronic part should be positioned both before and while fitting it. Naturally, the same hand must be used that holds (or is going to hold) the electronic part.

3.2 Replacing the EPROM

The EPROM is a programmable module, placed in a socket on the CPU print, which contains the software for the control system. When the software is upgraded (or commissioned) to a different version number, the control system must be configured to fit the task. The configuration process includes setting of panel type, burner type, etc. If, on the other hand, the EPROM is exchanged to an EPROM with the same version number, the re-configuration procedure should not be performed. This also applies if the EPROM has for some reason been removed from the socket holder for a period of time.

When the EPROM is replaced, the following work procedures must be carried out:

Step A: Before the power supply is switched off, note all settings. Even though the EEPROM stores all settings that deviate from the default settings provided in the EPROM, it is advisable to carry out this initiative. This is due to the fact that if an irreversible error occurs during the replacement, the data will still be available.

Step B: See section 3.1 for disassembling instructions.

Step C: Remove the EPROM from the socket on the CPU print. The position can be seen in Figure 2.

Note: It is of great importance that the EPROM is handled with extreme care because it is a sophisticated electronic device. An EPROM must always be carefully manoeuvred in and out of the socket holder due to the risk of bending the pins on the EPROM.

Step D: Check the version number on the new EPROM. The version number appears from the white label on the surface of the EPROM. Please note that the version number of the EPROM must be identical in all included controllers.

Step E: Insert the new EPROM in the socket by using the fingers. Take care that all pins on the EPROM are fitted into the socket. One of the EPROM ends is provided with a notch. When the EPROM is inserted in the socket holder, this notch must be in the same direction as the notch indicated on the protection plate. Please see Figure 2. If the EPROM is inserted in the reversed direction, the display flashes when the power supply is switched on again.

Step F: See section 3.1 for assembling instructions.

Step G: Carry out the work procedures described in section 2.6 if a re-configuration of the control system is necessary (if the software is upgraded to a different version number).

3.3 Replacing the EEPROM

The EEPROM is a programmable module, placed in a socket on the CPU print, in which the settings are stored that deviate from the default settings provided in the EPROM (e.g. settings for shut downs, alarms, start/stop set points, etc.).

The panels should always be operated with the EEPROM inserted. But operation is possible without the EEPROM inserted, and settings, configuration, etc. can be changed and remembered even if the power supply is switched off. The data are also stored in the RAM store circuit, which is supplied with power from the battery. When the EEPROM is inserted in the CPU print again, these changes will automatically be stored in the EEPROM.

If the EPROM is replaced, e.g. due to upgrading of the software, and the EEPROM is removed, all settings set during commissioning or at a later point will be lost.

When the EEPROM is replaced, the following work procedures must be followed:

Step A: Before the power supply is switched off, note all settings. If an irreversible error occurs during the replacement, the data will still be available.

Step B: See section 3.1 for disassembling instructions.

Step C: Remove the EEPROM from the socket on the CPU print. The position can be seen in Figure 2. When the EEPROM is replaced, the same precautions must be taken with regard to removal and insertion as during the replacement of an EPROM, see section 3.2.

Step D: Insert the new EEPROM in the socket by using the fingers. Take care that all pins on the EEPROM are fitted into the socket and that the direction is correct.

Step E: See section 3.1 for assembling instructions.

The control system is now in normal operation, and no further initiatives are necessary. The current settings, configuration, etc. are automatically transferred and stored into the new empty EEPROM. This also applies when changes have been made after the old EEPROM became defective or was removed.

Note: If the serial number is changed, the controller displays the menu item line "SERIAL NO." after power cut. The changed serial number must be entered before the control system is operational again.

3.4 Replacing the CPU

If the CPU is defect or removed, the display will be out, and several of the relays switch continuously. The following work procedures should be performed when the CPU is replaced:

Step A: See section 3.1 for disassembling instructions.

Step B: Remove the CPU from the socket on the CPU print. The position can be seen in Figure 2. When the CPU is replaced, the same precautions must be taken with regard to removal and insertion as during the replacement of an EPROM, see section 3.2.

Step C: Insert the new CPU in the socket by using the fingers. Take care that all pins on the CPU are fitted into the socket and that the direction is correct.

Step D: See section 3.1 for assembling instructions.

3.5 Replacing the CPU print

If the CPU print, which holds the EPROM, EEPROM, and CPU (see Figure 2), must be replaced, the following work procedures should be carried out:

Step A: Before the power supply is switched off, note all settings. If an irreversible error occurs during the replacement, the data will still be available.

Step B: See section 3.1 for disassembling instructions.

Step C: Remove the screws by which the CPU print is fixed.

Step D: Carefully pull out the CPU print. It should be pulled out at the side in which the connecting plugs are positioned. This is the side opposite the position of the EPROM.

Step E: Remove the EPROM and EEPROM from the CPU print. Please see sections 3.2 and 3.3 for instructions regarding removal and insertion of the EPROM and EEPROM.

Step F: Insert the EPROM and EEPROM in the new CPU print by using the fingers. Take care that all pins on the EPROM and EEPROM are fitted into the sockets and that the directions are correct.

Step G: Insert the new CPU print into the socket connections on the DI relay print and fix it with the screws.

Step H: See section 3.1 for assembling instructions.

Step I: When the menu item line "COPY EEPROM [YES]" appears in the display, press the ◄ soft key a few times and the data of the EEPROM will be copied into the RAM store circuit of the local panel.

Step J: When the selection has been made in the "COPY EEPROM" menu, press the ◄ soft key three times more. The control system displays the menu items "SERIAL NO." and "PANEL SYSTEM" before it performs an automatic re-start of the system. Entering of data in these menu items is not necessary because the previously entered data are remembered. This also applies for all other settings.

If "NO" is selected in the menu item "COPY EEPROM", the system must be re-configured once again. This is also the case if a new EEPROM is inserted in connection with the replacement of a CPU print.

3.6 Replacing the DI relay print

If the DI relay print must be replaced, the following work procedures should be carried out:

Step A: Before the power supply is switched off, note all settings. If an irreversible error occurs during the replacement, the data will still be available.

Step B: See section 3.1 for disassembling instructions.

Step C: Remove the CPU print, see section 3.5 for disassembling instructions.

Step D: Remove the screws by which the DI relay print is fixed.

Step E: Carefully pull out the DI relay print. It should be pulled out at the side in which the connecting plugs are positioned.

Step F: Insert the new DI relay print into the socket connections on the relay print and fix it with the screws.

Step G: Insert the CPU print into the socket connections on the DI relay print and fix it with the screws.

Step H: See section 3.1 for assembling instructions.

Step I: When the menu item line "COPY EEPROM [YES]" appears in the display, press the ◄ soft key a few times and the data of the EEPROM will be copied into the RAM store circuit of the local panel.

Step J: When the selection has been made in the "COPY EEPROM" menu, press the ◄ soft key three times more. The control system displays the menu items "SERIAL NO." and "PANEL SYSTEM" before it performs an automatic re-start of the system. Entering of data in these menu items is not necessary because the previously entered data are remembered. This also applies for all other settings.

If "NO" is selected in the menu item "COPY EEPROM", the system must be re-configured once again. This is also the case if a new EEPROM is inserted in connection with the replacement of a CPU print.

3.7 Replacing the relay print

When the relay print must be replaced, the following work procedures should be followed:

Step A: Before the power supply is switched off, note all settings. If an irreversible error occurs during the replacement, the data will still be available.

Step B: See section 3.1 for disassembling instructions.

Step C: Mark all connected wires and disconnect these from the terminal rows of the relay print. The position of the terminal rows, relay print, etc. can be seen in Figure 2.

Warning: Some of the wires may still be live, and precautions must be taken to secure personal safety.

Step D: Remove the screws that fix the print and tilt the print out of the plastic holders positioned below the terminal row.

Step E: Pull the print off the guide opposite the terminal row and out of the cabinet.

Step F: Move the CPU print with the EPROM and EEPROM onto the new relay print, see section 3.5.

Step G: Insert the new relay print into the guide and click it into position at the plastic holders. Fix the relay print by means of the screws.

Step H: Connect all the marked wires to the terminal rows in the correct order.

Step I: See section 3.1 for assembling instructions.

If the menu item line "COPY EEPROM [YES]" appears in the display when the control system is restarted, perform the same work procedures as described in section 3.5.

3.8 Replacing an exchangeable relay

The digital output DRL1 to DRL4 are equipped with exchangeable relays. This is because the actions that are controlled by these output signals cause an increased number of relay changes which increases the risk of wearing down these relays.

The following work procedures should be performed when an exchangeable relay is replaced:

Step A: See section 3.1 for disassembling instructions.

Step B: Push the black plastic clamp, which holds the relay to the side.

Step C: Pull up the relay and replace it. The relay must be inserted correctly, see the connections on the relay bottom plate and the legs on the relay. Be careful not to bend the legs on the relay.

Step D: Push back the clamp over the relay.

Step E: See section 3.1 for assembling instructions.

3.9 Replacing the display

If the display must be replaced, the following work procedures should be carried out:

Step A: See section 3.1 for disassembling instructions.

Step B: Disconnect the connection plug for the display on the connection socket of the relay print. The position can be seen in Figure 2.

Step C: Unscrew the two nuts that fix the top display print and carefully pull it out. The two power supply wires to the bottom display print should also be disconnected.

Step D: Unscrew the four nuts that fix the display protection plate and bottom display print, which includes the display.

Step E: Replace the defective part (top display print, bottom display print, or both).

Step F: Assemble the bottom display print, display protection plate, and top display print by means of the nuts and distance pieces. When assembled, the nuts must not be fastened too mush or else several horizontal lines may appear in the display.

Step G: Connect the two power supply wires between the prints and the connection plug for the display into the connection socket of the relay print.

Step H: See section 3.1 for assembling instructions.

3.10 Replacing the soft keys

If the soft keys must be replaced, the following work procedures should be followed:

Step A: See section 3.1 for disassembling instructions.

Step B: Disconnect the connection plug for the soft keys on the connection socket of the relay print. The position can be seen in Figure 2.

Step C: Carefully remove the plastic cover that covers the soft key section.

Step D: Replace the soft key section.

Step E: Carefully mount the plastic cover again using silicone for sealing.

Step F: See section 3.1 for assembling instructions.

3.11 Replacing the door on power panels

If the door of a power panel must be replaced, the following work procedures should be performed:

Step A: See section 3.1 for disassembling instructions.

Step B: Disconnect the two connection plugs for the display and soft keys on the connection sockets of the relay print. The positions can be seen in Figure 2.

Step C: Remove the two fuse straps as well as the earth connections and remove the defective door.

Step D: Mount the two fuse straps and connect the earth connections between the door and the panel cabinet.

Step E: Connect the connection plugs for the display and soft keys on the new door to the connection sockets on the relay print.

Step F: See section 3.1 for assembling instructions.

3.12 Replacing the circuit fuse

If the circuit fuse has blown, the four line crystal display will be off. A new circuit fuse with the specifications 3.15T/250 V, 5 x 20 glass should be inserted.

The following work procedures should be carried out when the circuit fuse is replaced:

Step A: See section 3.1 for disassembling instructions.

Step B: Screw out the top of the fuse holder and replace the circuit fuse. The location of the circuit fuse can be seen in Figure 2.

Step C: Screw in the top of the fuse holder with the circuit fuse.

Step D: See section 3.1 for assembling instructions.

3.13 Replacing the battery

The battery is primarily used to ensure that the internal watch runs accurately after power cut. This is done by supplying the RAM-stores during power cuts.

The battery is of the Lithium type (size AA) and has an expected life up to five years, depending on the actual conditions such as humidity, ambient temperature, etc. Please note that it is not reloaded by the electronic circuit in the controller.

If the menu item line "COPY EEPROM [YES]" appears in the display after power cut, the battery should most likely be replaced.

The following work procedures should be followed when the battery is replaced:

Step A: See section 3.1 for disassembling instructions.

Step B: Cut off the cable binders, which hold the battery. The location of the battery can be seen in Figure 2.

Step C: Disconnect the battery wires and replace the battery.

Note: Disposal of the old battery should be in accordance with the environmental rules in force.

Step D: Use two new cable binders to fix the new battery in its correct place.

Step E: See section 3.1 for assembling instructions.

Step F: If the menu item line "COPY EEPROM [YES]" appears in the display, press the ◄ soft key a few times and the data of the EEPROM will be copied into the RAM store circuit of the controller.

Step G: When the selection has been made in the "COPY EEPROM" menu, press the ◄ soft key a few times. The control system displays the menu items "SERIAL NO." and "PANEL SYSTEM" before it performs an automatic re-start of the system. Entering of data in these menu items is not necessary because the previously entered data are remembered. This also applies for all other settings.

The controller is now ready for normal operation. If a new battery is not available, "YES" must be selected in the menu item line "COPY EEPROM" every time the panel is started.

3.14 Replacing the data communication cable

If the communication cable is damaged, it must be replaced. The installation and commissioning work should be performed as described in section 2.4. When the cable is replaced at one of the controllers, the screen must be connected correctly in the screwed joint as shown in Figure 3.

The new cable must be of the same type as the original cable delivered by Aalborg Industries and as a minimum have the following data:

- Cable type: 2-conductor data cable with screening
- Loop resistance: 74 Ω/min.
- Insulation resistance, minimum: 100 MΩ-km
- Pair capacity: 85 pF/m

Finishing of the cable screening in a screwed joint

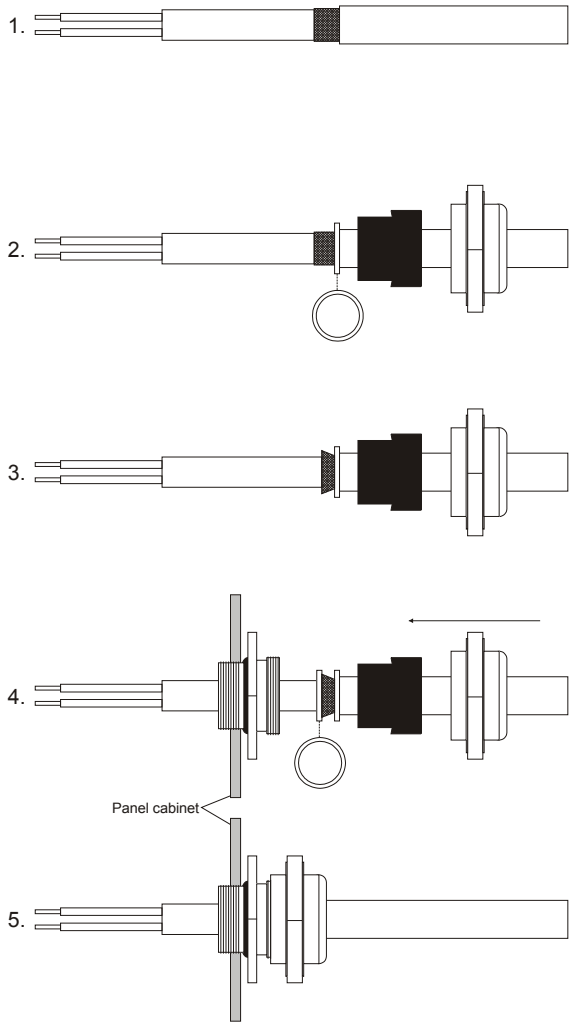


Figure 3 **om9306_59_unisabx0063060en.wmf**

Monitoring and control via touch screen

1 General

This section describes the mimic pictures, dialog boxes, lists, etc. for a standard monitoring and control system. In the example pictures is shown a generic boiler with a KBP burner and an EGBexhaustgas boiler. The illustrations and descriptions do not show the completetouch screen system, but gives an insight into the system concept. Notice also that the pictures show a maximum configuration meaning that e.g. inert gas is shown. On the real system this will not be present if the system is not configured for inert gas.

The touch screen is connected to the boiler control panels via a RS485 communication network. By means of this connection the touch screen monitoring and control system can receive, handle, and transmit data to and from the control panels. This enables control of the boiler plant from the touch screen. The mimic pictures and lists are used to monitor the boiler plant and the dialog windows are used to control and operate the boiler plant.

Notice that it is still necessary to configure the basic settings such as burner type on the local controller.

2 Operation of the touch screen system

When the touch screen is switched on, it will automatically start the monitoring and control program after a short initialisation period. Figure 1 illustrates the start-up mimic picture.

From the main picture, it is possible to acknowledge alarms have access to the different subsystems of the plant: Steam (and exhaust gas boiler), water, fuel, and burner system as well as an overview picture called boiler. In the main window the key can also be retrieved, trend curves for the performance of the plant can be viewed and the set-up menu can be accessed. A detailed description of the different menus is given in the following. The subsystem pictures steam, water, fuel, burner and boiler as well as the main- and alarm pictures areall accessible from each subsystem picture.

Start-up picture on the touch screen

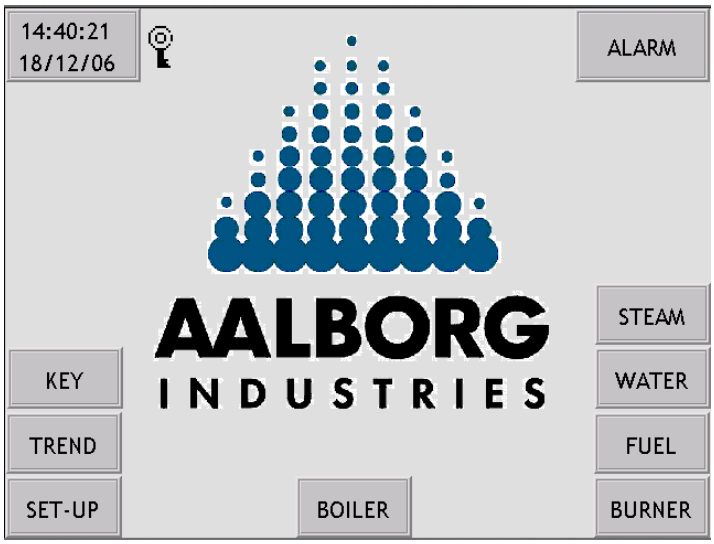


Figure 1 **om9306_56_pic_0x0062400en.wmf**

The key in the upper left corner shows that the system is unlocked allowing parameter changes from the touch screen.How to retrieve and release the key lock can be seen in the document “Key Operation Lock”.

2.1 Contact information

From the main picture access is given to contact information on Aalborg Industries A/S by clicking the logo as illustrated in Figure 2.

Access to contact information

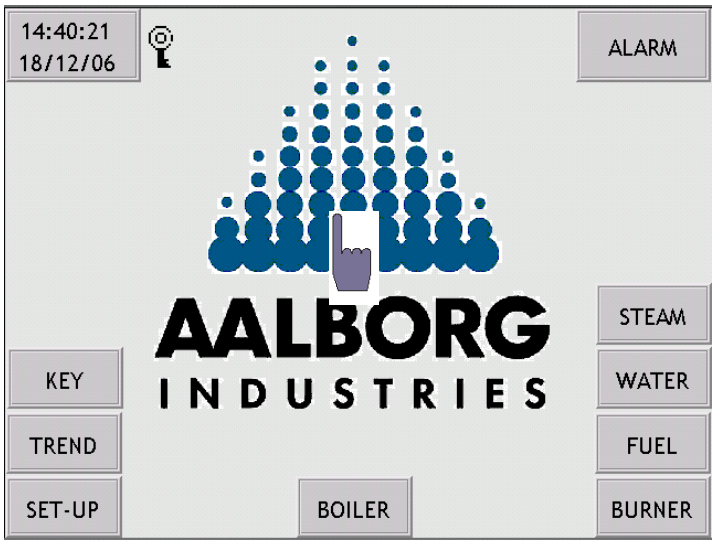


Figure 2 **contouch_15bx0200170en.wmf**

Contact information picture



Figure 3 **contouch_16x0197880en.wmf**

From the picture containing contact information access is given to the main menu by clicking the arrow in the lower left corner (Figure 3).

2.2 Alarm menu

The [ALARM] button (Figure 4) placed in the upper right corner of the screen is accessible from any of the submenus, which ensures full access to acknowledging alarms independent of which picture is present on the screen.

Allarm button

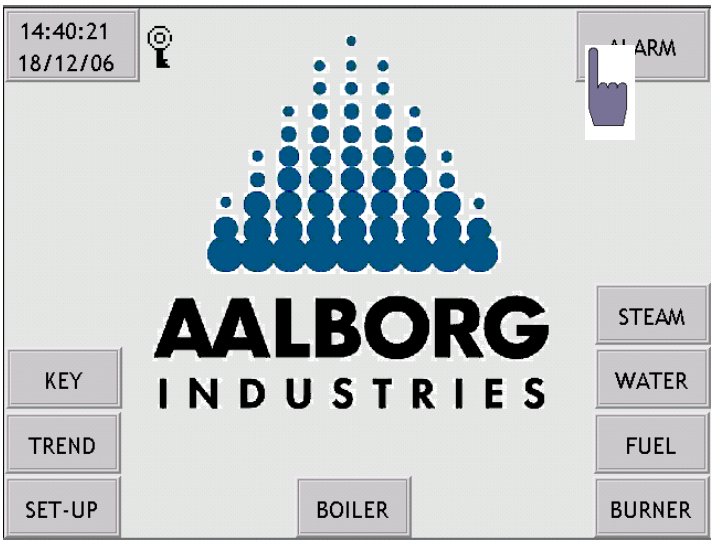


Figure 4 **contouch_17ax0200180en.wmf**

The [ALARM] button gives access to the alarm list (Figure 5)

Sub menu: Alarm list

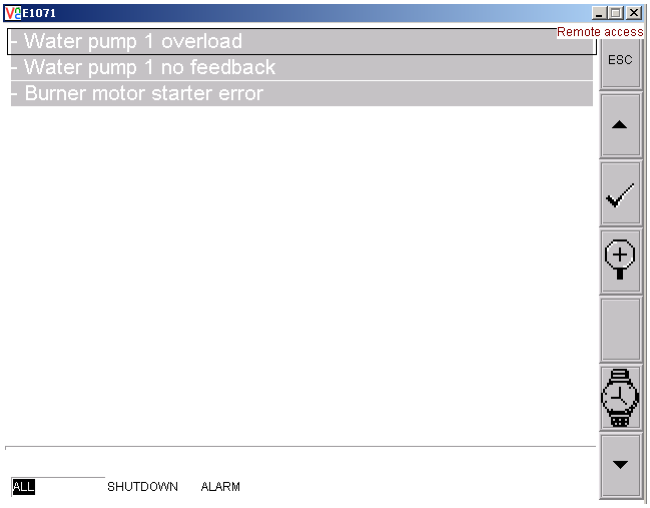


Figure 5 **om9306_56_alarmx0062290en.wmf**

[ESC] Escape button. Return to the previous menu.

[↑] Scroll up in the alarm list.

[√] Acknowledge an alarm.

[] Enlarge text (cycles through sizes)

[] See timestamp and other information for the alarms.

[↓] Scroll down the alarm list.

2.3 Steam system menu

The steam system menu gives access to an overview of the steam system including steam dump and inert gas status, modifying parameters and accessing the exhaustgas boiler menuif such is part of the system. The structure of the steam menu is illustrated in Figure 6

Menu structure for the steam menu

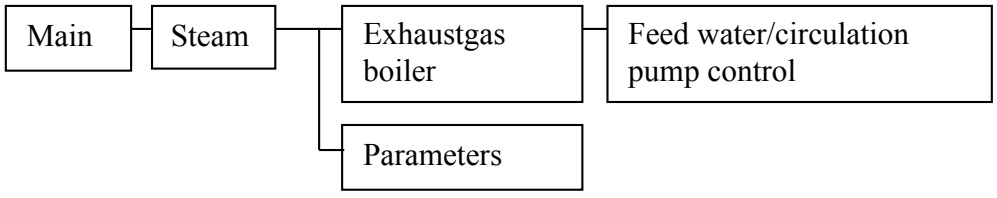


Figure 6 **contouch_19x0197910en.wmf**

The steam system menu is entered from the main menu by clicking the [STEAM] button (Figure 7).

Steam system menu

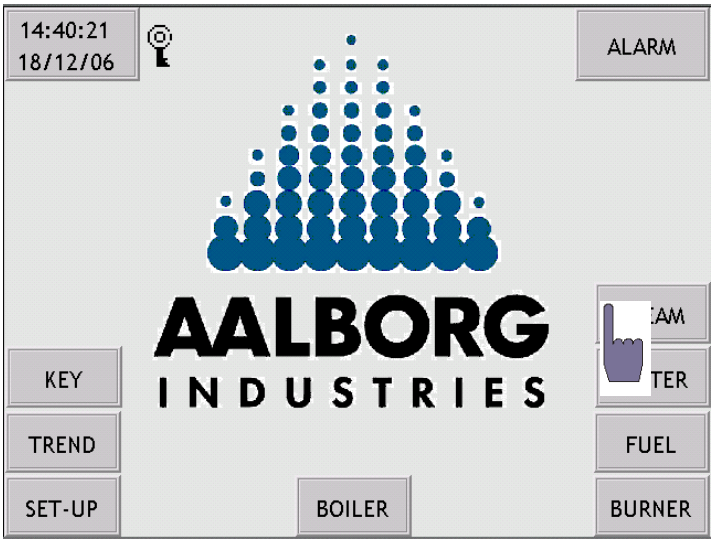


Figure 7 **contouch_20bx0200190en.wmf**

The picture under the steam menu is an overview of the steam system (Figure 8).

Steam system overview

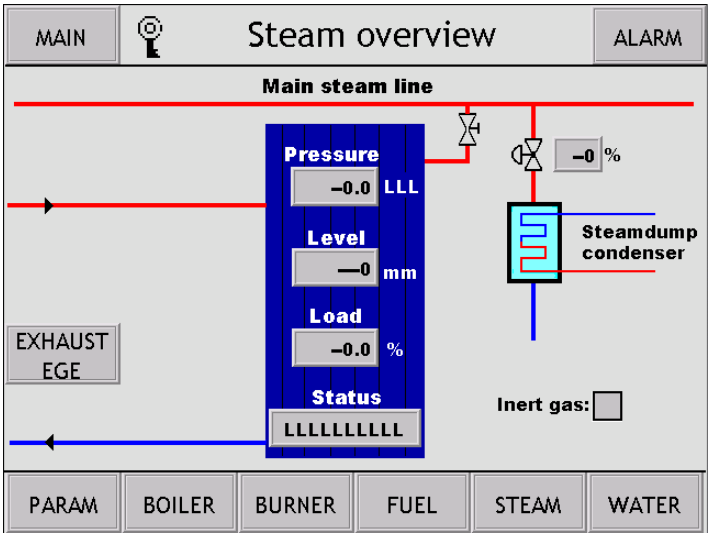


Figure 8 **om9306_56_pic_50x0062680en.wmf**

In the steam overview picture, the actual values for boiler pressure, water level, and load can be seen as well as the state of the steam dump valve and inert gas. Parameters for the steam system are set under the [PARAM] button in the lower right corner and in the middle left access is given to the exhaust gas boiler picture if configured.

2.3.1 Parameters for the steam menu

From the steam menu there is access to the parameters submenu by clicking the [PARAM] button in the lower right corner of the steam menu (see Figure 9)

Entering parameter sub menu for the steam menu

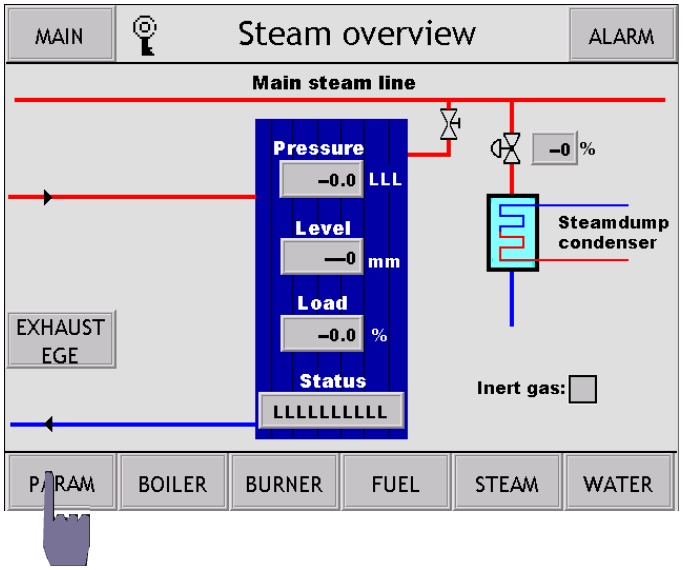


Figure 9 **contouch_22x0197940en.wmf**

In the parameter sub menu (illustrated in Figure 10) the actual set point for the steam dump is monitored as well as the process value and the regulator output. The set point can be changed by pushing Set point button (dark grey). From the parameter submenu there is also access to the inert gas menu, the main menu, the steam menu (arrow), and the regulator parameters

Parameter sub menu under the steam menu

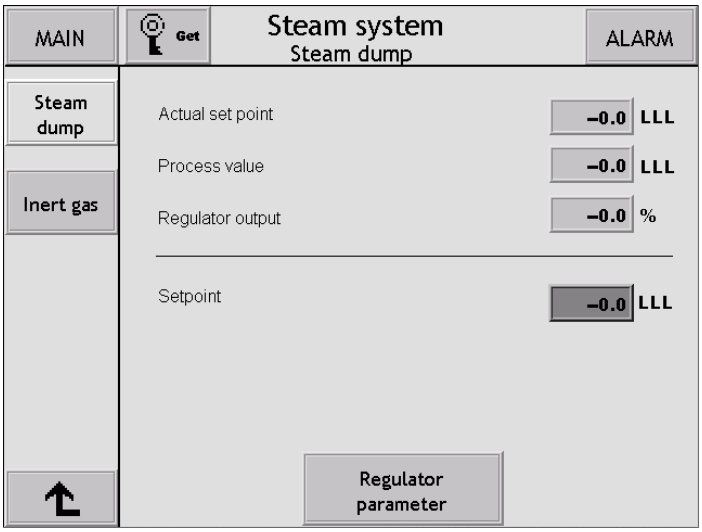


Figure 10 **om9306_56_pic_52x0062690en.wmf**

Regulator parameters

The regulator sub menu (see Figure 11) gives access to monitoring and changing of the regulation parameters: sampling time, proportional gain, integral time, and the derivative time. Furthermore, the control mode of the valve can be monitored and changed between auto and manual. If the valve is controlled manually, the position can be set under the “Manual position set-point” as a percentage of full open. 0.0 % is closed valve, and 100.0 % is a fully open valve. From this sub menu it is possible to return to the parameter submenu (Arrow) or the main menu.

Regulator parameteres under the steam dump sub menu

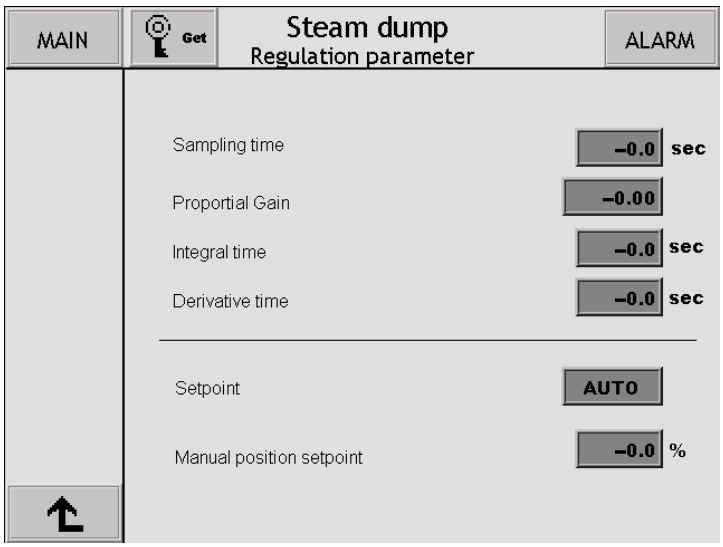


Figure 11 **om9306_56_pic_53x0062700en.wmf**

Inert Gas sub menu

From the parameters sub menu there is access to the inert gas menu by pushing the button [Inert gas] (Figure 12)

Parameters submenu under the steam menu

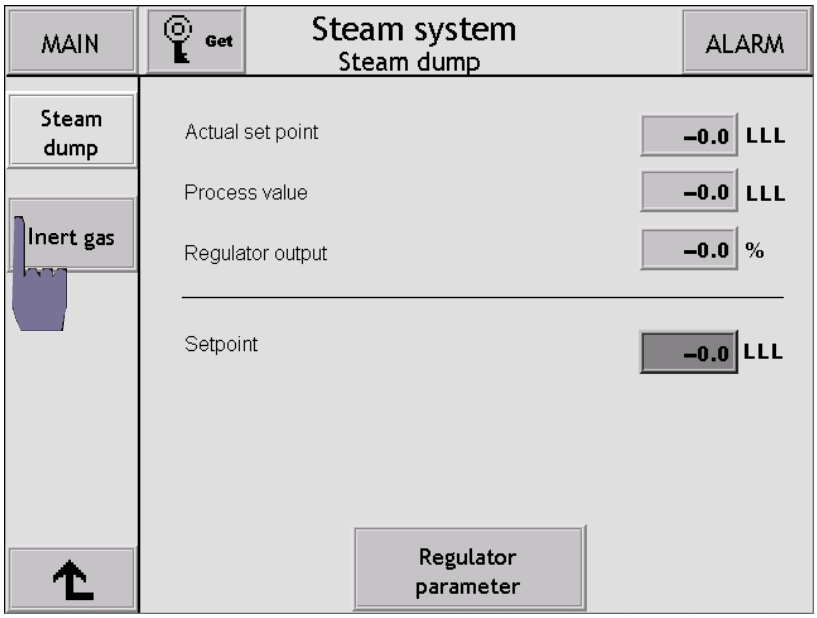


Figure 12 **contouch_25x0197970en.wmf**

In the inert gas menu (Figure 13) the load and forced load can be monitored.

Inert gas menu

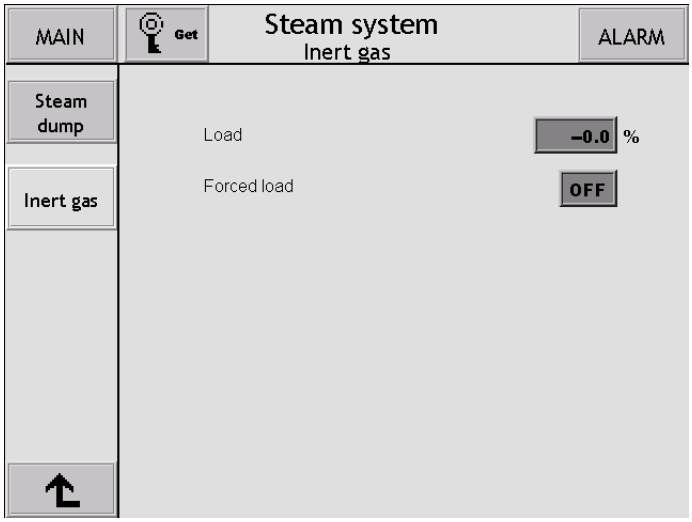


Figure 13 **om9306_56_pic_54x0062710en.wmf**

From the Inert gas menu there is access to the main menu, the steam dump parametersusing the [steam dump] button, and the steam menu, when pushing the arrow in the lower left corner.

2.3.2 Exhaust gas boiler picture

If an exhaust gas boiler is chosen, the Steam overview picture will show an EGE or EGB button (Figure 14 shows an EGB button) depending on if and what exhaust gas boiler is configured (done on the controller in the panel).

Exhaust gas boiler button

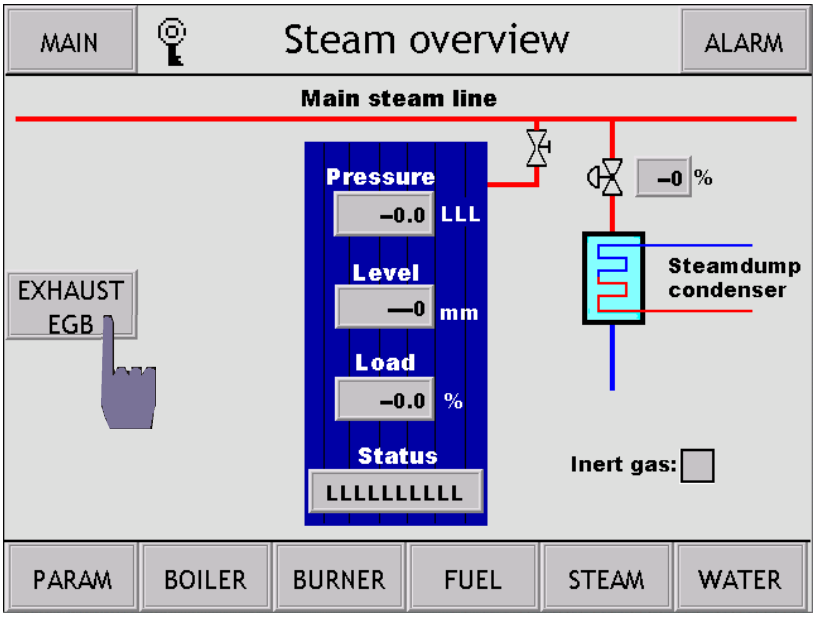


Figure 14 **contouch_27x0197990en.wmf**

Pressing the button brings the user to the exhaust gas menu (see Figure 15).

Exhaust gas boiler menu

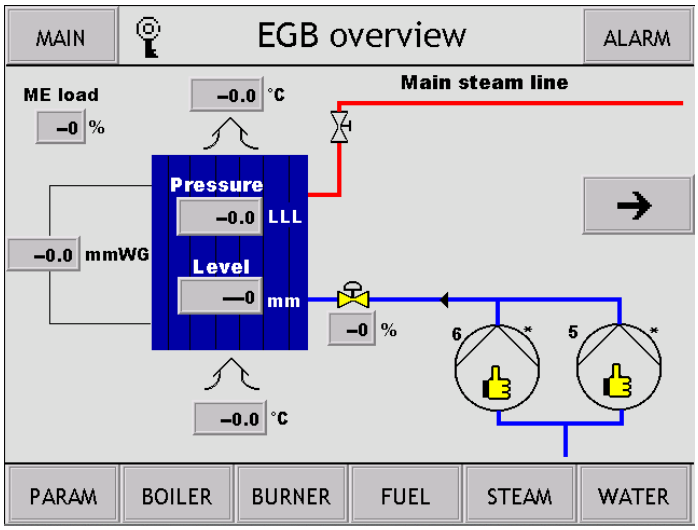


Figure 15 **om9306_56_pic_80x0062760en.wmf**

In Figure 15 both circulation pumps are stopped. Manual control of the pumps can be done by clicking the pump. Notice the * besides the pump. * marks that the icon (pump) is a button.

2.3.3 Circulation/EGB feedwaterpumps

Depending on the boiler type chosen the exhaust gas water pumps are called circulation pumps (EGE) or EGB feed water pumps (EGB). In the following they will just be referred to as EGB feed water pumps.

Changing the state of these pumps is done by clicking the pump button (Figure 16).

Accessing EGB feed water pumps sub menu

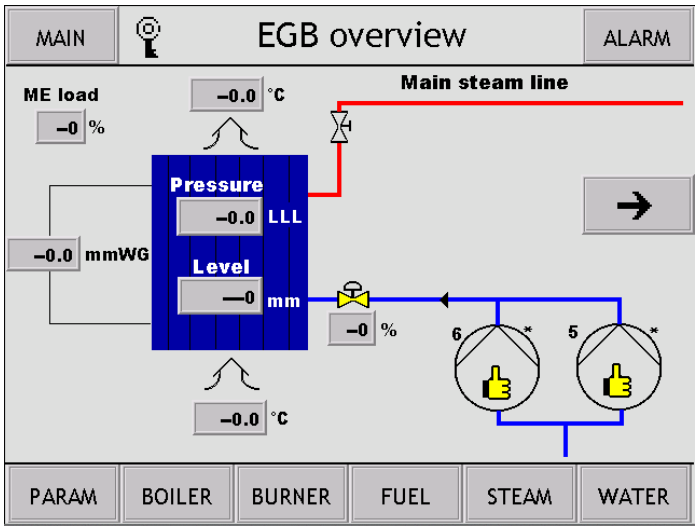


Figure 16 **om9306_56_pic_80x0062760en.wmf**

The dialog window for the circulation pump is illustrated inFigure 17. In this dialog box, the mode of the pump (start, stop, and stand by) can be set by pushing the buttons. The status of the pump is seen under status. If any alarms were present, they would be marked in the “Alarms” section of the window. It will be marked if the alarm is due to no feedback or overload (Circulation pumps also have a low flow alarm).

Dialog window for an EGB feed water pumps

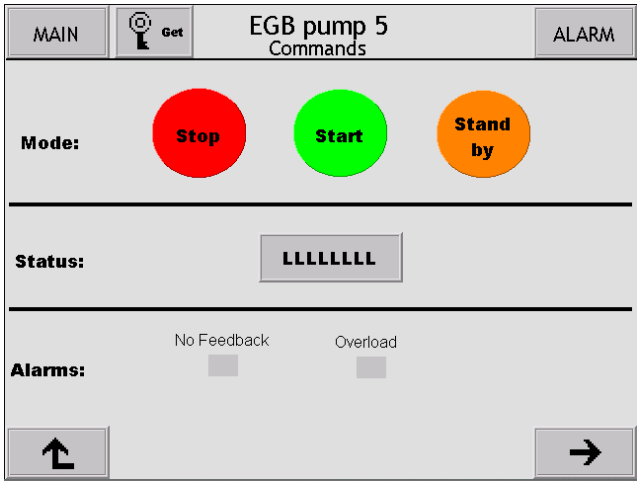


Figure 17 **om9306_56_pic_87x0062770en.wmf**

From the pump dialog, it is possible to navigate back to the exhaust gas boiler picture by pushing the arrow in the lower left corner, to the main menu by pushing the [MAIN] button in the upper left corner or to go to the next pump on the exhaustgas boiler (if available) by pressing the arrow in the lower right corner of the picture.

2.4 Water Menu

The water menu gives access to an overview of the feed water system and to change the parameters of the system. The structure of the feed water menu is illustrated in Figure 18

Menu structure for the water menu

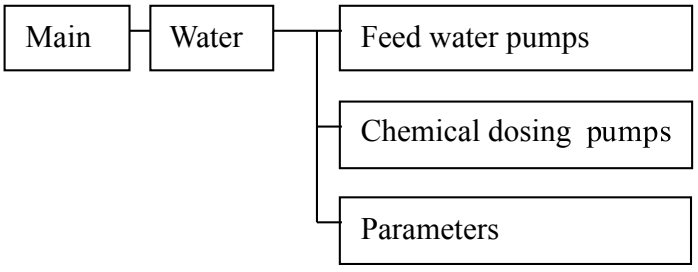


Figure 18 **contouch_31x0198030en.wmf**

The water menu is entered from the main menu (Figure 19) or from any of the other overview pictures.

Water menu access

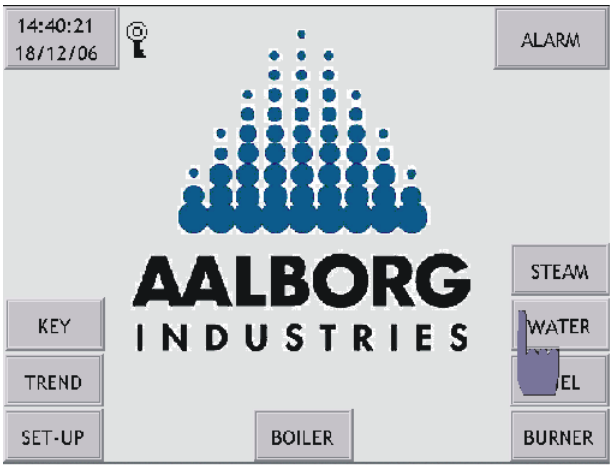


Figure 19 **contouch_32ax0198790en.bmp**

The mimic picture of the water menu gives an overview of the feed water system (Figure 20).

Feed water system overview

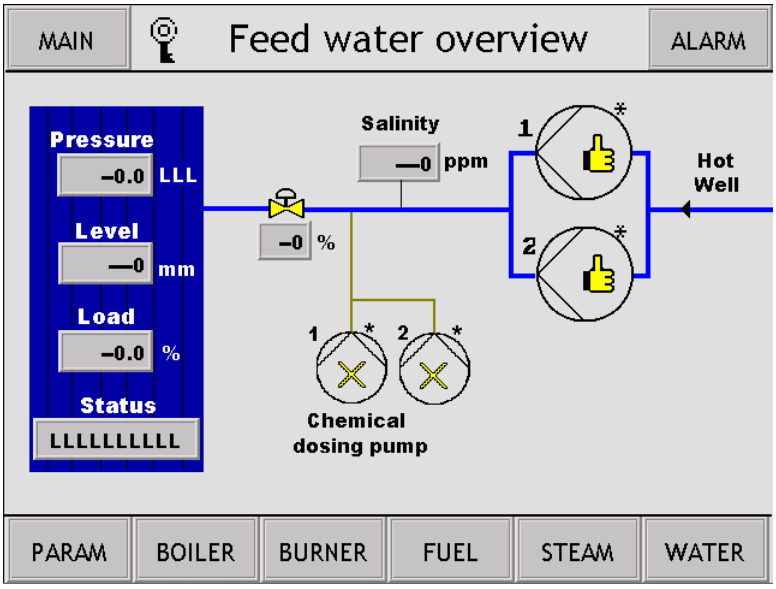


Figure 20 **om9306_56_pic_40x0062600en.wmf**

At the feed water overview, the steam pressure, water level and load of the system can be monitored. Furthermore, the status of the feed water valve is seen as a percentage of open, in this example (Figure 20) the valve is closed. A measurement of the salinity is also visible as well as it is possible to see if the pumps are running or stopped. In Figure 20 the two circulation pumps from the hot well are running and the chemical dosing pump is stopped.

From the feed water menu there is access to monitoring and control of the different pumps by pushing them and also parameters for the feed water system can be set under the [PARAM] button in the lower right corner.

2.4.1 Feedwater Pump

Control and monitoring of the feedwater pumps can be done by clicking the pump as illustrated in Figure 21.

Access to circulation pump

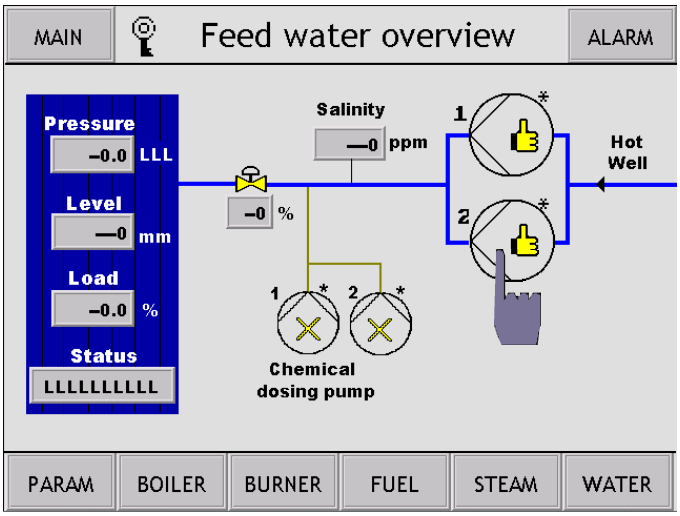


Figure 21 **contouch_34x0198060en.wmf**

The dialog window for the feedwater pump is illustrated in Figure 22

Dialog window for a circulation pump

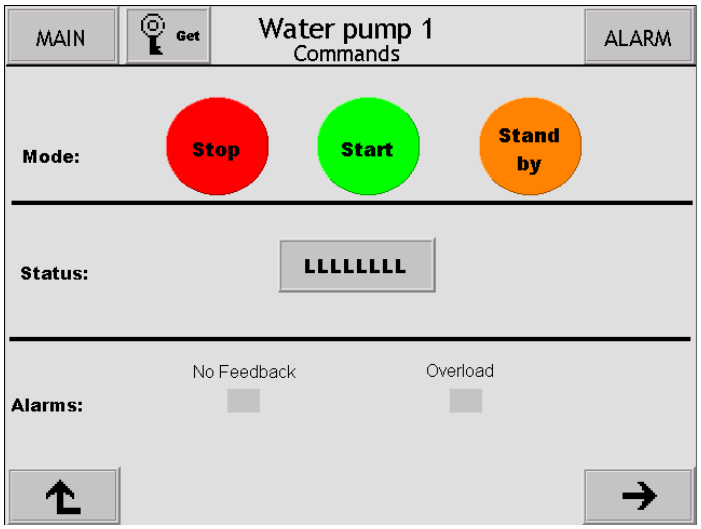


Figure 22 **om9306_56_pic_47x0062650en.wmf**

As seen in the figure the pump control resembles the control described in Section 2.3.3. From the dialog window of a water pump there is access to the main menu or the overview of the feed water system by clicking the button in the lower left corner.

2.4.2 Parameters

Under the submenu parameters access is given to alarm settings, water level settings etc. The submenu is entered from the feed water overview picture (Figure 23)

Access to the parameter submenu

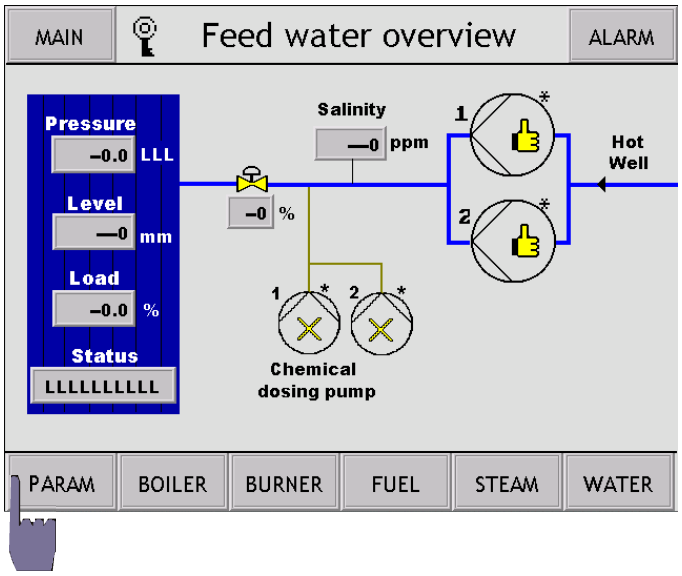


Figure 23 **contouch_36x0198080en.wmf**

The parameter submenu under the feed water system gives access to the water alarm limits as illustrated in Figure 24. The shut-down limit and the alarm limits for salinity can be monitored and changed.

Parameter submenu

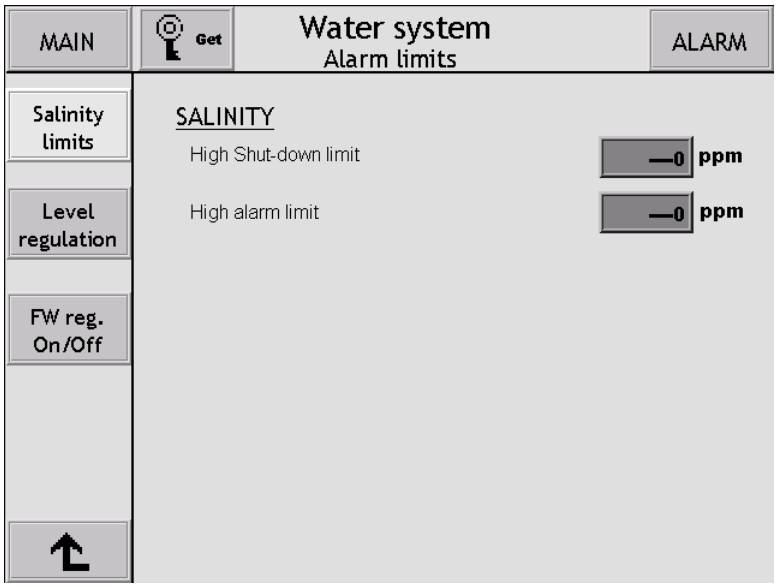


Figure 24 **om9306_56_pic_41x0062610en.wmf**

From the water alarm limits access is given to water level regulation parameters,to feedwater ON/OFF regulation parameters, to the main menu, and to the water system overview

Water level regulation

Access to the regulation and monitoring of the water level is done by clicking the button on the left side of the picture (Figure 25).

Access to water level regulation

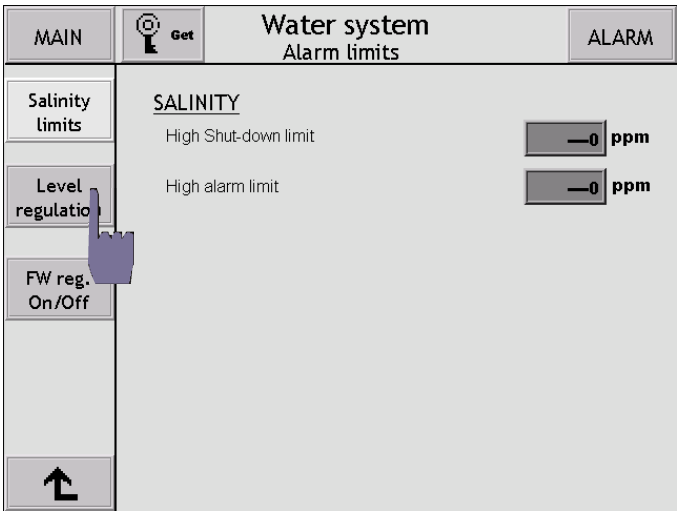


Figure 25 **contouch_38x0198100en.wmf**

The water level regulation and monitoring is carried out from the mimic picture illustrated in Figure 26. In the upper part of the level regulation dialog window the actual values are monitored, i.e. the actual set point, the actual value, and the regulator output. The set point and the process value are measured in mm from normal water level, where a minus indicates that the water level is below normal water level, and no sign in front of the figure means above normal water level. The lower part of the dialog window is for changing the values of the set points and the normal/stand-by limits.

Water level regulation dialog window

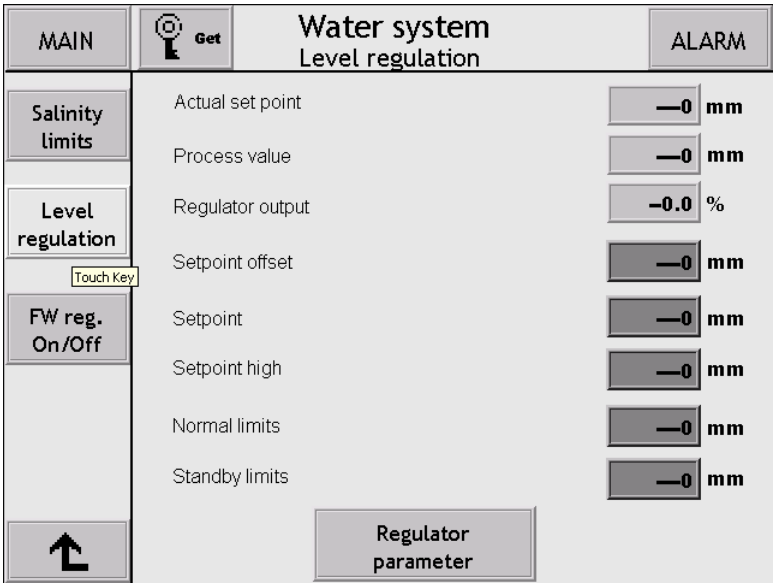


Figure 26 **om9306_56_pic_42x0062620en.wmf**

From the water level regulation dialog window, there is access to the Salinity limits, the ON/OFF regulation menu and it is possible to go to the main menu and well as return to the overview of the feed water system (the buttons in the lower left of Figure 26). Furthermore, access is given to the regulator parameters.

Regulator Parameter

Access to the feed water regulator parameters is given from the water level menu as illustrated in Figure 27.

Access to feed water regulation parameters

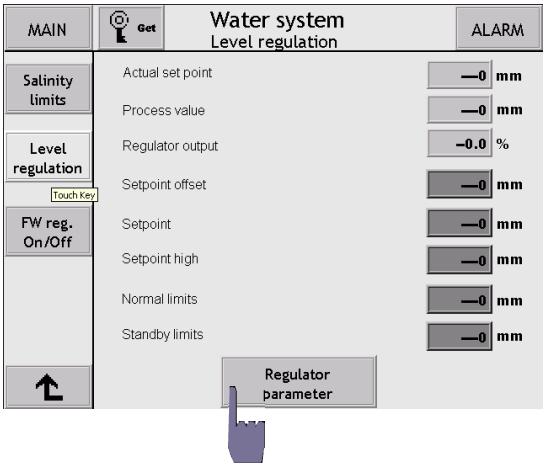


Figure 27 **contouch_40x0198120en.wmf**

The regulator parameters, which can be set is illustrated in Figure 28 and they are listed and described below.

Feed water regulation parameters

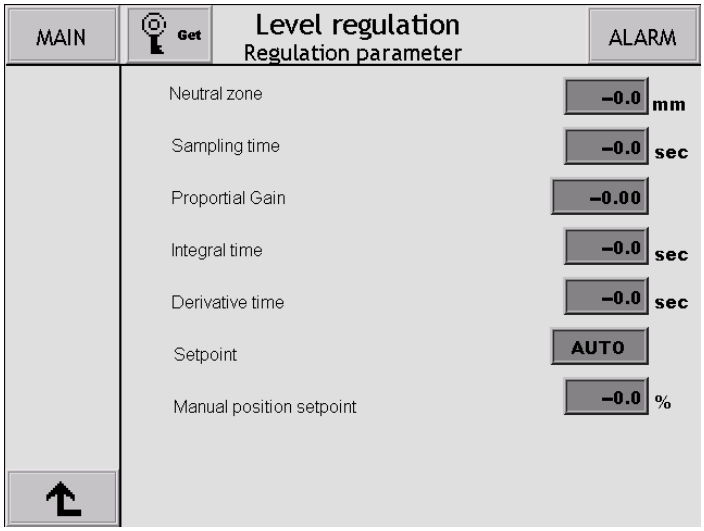


Figure 28 **om9306_56_pic_43x0062630en.wmf**

Feed water level regulator parameters, which can be set:

[Neutral zone] The maximum deviation from the set point, which is accepted without any regulation, takes place.

[I low limit] The lowest acceptable water level.

[I high limit] The highest acceptable water level.

[Sampling time] The time between two samples.

[Proportional Gain] Regulator parameter

[Integral time] Regulator parameter

[Derivative time] Regulator parameter

[Valve control mode] For setting the valve in automatic or manual mode.

[Manual pos. set point] If the valve is set to be in manual mode, the position can here be set as a percentage of fully open.

From the feed water level regulation dialog window, access is given back to the main menu and the feed water overview (lower left arrow).

Feedwater ON/OFF regulation

The last menu point in the feed water menu is the feedwater ON/OFF regulation menu accessible via the button with the same name on the left of the menu (see Figure 29).

Access to feed water ON/OFF regulation

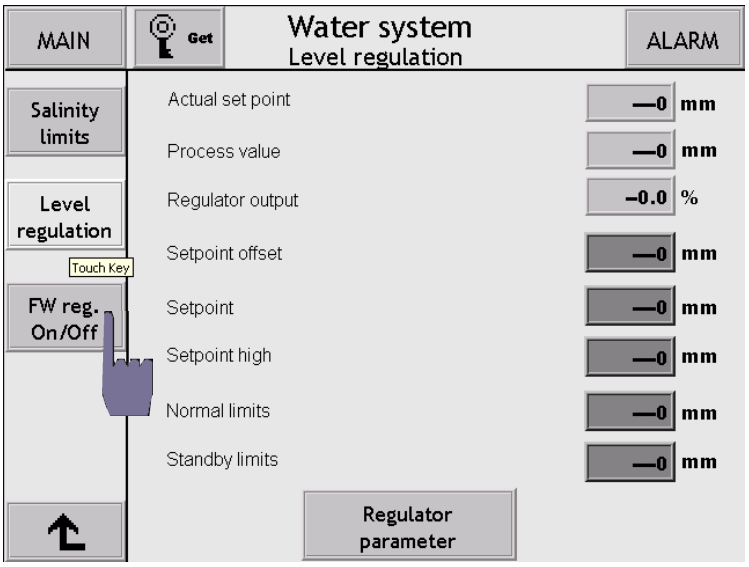


Figure 29 **contouch_42x0198140en.wmf**

The menu simply shows the status of the pumps (see Figure 30) to be used when running an ON/OFF feedwater regulation.

Feed water ON/OFF regulation dialog window

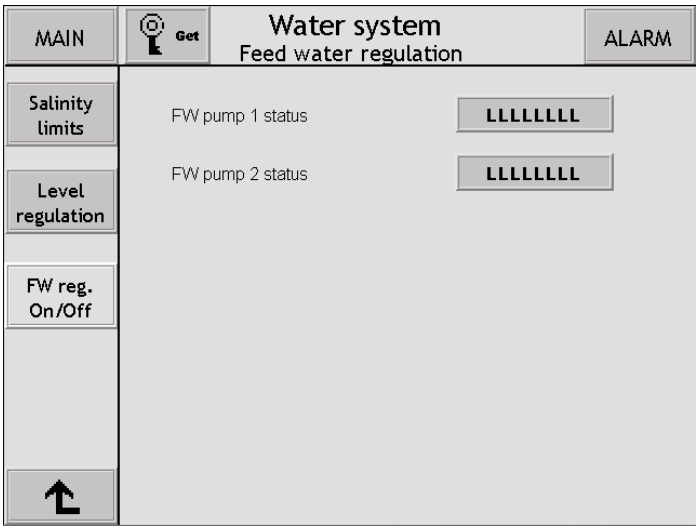


Figure 30 **om9306_56_pic_44x0062640en.wmf**

From the feedwater ON/OFF regulation dialog window, there is access to the Salinity limits and the Level regulation menu. It is also possible to go to the main menu and well as return to the overview of the feed water system (the buttons in the lower left of Figure 30).

2.5 Fuel menu

From the fuel menu access is given to an overview of the fuel system and control of the pumps in the system. The structure of the fuel menu is illustrated inFigure 31

Menu structure for the fuel meny

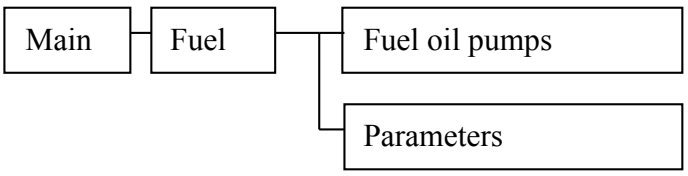


Figure 31 **contouch_44x0198160en.wmf**

The fuel menu is entered from the main menu as illustrated in Figure 32 or any of the other system menus.

Access to the fuel menu

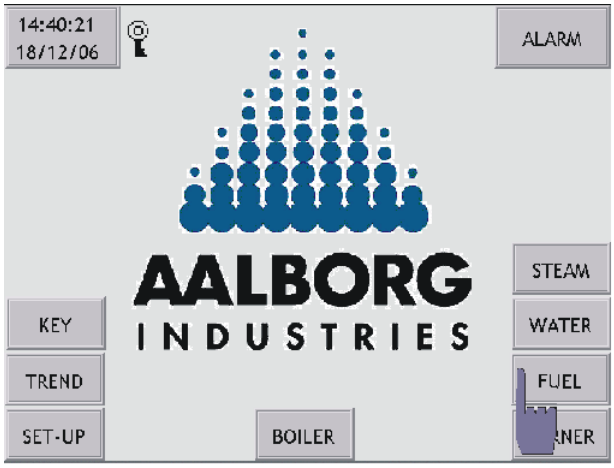


Figure 32 **contouch_45ax0198800en.bmp**

The picture under the fuel menu is an overview of the fuel system, which is illustrated in Figure 33.

Fuel oil system overview

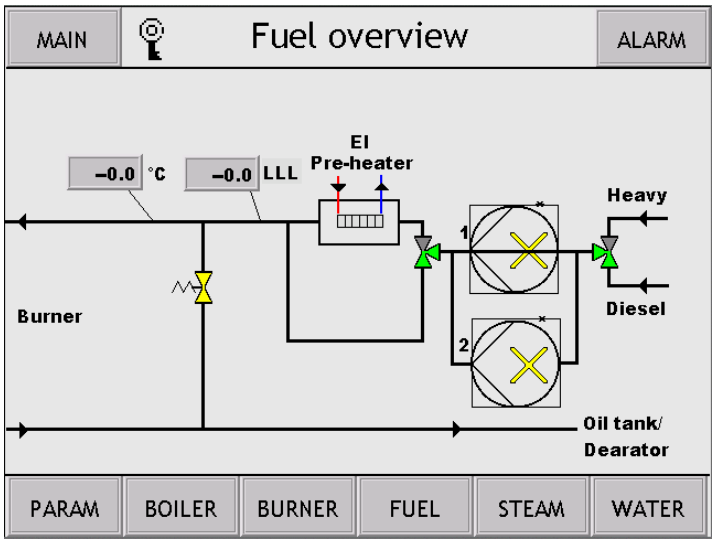


Figure 33 **om9306_56_pic_30x0062580en.wmf**

On the overview of the fuel oil system access is given to the fuel oil pumps and parameters to be set in the fuel oil system. Furthermore, fuel oil temperature and pressure can be monitored if available. It is also possible to see if the system is running HFO or diesel and what type of oil heater is configured. If the heater is electric the status of the element is indicated with a green bar meaning on. If the heater is a steam heater the temperature of the steam used to heat the fuel oil is displayed.

2.5.1 Fuel oil pumps

From the fuel oil system overview, access is given to the fuel oil pumps by clicking the pumps as illustrated in Figure 34.

Access to fuel oil pump

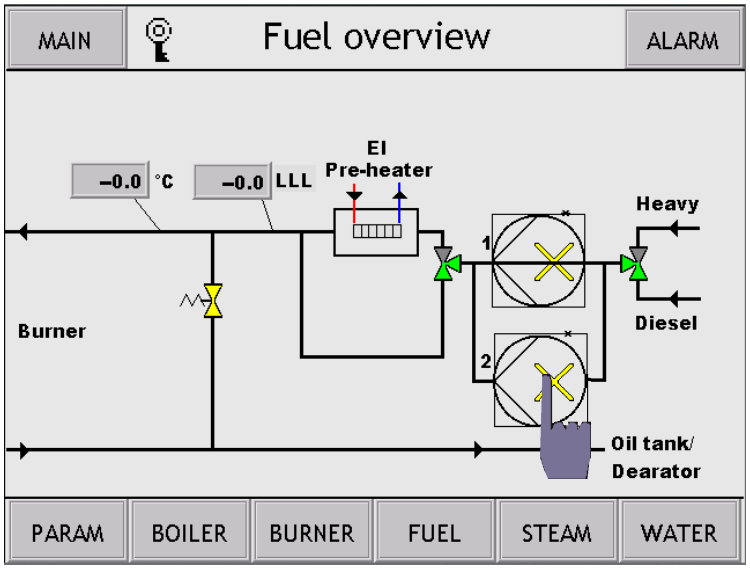


Figure 34 **contouch_47x0198190en.wmf**

As seen in Figure 35 the pump control resembles the control described in Section 2.3.3.

Fuel oil pump dialog window

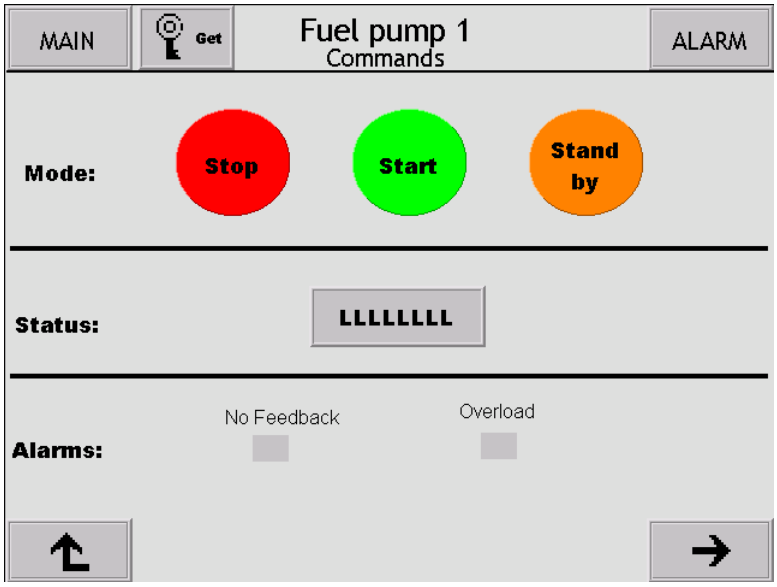


Figure 35 **om9306_56_pic_37x0062590en.wmf**

From the dialog window of a fuel oil pump there is access to the main menu or the overview of the fuel oil system by clicking the button in the lower left corner. By pressing the arrow in the lower right corner the picture switches to the next fuel oil pump.

2.5.2 Parameters for the fuel oil system

Access to the parameter settings of the fuel oil system is given by clicking the [PARAM] button in the lower left corner as illustrated in Figure 36

Acess to the fuel oil system parameters

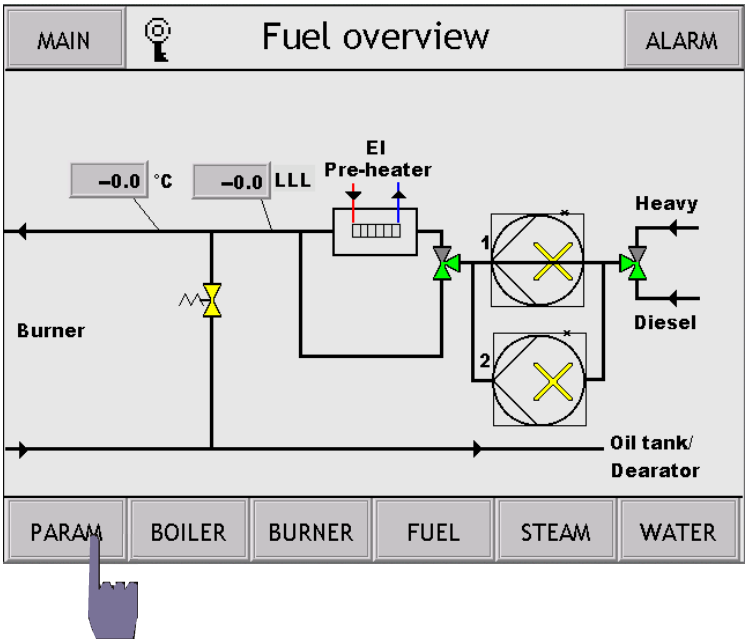


Figure 36 **contouch_49x0198210en.wmf**

The dialog window for the parameter settings for the fuel oil system is illustrated in Figure 37. Notice that the illustration is for a KBP burner as mentioned in the introduction. For some burners (e.g. RMS) the preheater is placed on the burner picture for better correspondence with the actual burner design. Placement for menus relevant for the preheater will therefore move as well.

Parameters / Pressure alarm limits for the fuel oil system

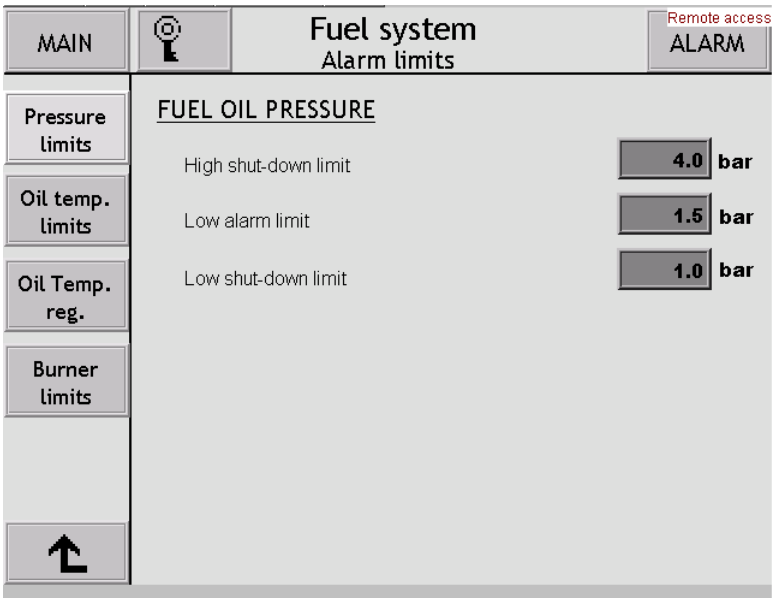


Figure 37 **om9306_56_hc_003x0062330en.wmf**

Fuel oil pressurelimits menu

The top menu available (Figure 37) is the Pressurelimits list. The list holds the alarm limits concerning fuel oil pressure.Notice that if a pressure measurement is not available on the burner (e.g. on MS), the common oil pressure on the common controller is used.

The high shutdown alarm limit, low alarm limit, and the low shut-down limit can be set by pressing the dark grey button after each point in the list.

From the menu there is access to the main menu or the overview of the fuel oil system by clicking the button in the lower left corner. Accessis also available to the other menu points: Oil temp. limits, Oil Temp reg. and burner limits.

Fuel Oil Temperature limits menu

The menu oil temp. limits holds alarm limits concerning fuel oil temperatures (see Figure 38). Notice that this temperature is measured in the preheater.

Temperature alarm limits for the fuel oil system

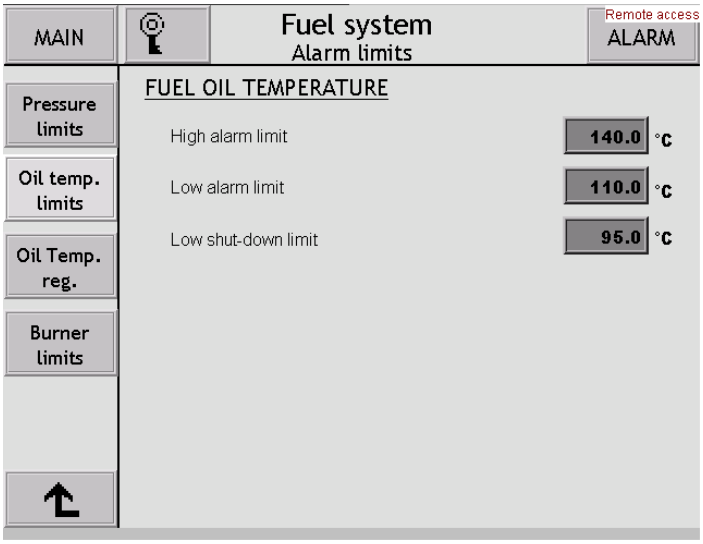


Figure 38 **om9306_56_hc_006x0062350en.wmf**

The high and low shutdown as well as the low alarm limit can be set by pressing the dark grey button after each point in the list.

From the menu there is access to the main menu or the overview of the fuel oil system by clicking the button in the lower left corner. Access is also available to the other menu points: Pressure limits, Oil Temp reg. and burner limits.

Temperature regulator menu

In the Oil temp reg. menu (see Figure 39) the regulation set points are displayed in the top.

Fuel oil temperature regulation

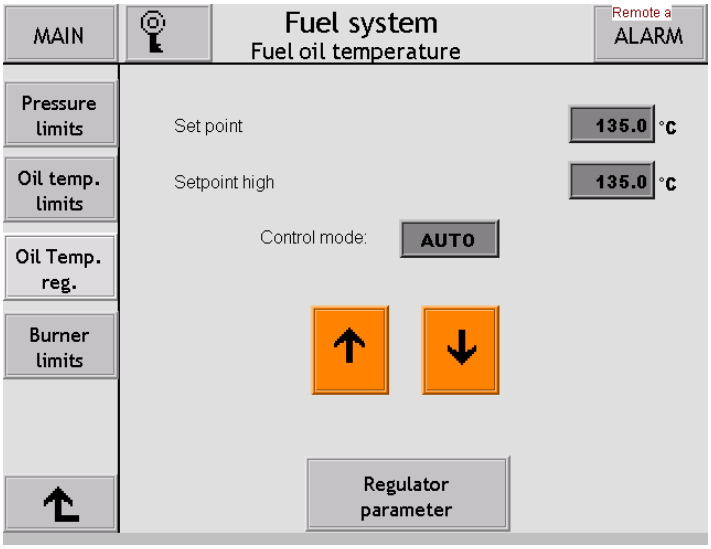


Figure 39 **om9306_56_hc_007x0062360en.wmf**

Notice that KBP has two set points: One for standby and one for firing. If a steam heater is chosen (as it is the case in Figure 39) the menu also displays control buttons used for controlling the steam valve in the heater. The actuator can be set in manual mode allowing manual control of its position by pressing the up arrow for increasing the opening degree of the valve or down arrow for decreasing the degree. By pressing the Regulator set points button in the bottom of the picture it is possible to configure the regulator parameters. The parameters that can be set for a steam heater is illustrated in Figure 40 and described in the list below.

Fuel oil temperature regulation parameters

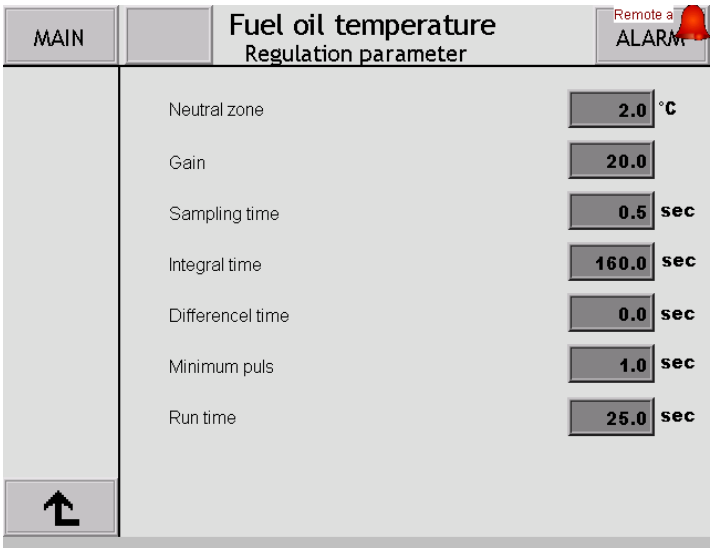


Figure 40 **om9306_56_hc_009x0062370en.wmf**

Fuel oil temperature regulator parameters, which can be set:

[Neutral zone] A band around the set point where regulation is not carried out (the process value error is ignored).

[Gain] Regulator parameter – Proportional gain

[Sampling time] The time between two samples.

[Integral time] Regulator parameter

[Difference time] Regulator parameter

[Minimum pulse] The minimum time the preheater can be on in each PWM period.

[Run time] Time for one PWM period.

From the parameters menu access is given either back to the temperature regulation menu using the arrow in the lower left corner or to the main menu using the top left button. Back in the Temperature regulation menu there is access to the main menu or the overview of the fuel oil system (button in the lower left corner). Access is also available to the other menu points: Pressure limits, Oil Temp. limits and burner limits.

Burner limits menu

Some of the burners are equipped with an additional temperature measurement on the burner. Alarms concerning this measurement can be set under the last menu – the Burner limits menu illustrated in Figure 41.

Acess to preheater limits menu

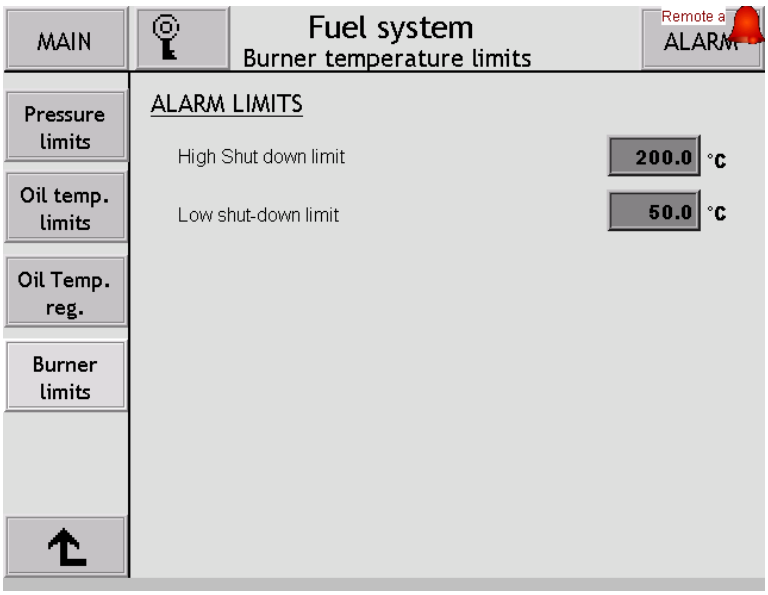


Figure 41 **om9306_56_hc_010x0062380en.wmf**

The menu holds a high and low shutdown value that can be modified through the dark grey indicators.From the Burner limits menu, access is given back to the main menu and the fuel oil overview (lower left arrow). Access is also available to the three other menu points: Pressure limits, Oil Temp. limits and Oil temp. reg.

2.6 Burner Menu

The burner menu gives access to an overview of the burner system and to alarm settings of the system. The structure of the burner menu is illustrated in Figure 42

Menu structure for the burner menu

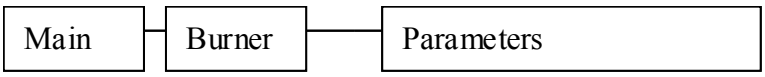


Figure 42 **contouch_55bx0201950en.wmf**

Access to the burner menu is given from the main picture (Figure 43) or from any of the other system menus.

Access to the burner menu

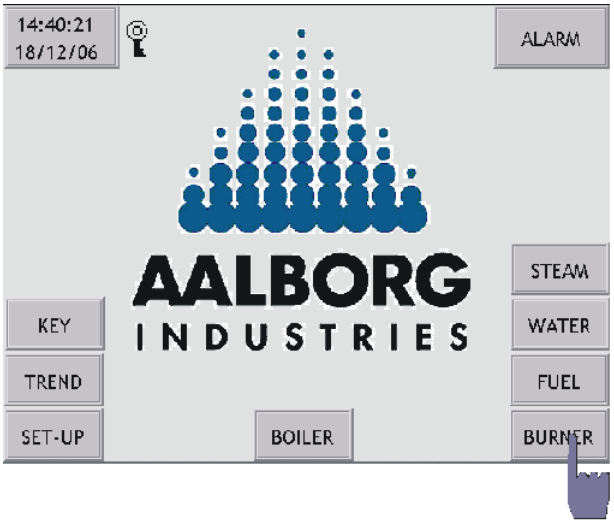


Figure 43 **contouch_56ax0198810en.bmp**

The overview of the burner system is illustrated in Figure 44

Burner system overview

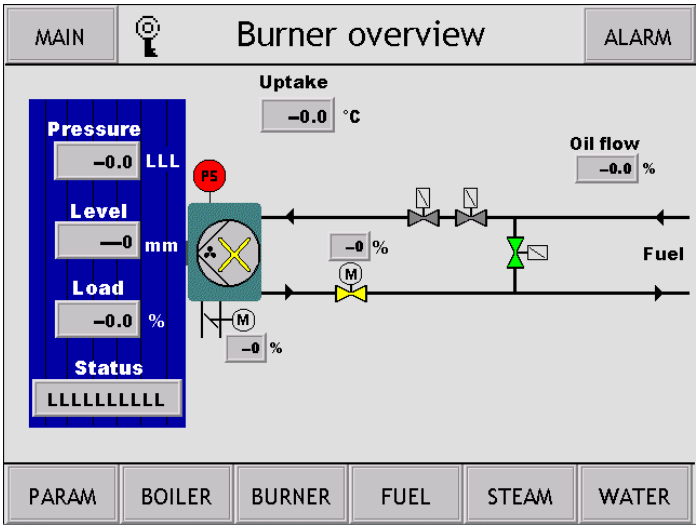


Figure 44 **om9306_56_pic_20x0062490en.wmf**

In the overview picture a simplified diagram of the burner system is shown. On the left side is the pressure, water level and boiler load. On the right side the main burner components, that are important for illustrating the system state, are shown:

- **Position of the fuel valve and air damperdamper.**State is shown as a percentage of fully open. If actuators are mechanically connected only the fuel valve are shown.
- **Fuel oil flow**(percentage of full load). If available.
- **Uptake temperature.**If available.
- **State of the main valves.** State is shown with green meaning activated and grey meaning deactivated.
- **State of the main switches.**E.g. the combustion air pressure switch indicating if pressure is high enough. If the switch is in an error state the switch symbol is red (illustrated in Figure 44).
- **State of burner system motors**The state of the burner motor and, if separate as in rotary cup burners, the combustion air fan motor is also monitored. Figure 44 Ç€äshows a KBP burner with a burner motor. The yellow cross means that the burner is stopped. A green “rotation symbol”:indicates that the motor is running.

Nothing can be activated directly from the burner picture. If burner parameters has to be modified, this must instead be carried out in the parameter menu.

2.6.1 Parameter settings

The parameter settings or alarm limit settings related to the burner system is accessed from the burner overview picture by clicking the [PARAM] button (Figure 45).

Acess to the parameter settings in the burner system

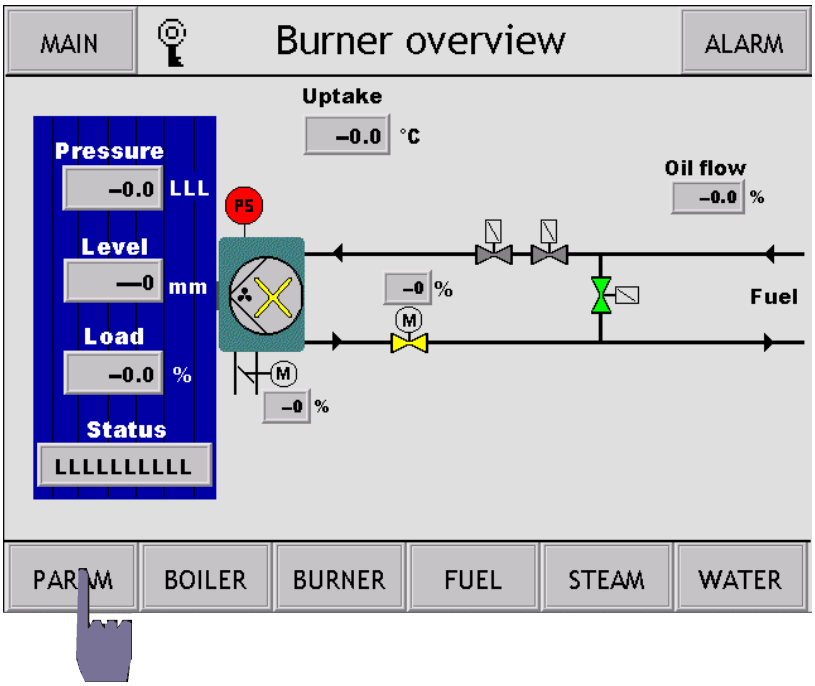


Figure 45 **contouch_58x0198300en.wmf**

The first menu displayed is the Uptake limits menu. Here limits can be set for the high alarm and the high shut-down uptake temperature (see Figure 46).Notice that the illustration is for a KBP burner as mentioned earlier. For some burners (e.g. RMS) the preheater is placed on the burner picture for better correspondence with the actual burner design. Placement for menus relevant for the preheater will therefore move as well.

Uptake limits list for burner system

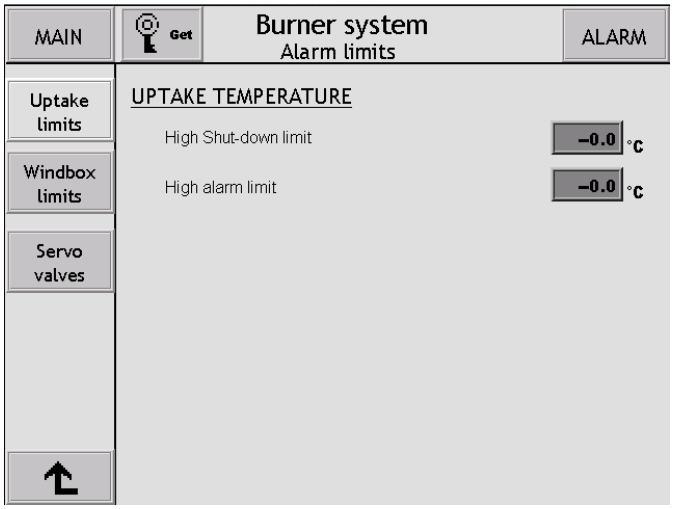


Figure 46 **om9306_56_pic_21x0062510en.wmf**

From the uptake limits menu, access is given to the main menu and back to the burner overview (lower left arrow). Figure 46 also shows another menu choice – the Servo valves menu. If the system was configured with a burner that had a windbox another menu choice would be possible as well – the windbox limits menu.

Windbox limits

The windbox limits menu is available on burners that is configurated with such and can be accessed by pressing the windbox limits button on the left side of the screen (Figure 47shows the parameter menu on KBE burner).

Access to th windbox limits menu

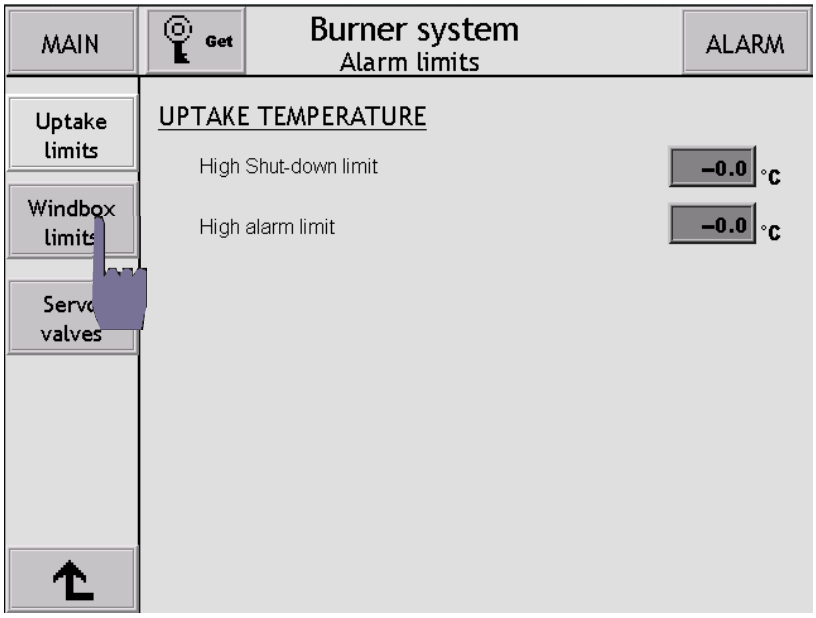


Figure 47 **contouch_60x0198320en.wmf**

The windbox limits menu actually just holds one limit – the temperature high limit used to determine a threshold for the “fire in windbox” shutdown (see Figure 48).

Windbox limits list for the burner system

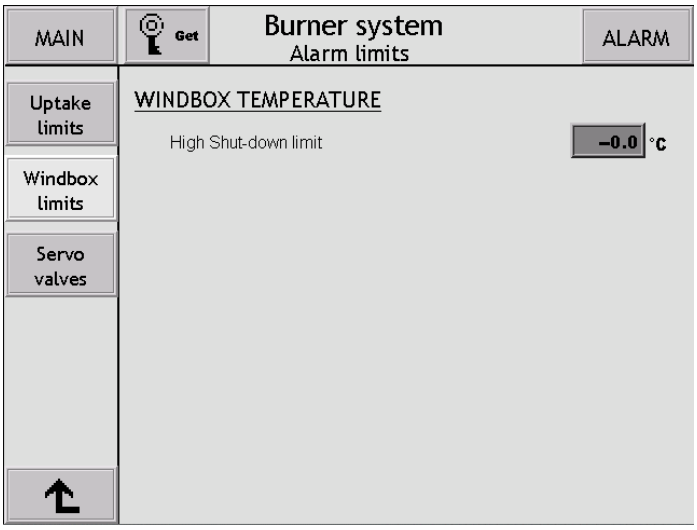


Figure 48 **om9306_56_pic_22x0062530en.wmf**

The last menu available is the servo valves menu.

Servo valves

The servo valve control menu is available by pressing the servo button on the left side of the screen see Figure 49

Access to the servo valve control menu

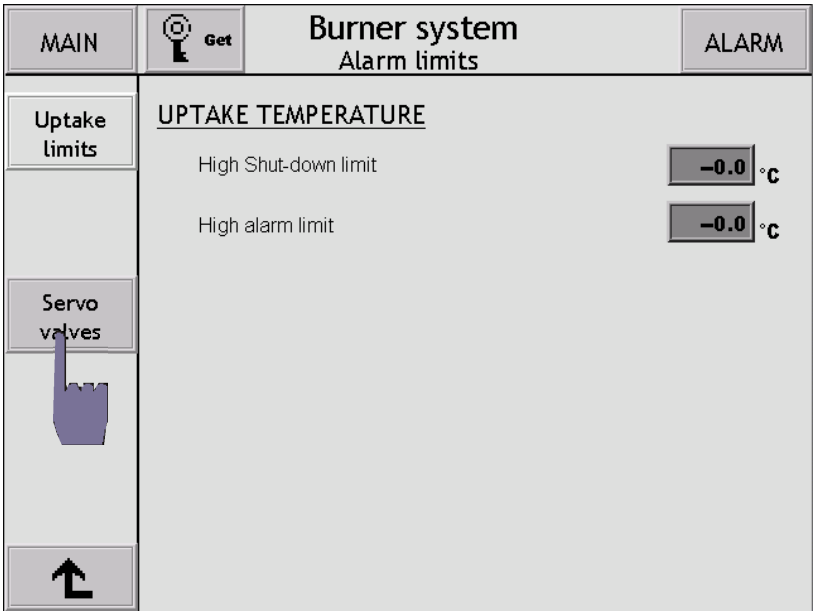


Figure 49 **contouch_62x0198340en.wmf**

The servo valves menu allows for manual or automatic control of the oil (valve) and air (damper) servos as well as setting different parameters relevant to this. The menu is illustrated in Figure 50.

The servo valve control menu

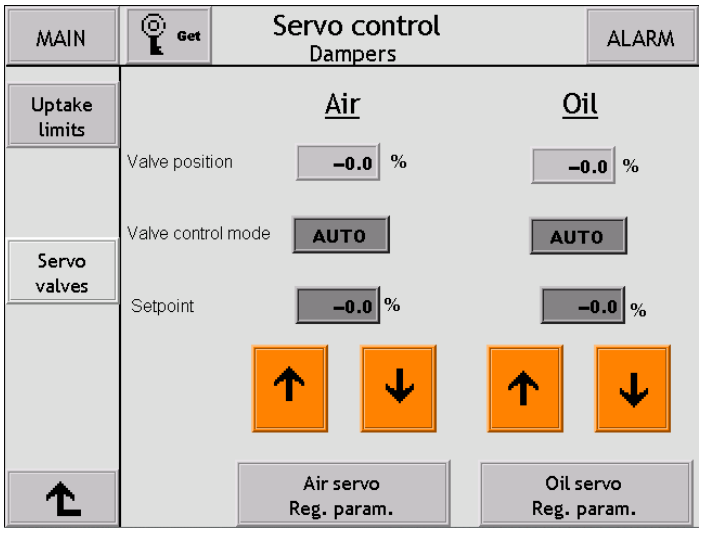


Figure 50 **om9306_56_pic_29x0062570en.wmf**

In the menu the air damper and oil valve position can be monitored. The actuators can be set in manual mode allowing manual control of their position by either entering the position (as a percentage of full open) in the setpoint (dark grey) box or by pressing the arrows. For each servo it is possible to configure the regulators behind their automatic functioning. This is done by pressing the servo reg. param. button below the servo that is to be changed (See Figure 51).

Access to the servo valve settings

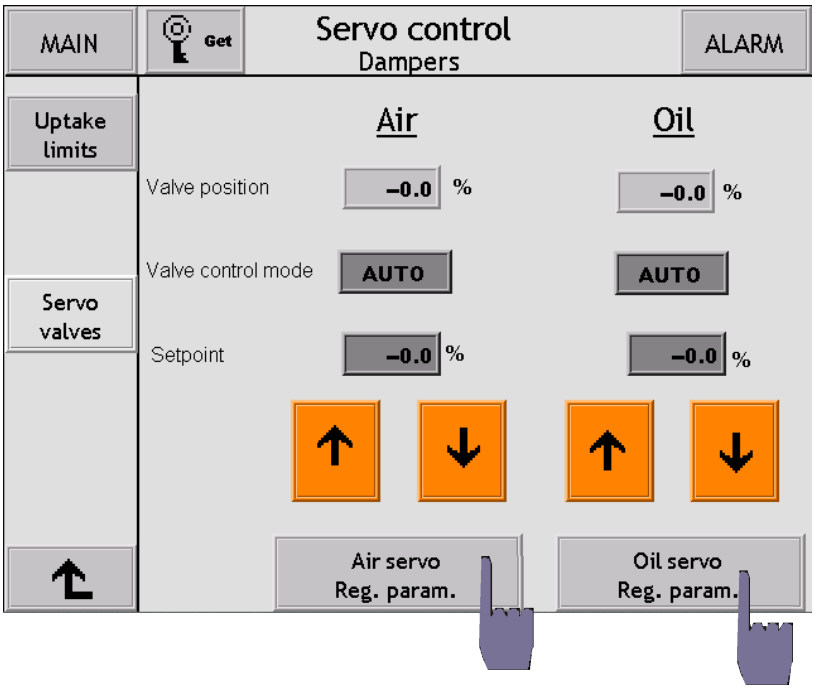


Figure 51 **contouch_64x0198360en.wmf**

The servo reg. param. menu allows the user to change to regulator parameters. The menu for the air servo is displayed in Figure 52.

Servo control to air damper

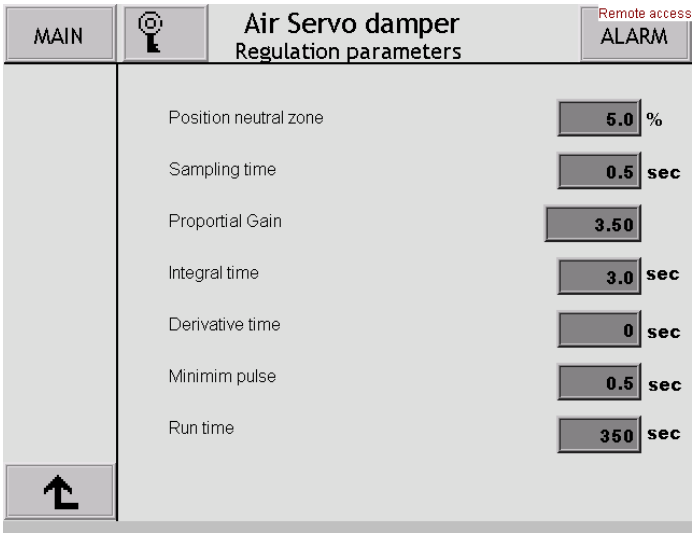


Figure 52 **om9306_56_hc_005x0062340en.wmf**

Parameters which can be set are:

Position neutral zone: The accepted distance from the actual position to the set point position.

Sampling time: The time between two samples.

Proportional Gain: Regulator parameter

Integral time: Regulator parameter

Derivative time: Regulator parameter

Minimum pulse: The minimum on time that the servo relay can be activated.

Run time: A parameter indicating the time period in which the regulator operates. This is not the same as the period the actuator is active but it affects this.

From the servo control menu access is given to the main menu, alarm limit list and back to the parameter menu (arrow in lower left corner).

2.7 Boiler Menu

The boiler menu gives access to an overview of the entire boiler system and alarm limits can be set. Manual control of the load can be taken. The menu structure of the boiler menu is illustrated inFigure 53.

Menu structure of the boiler menu

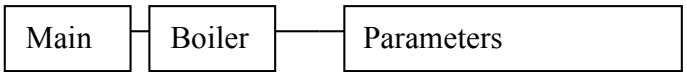


Figure 53 **contouch_66x0198380en.wmf**

Access to the boiler menu is given from the main picture as illustrated in Figure 54.

Access to the boiler menu

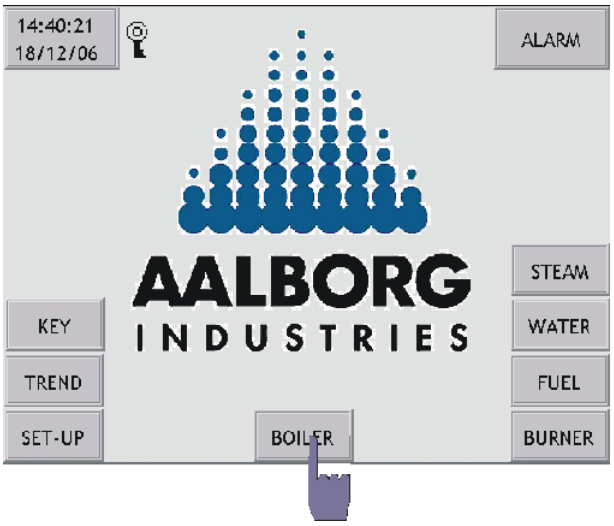


Figure 54 **contouch_67ax0198820en.bmp**

In the boiler overview picture the boiler pressure, water level, and the load of the boiler can be monitored in the middle of the picture. Also oxygen level and the smoke density can be monitored as illustrated in Figure 55.

Boiler menu overview

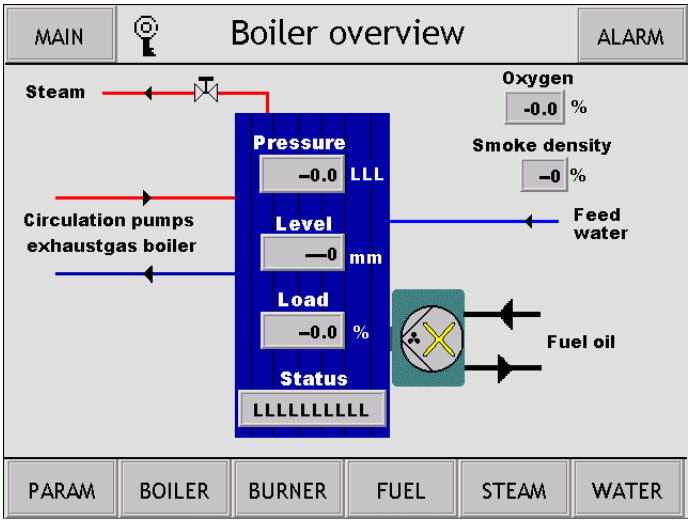


Figure 55 **om9306_56_pic_10x0062420en.wmf**

2.7.1 Parameter settings for the boiler system

From the boiler overview picture access is given to parameter settings of the boiler settings as illustrated in Figure 56.

Access to the parameter settings for the boiler menu

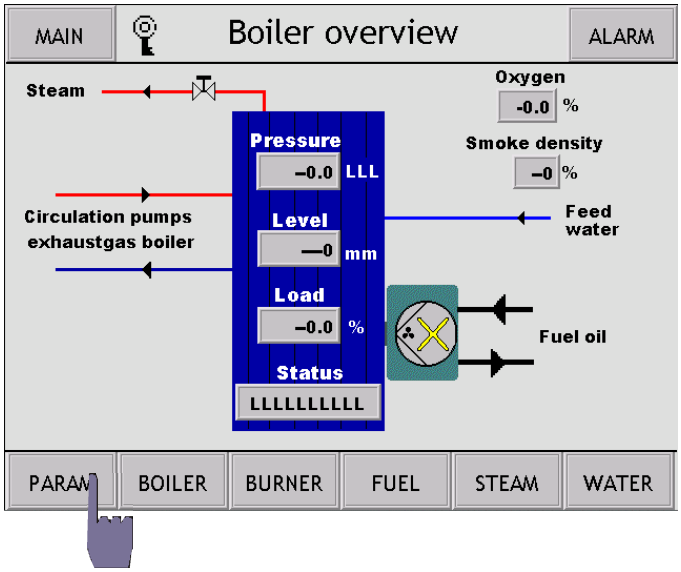


Figure 56 **contouch_69x0198410en.wmf**

The alarm limits list is divided into two sections. In the upper section the alarm limits concerning water level are placed, and in the lower section, the alarm limits concerning the boiler pressure are placed.

The alarm limits, which can be changed,are for the water level: High and low shut-down limits, and high and low alarm limits. For the boiler pressure high and low alarm limits, and the high shut-down limit can be set.

Parameters / alarm limits for the boiler system

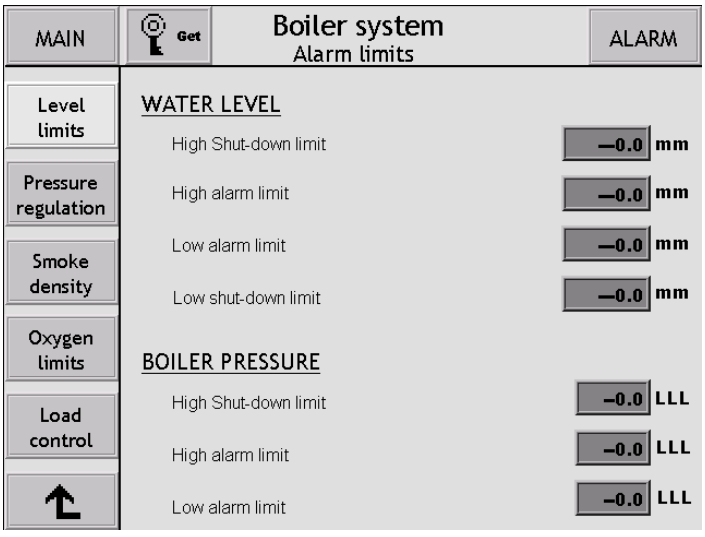


Figure 57 **om9306_56_pic_11x0062430en.wmf**

From the alarm list, access is given to parameter settings for pressure regulation, smoke density alarms, oxygen limits and load control in the left side of the picture.

Access to the pressure regulation dialog window is achieved by pressing the pressure regulation button on the left (see Figure 58).

Access to pressure regulation parameters

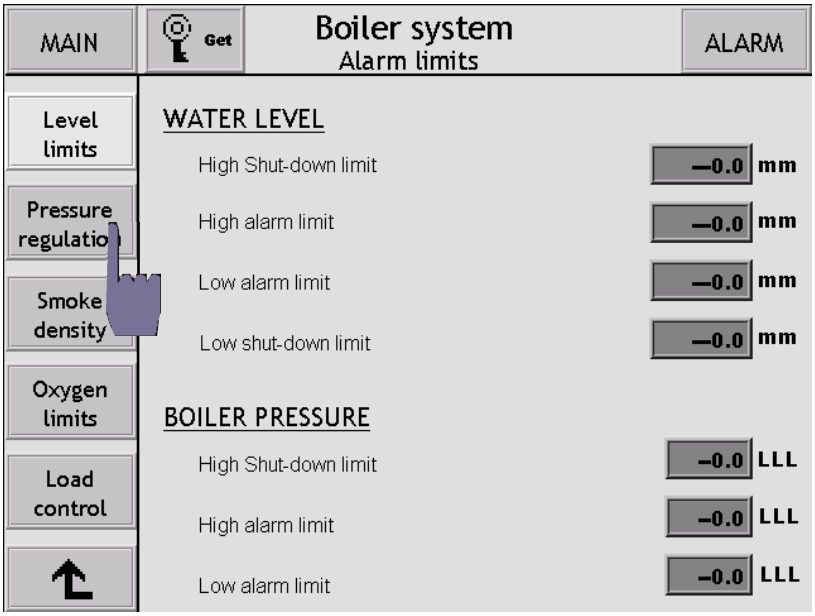


Figure 58 **contouch_71x0198430en.wmf**

The pressure regulation dialog window(see Figure 59) is divided into two sections. The upper section is a monitoring section and the lower section is a control section, where the parameters can be set. The values, which can be monitored,are the current set point, pressure and regulator output. The parameters, which can be set, are the normal set point and the high set point.

Pressure regulating dialog box

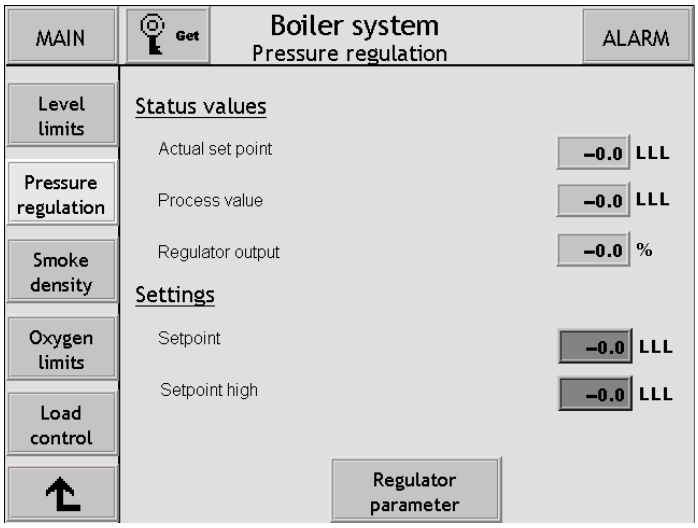


Figure 59 **om9306_56_pic_12x0062440en.wmf**

From the pressure regulation dialog window access is given to the regulator parameters as illustrated in Figure 60.

Pressure refulation dialog box

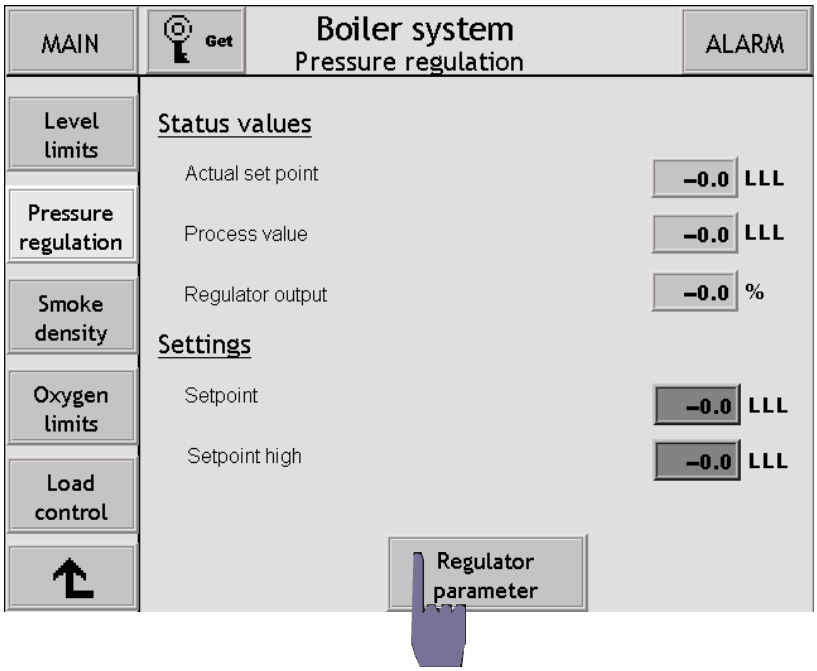


Figure 60 **contouch_73x0198450en.wmf**

The regulator parameters for the boiler pressure regulation (Figure 61), which can be changed, are:

Sampling time: The time between two samples.

Proportional Gain: Regulator parameter

Integral time: Regulator parameter

Derivative time: Regulator parameter

Set point: The desired temperature.

Mode: For setting the valve in automatic or manual mode.

Regulator parameters for pressure regulation

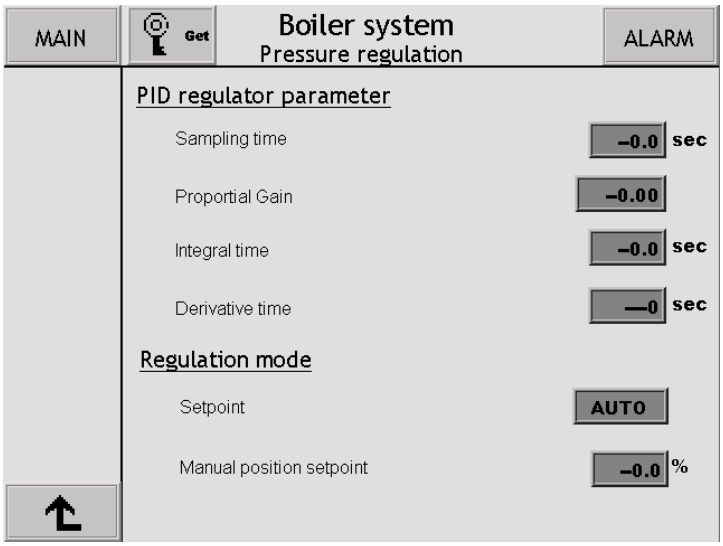


Figure 61 **om9306_56_pic_13x0062460en.wmf**

From the pressure regulation parameters access is given to the main menu and back to the pressure regulation (arrow in lower left corner).

Smoke Density

Access is given to the smoke density menu from the boiler system parameter menu as illustrated in Figure 62 or from the other sub dialog windows under the boiler system parameter list.

Access to the smoke density menu

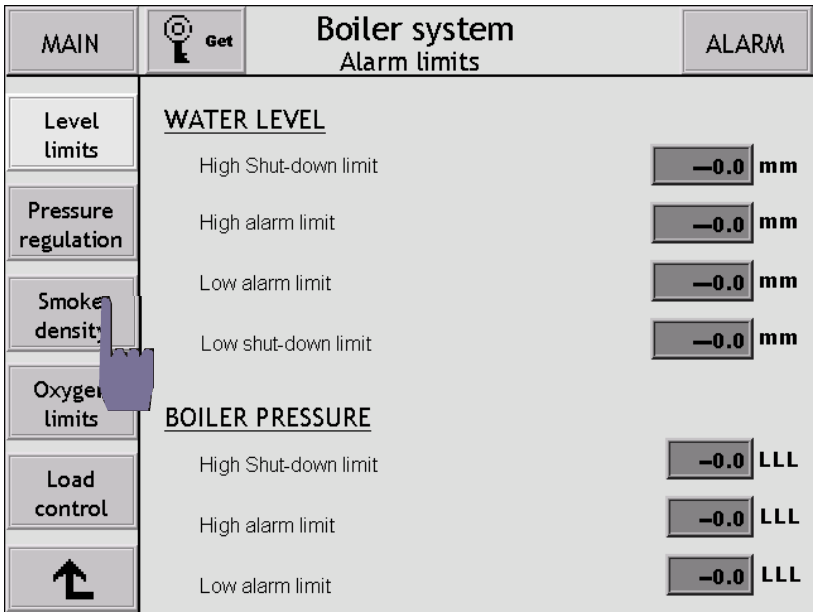


Figure 62 **contouch_75x0198470en.wmf**

In the smoke density menu, the high alarm limit can be set as a percentage (see Figure 63). The menu also allows operation of the smoke density blower. By switching the lowest dark grey button from OFF to ON the smoke density blower is started.

Smoke density menu

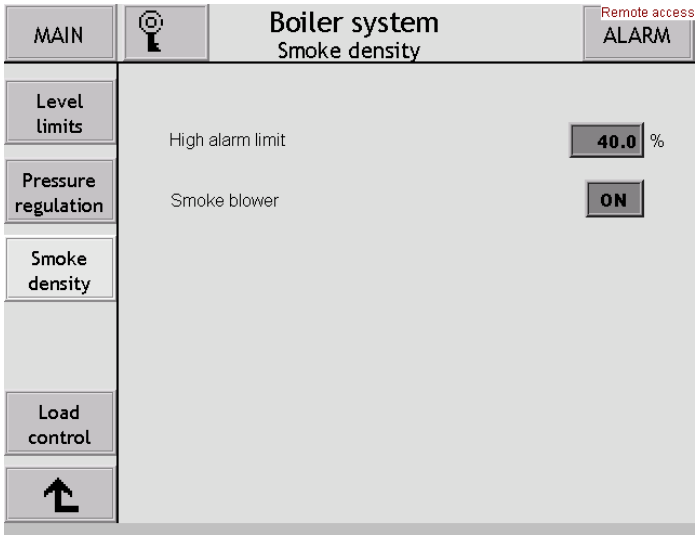


Figure 63 **om9306_56_hc_002x0062320en.wmf**

From the smoke density alarm list access is given to the main menu, the alarm limit dialog windows under the boiler alarm list in the left side of the picture.

Load control

Access to manual load control of the boiler is also available from the parameter menu or from the sub dialog windows (illustrated in Figure 64).

Access to manual load control

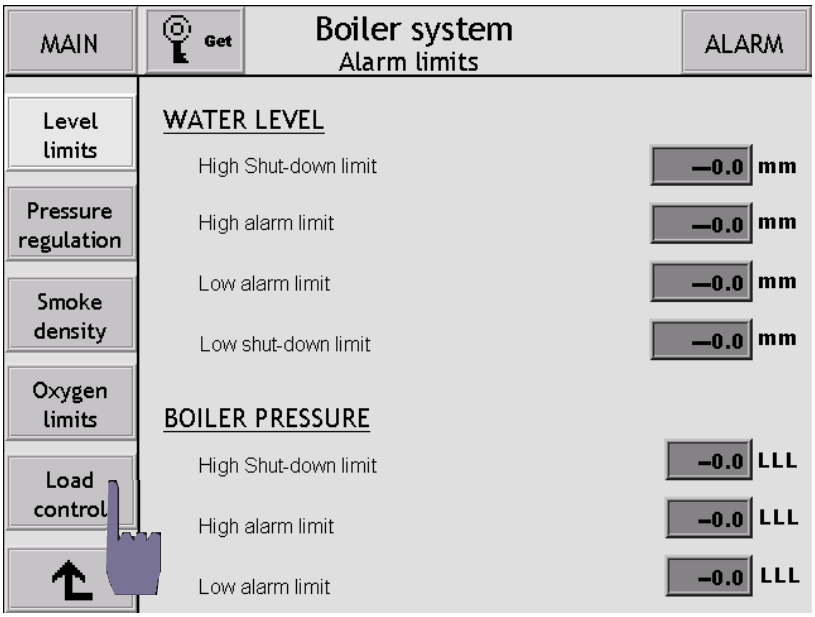


Figure 64 **contouch_77x0198490en.wmf**

The manual load control dialog window (Figure 65) is not only for monitoring and controlling the load. It is also to be used as a general purpose inspection screen.

The actual load of the boiler can be monitored in the bar in the left part of the window. The load is displayed using a bar graph showing load as a percentage of the full load. For precise read out the load value is also displayed numerically in the middle of the bar. The state of the boiler is seen in the middle of the screen. The state can be set to either stopped (as on Figure 65), automatic or manual.If in manual mode the burner can be started and stopped and the load increased and decreased using the respective buttons.In the top of the picture is the current boiler pressure to help when controlling the load manually. In the bottomright is the set point choice for easy changing of set points especially when running in automatic mode. To the left of this is the total oil consumption value for easy readout of this common task.

Manual load control dialog window

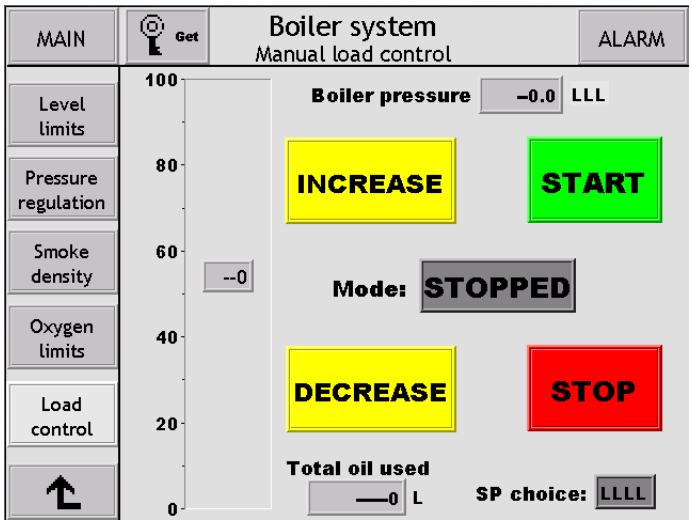


Figure 65 **om9306_56_pic_17x0062480en.wmf**

Notice that the burner must be in modulation free mode before the load can be controlled.

2.8 Trend

From the main menu access is given to trend curves for selected parameters of the plant. Access to the trend information is illustrated in Figure 66.

Access to the trend menu

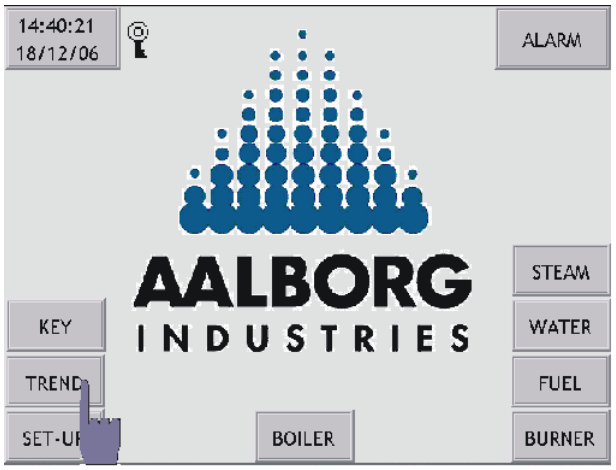


Figure 66 **contouch_79ax0198830en.bmp**

The trend menu is illustrated in Figure 67. From this dialog window access is given to trends of different plant variables, e.g. boiler pressure, load, fuel pressure, etc. A trend curve for each of these variables is accessible by clicking the variable button on the dialog window. A trend exampleis shown in Figure 68.

Plant view for trend curves

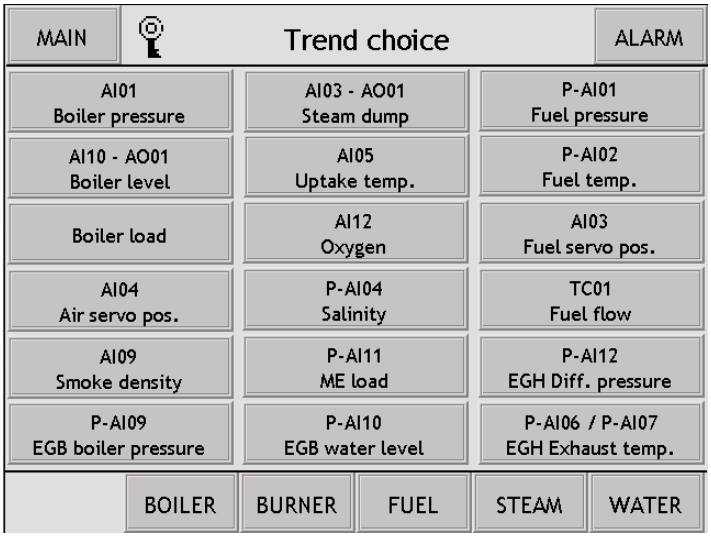


Figure 67 **om9306_56_pic_50x0062660en.wmf**

Example of trend curve

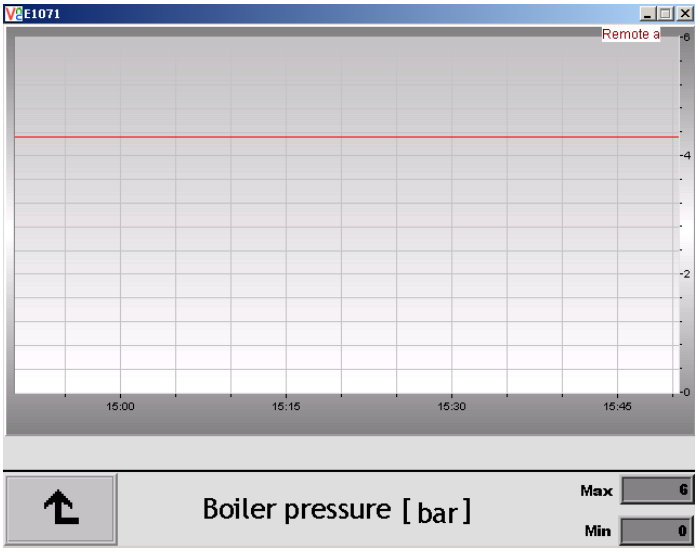


Figure 68 **om9306_56_trendx0062780en.wmf**

There are several ways of controlling how the trend curve is displayed.

The vertical scaling (value) can be adjusted by setting the max and min value in the lower right corner.

To adjust the horizontal axis (time / history) simply press anywhere on the graph to bring up the history control buttons (see Figure 69).

Activating history control

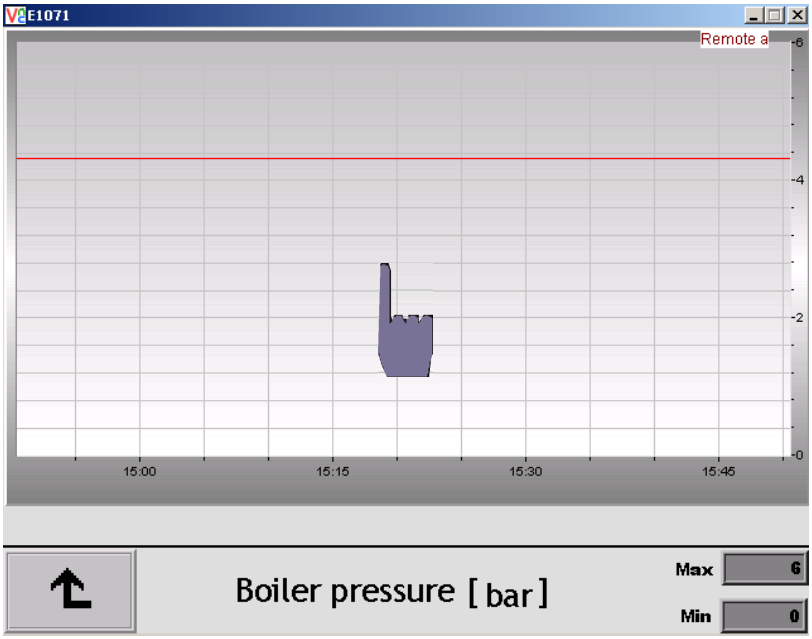


Figure 69 **contouch_82x0198540en.wmf**

The buttons function as follows:

[<<] Large jump back in measurement history

[<] Jump back in measurement history

[-] Zoom in / decrease shown time span.

[^] Reset view

[+] Zoom out / increase shown time span.

[>] Jump forward in measurement history

[>>] Large jump forward in measurement history

2.9 Set-up

The set-up menu gives access to set timers, alarm limits, diagnostics, configuration of the displayed system, etc. The structure of the set-up menu is illustrated in Figure 70

Menu structure of the set up menu

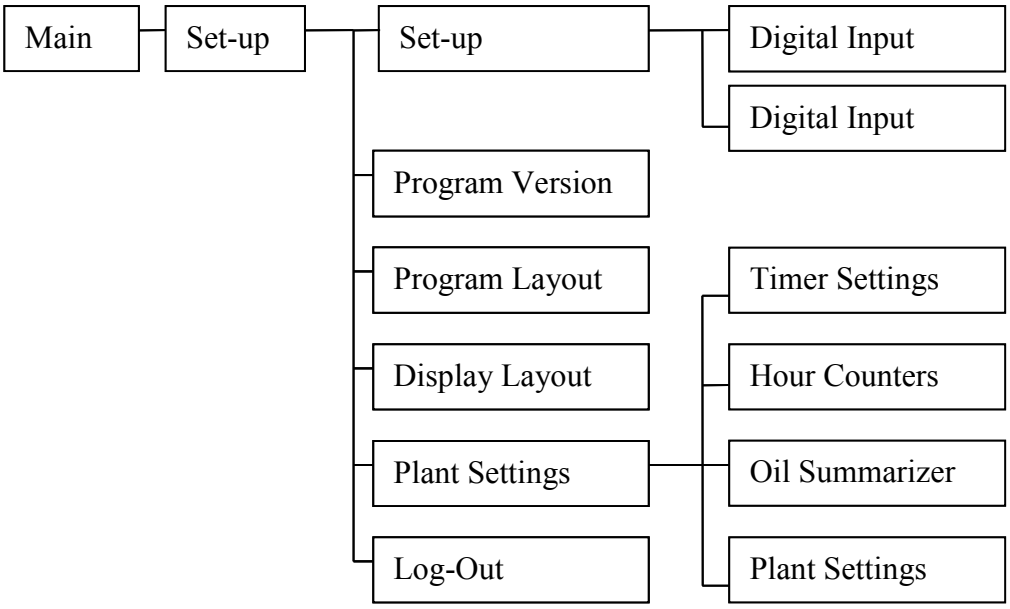


Figure 70 **contouch_83ax0200230en.wmf**

Access to the set-up menu is given from the main picture as illustrated in Figure 71

Access to set-up menu

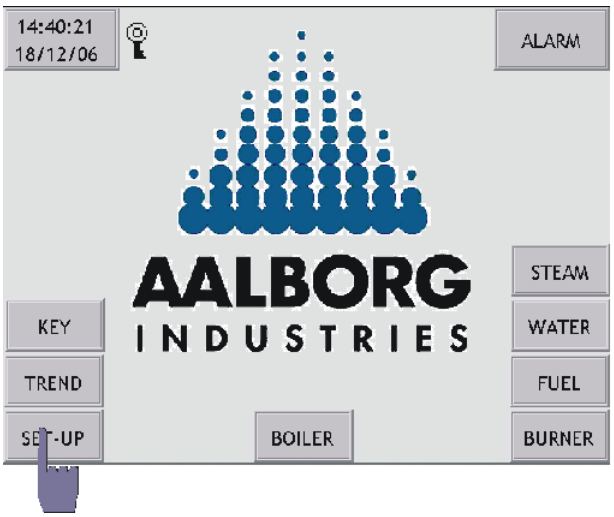


Figure 71 **contouch_84ax0198840en.bmp**

The set-up menu gives access to set-up of timers, counters, plant limits, diagnostic digital input, diagnostic digital output, and configuration of the display layout.

2.9.1 System

Under system setup information is given on the type of the panel and the burner. The system clock and date can be monitored and set as illustrated in Figure 72.

System set-up dialog window

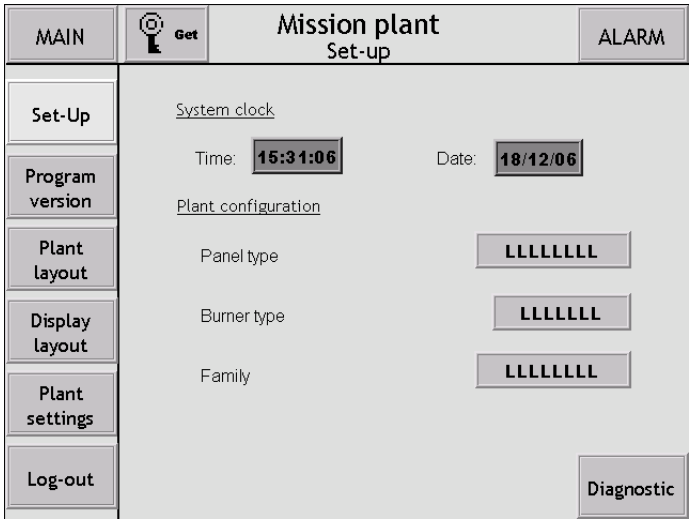


Figure 72 **om9306_56_pic_60x0062720en.wmf**

Diagnostic information on digital inputs and outputs

From the system dialog window access is given to the diagnostic information on the digital inputs and outputs in the lower right corner as illustrated in Figure 73.

Access to diagnostic information on in- and outputs

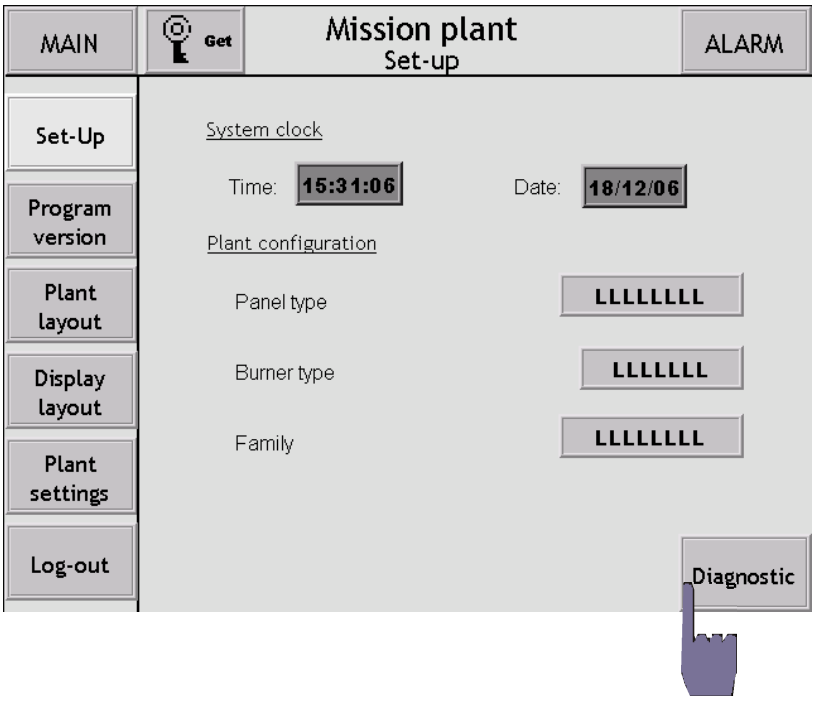


Figure 73 **contouch_86x0198580en.wmf**

An example of on of the dialog windows with the digital inputs are illustrated in Figure 74. The status of each input is seen in the box next to the line (Green marks ON/Activated).

Diagnostic-digital input example

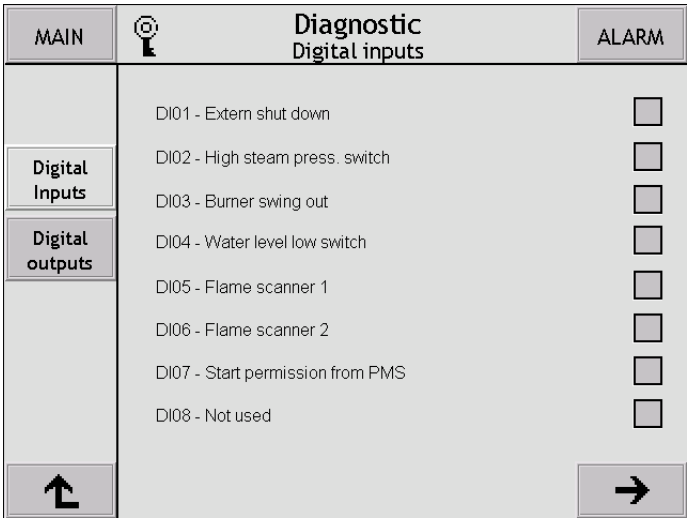


Figure 74 **om9306_56_pic_22x0062540en.wmf**

By pressing the arrow on the lower right corner of the picture the next window with digital inputs are presented.

Diagnostic Digital Output

The digital outputs can also be checked for diagnostic purposes. These pictures have the same functionality as the inputs. Figure 75shows an example.

Diagnostic -digital input example

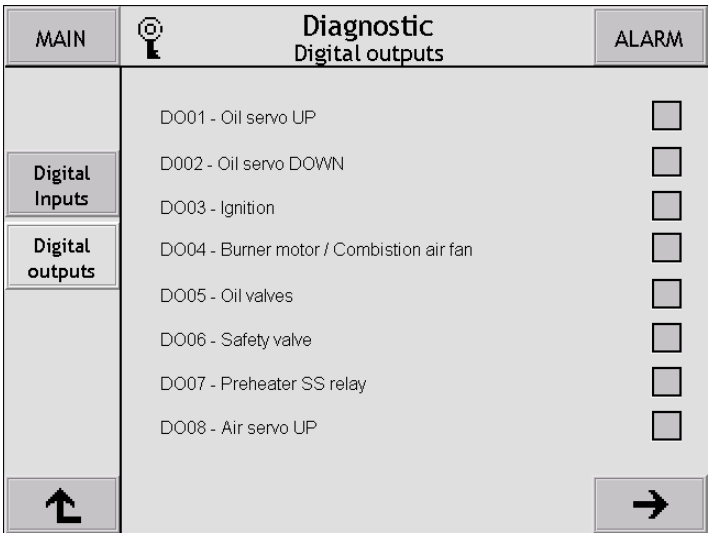


Figure 75 **om9306_56_pic_24x0062550en.wmf**

2.9.2 Program version

From the set-up menu access is given to monitor information on the software installed as illustrated on Figure 76.

Access to program version information

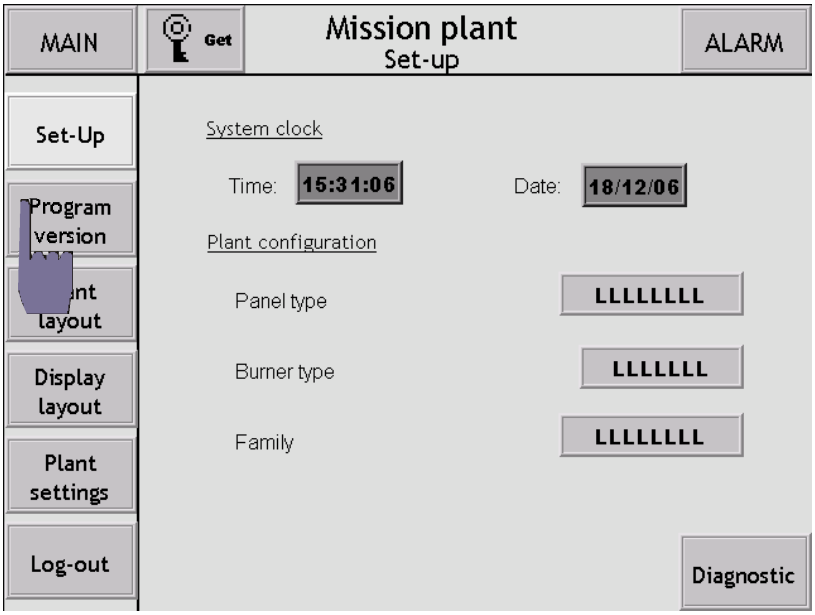


Figure 76 **contouch_89x0198620en.wmf**

Information is given on the version number of the human-machine-interface software, the controller version, and the date of the controller software as illustrated in Figure 77.

Program version informationÁà»

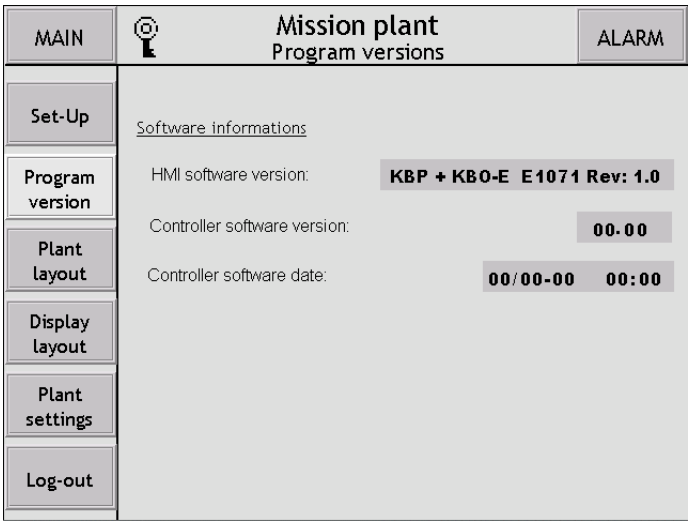


Figure 77 **om9306_56_pic_61x0062740en.wmf**

2.9.3 Plant layout

Information on communication addresses, and set-up of the units used for pressure measurements are accessed from the system dialog window under set-up as illustrated on Figure 78.

Access to plant layout

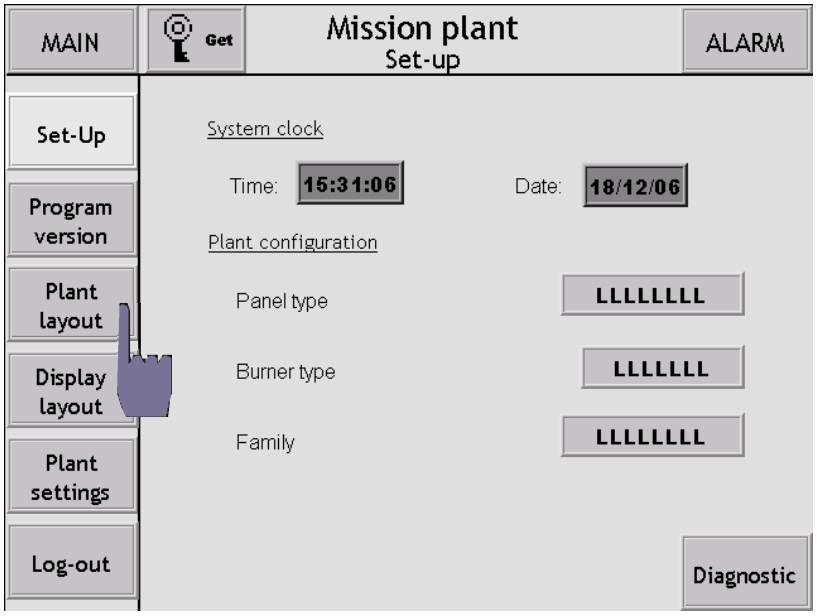


Figure 78 **contouch_91x0198640en.wmf**

Plant layout dialog window

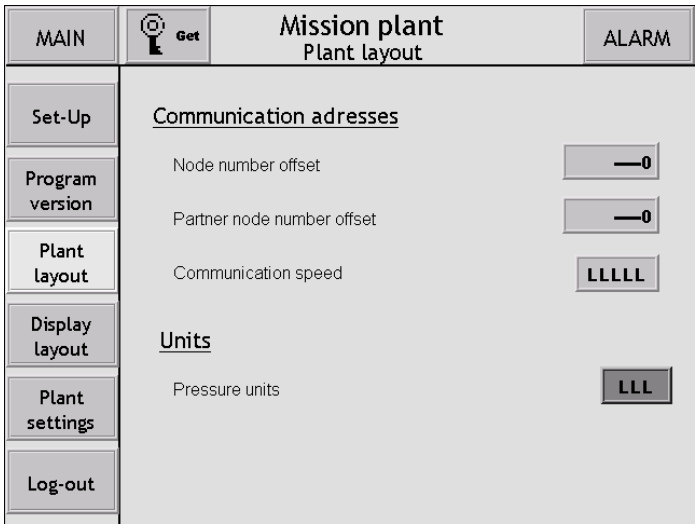


Figure 79 **om9306_56_pic_61x0062730en.wmf**

2.9.4 Display layout

The elements displayed on the touchscreen depend on what is enabled / activated on the controller. To view the status of the individual elements the display layout menu can be used. The menu is accessed from the system dialog window under set-up as illustrated onFigure 80.

Access to plant layout

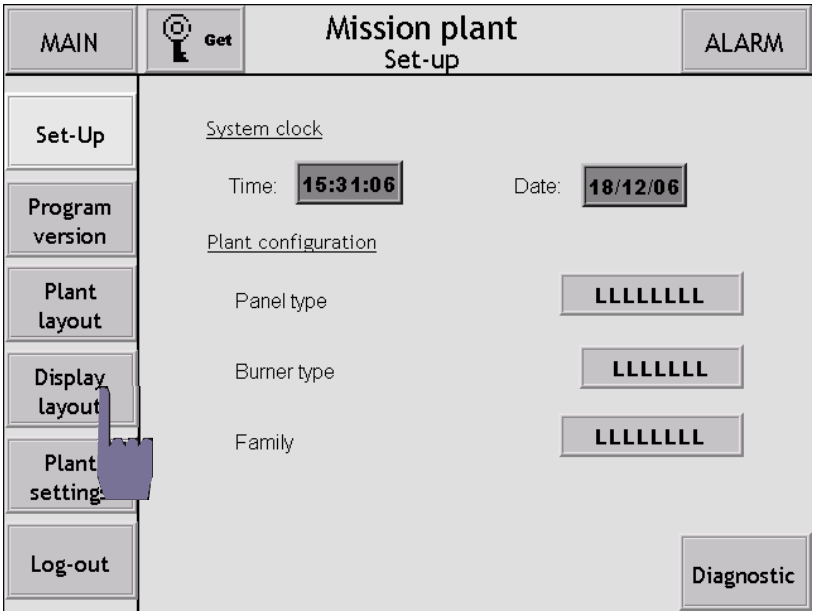


Figure 80 **contouch_93x0198660en.wmf**

The menu indicates the viewing status for each screen element (see Figure 81). No means that the element is not chosen / activated and therefore is not present on the display. The arrow in the lower right corner switches to a screen with more elements.

Plant layout dialog window

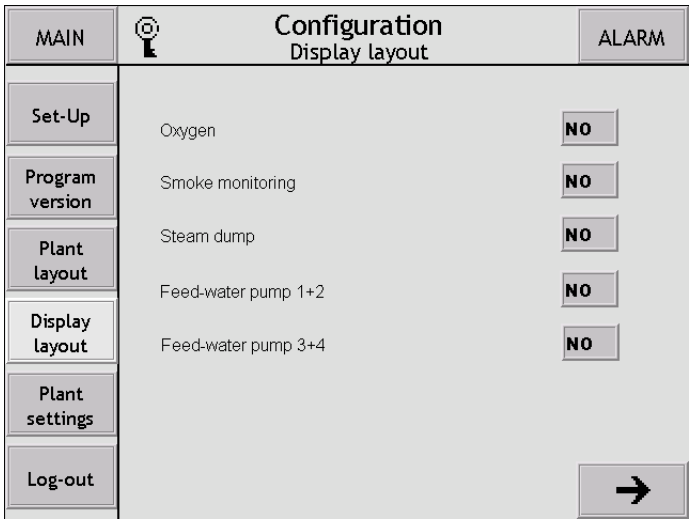


Figure 81 **om9306_56_pic_25x0062560en.wmf**

2.9.5 Plant settings

Access to timers, counters, and limits for the plant is given from the set-up dialog window as illustrated in Figure 82.

Access to plant settings

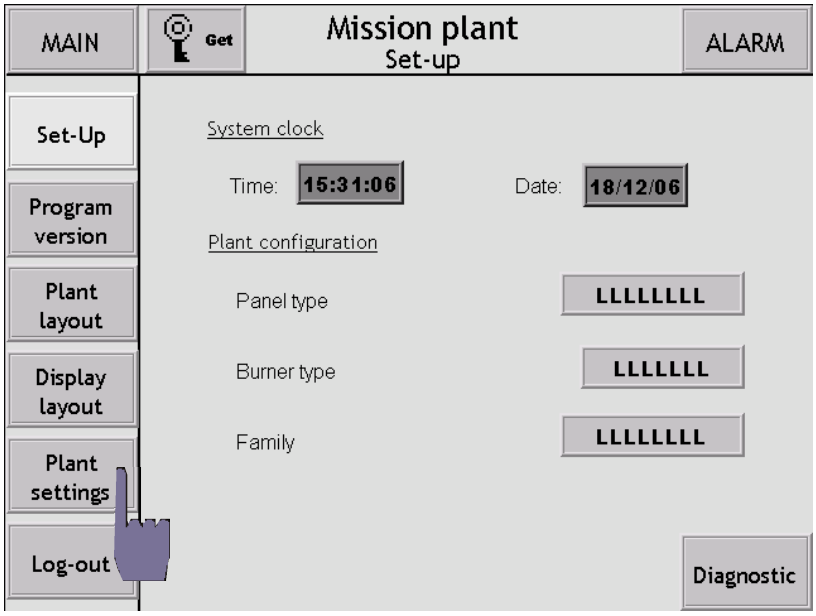


Figure 82 **contouch_95x0198680en.wmf**

The plant settings dialog window is illustrated in Figure 83.

Plant settings dialog window

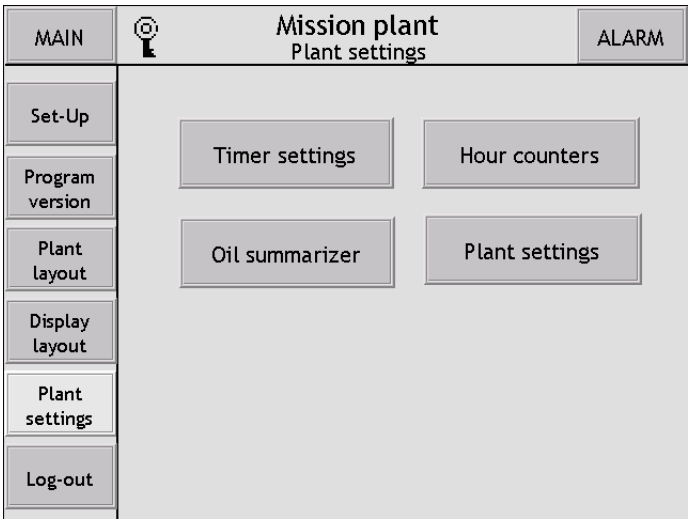


Figure 83 **om9306_56_pic_61x0062750en.wmf**

From the plant setting dialog window (Figure 83) access is given to timer settings, hour counters, and plant settings.

Timer settings

Several timers are used in the system. These timers are accessible in the timer settings dialog window, accessed from the plant setting dialog window as illustrated in Figure 84.

Acess to the timer settings

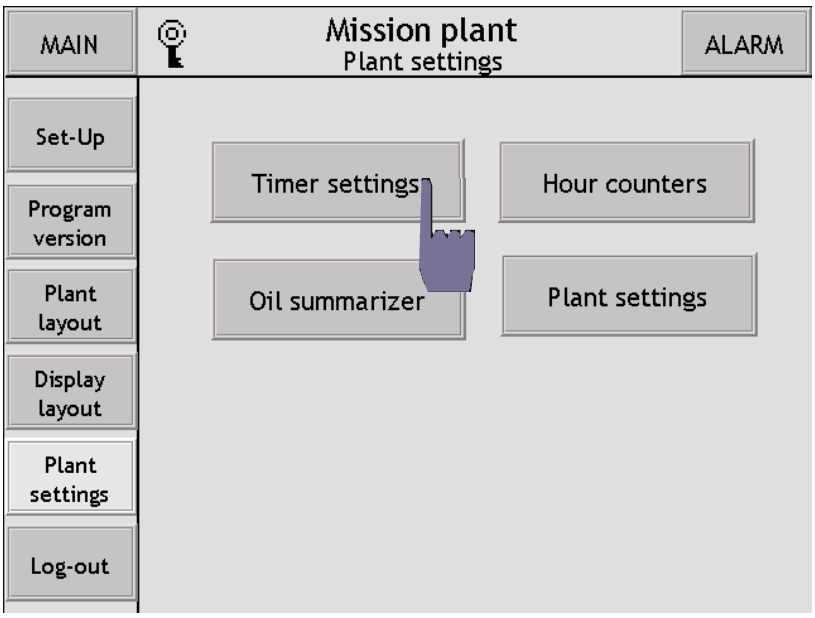


Figure 84 **contouch_97x0198700en.wmf**

The timers menu is divided into five categories: sequence, surveillance, power, shared, and communication. Notice that each category may contain several pictures. If available the next windows is accessed by clicking the arrow located in the lower right corner. The value for the timer can be modified by clicking the dark grey button next to each timer name. See also Figure 85 for an example.

Timer settings example

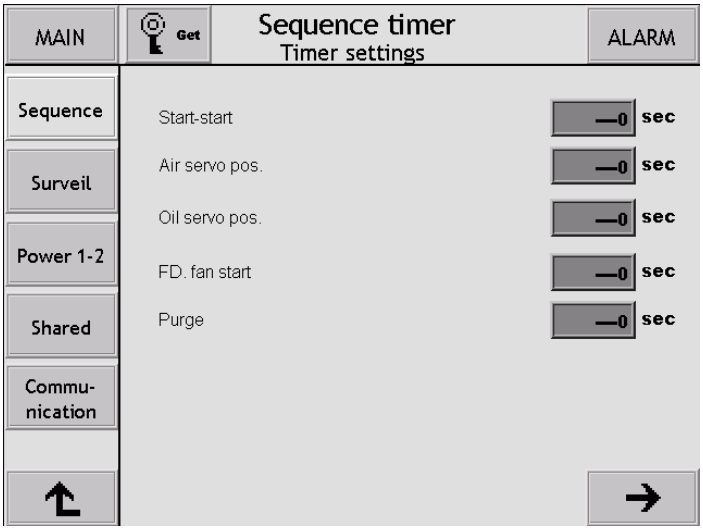


Figure 85 **om9306_56_pic_12x0062450en.wmf**

Hour Counters

The hour counters menu actually holds bothhours counters as well as start counters. Here the monitoring and configuration of the counters can be carried out. Access to the counters is given from the plant settings dialog window under the set-up menu as illustrated in Figure 86.

Access to houer counter settings

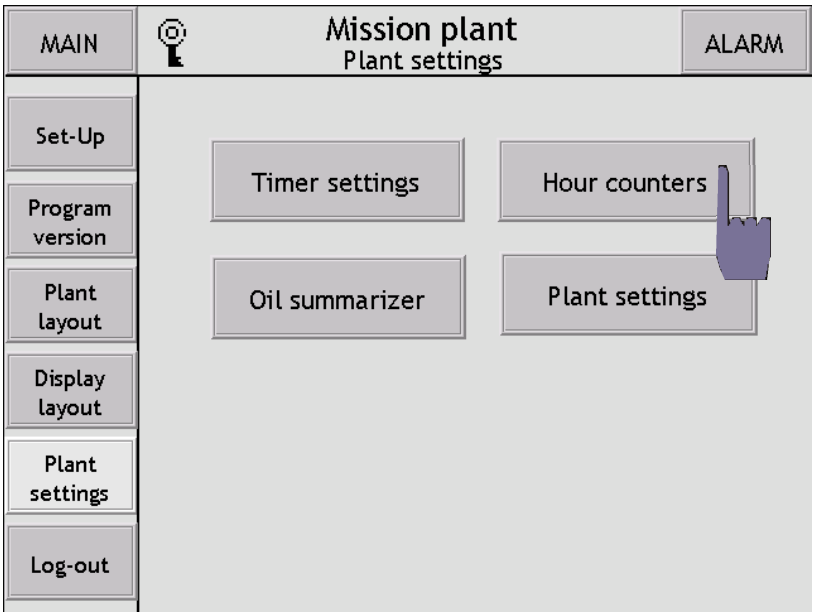


Figure 86 **contouch_99x0198720en.wmf**

The counters are sorted into five main groups: Boiler, burner, fuel, water, and steam.

An example of the counter dialog windows is illustrated in Figure 87. Again notice that each category may contain several pictures. If available the next windows is accessed by clicking the arrow located in the lower right corner.

Counter settings example

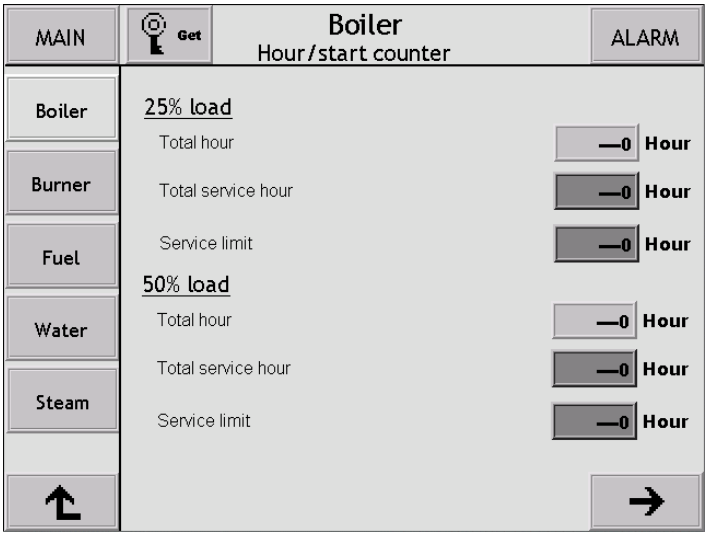


Figure 87 **om9306_56_pic_15x0062470en.wmf**

Typically each counter has a total counter that is not resettable (it loops as a mechanical counter), a total service counter that can be used to keep track of the system since last service and a service value limit that can be used to generate a “service is needed” alarm. Notice that the service counter value can be manually modified.

Plant Settings

The plant settings sub menu gives access to system parameters configuring the behaviour of the system. The parameters can e.g. be actuator positions during the different steps in the start up sequence or the fuel/air ratio. Themenu is accessed from the plant settings dialog window under the set-up menu as illustrated in Figure 88

Access to plant limits settings

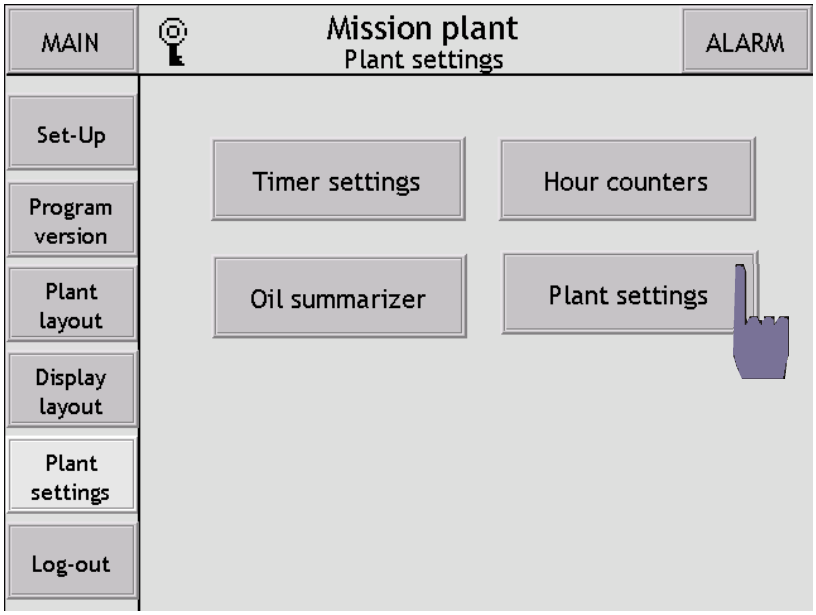


Figure 88 **contouch_101x0197780en.wmf**

The menu contains two submenus: Plant limits and Ratio. Plant limits (parameters) concerning firing, ignition, purging, etc are done from this dialog window. An example is illustrated in Figure 89.

Plant limits

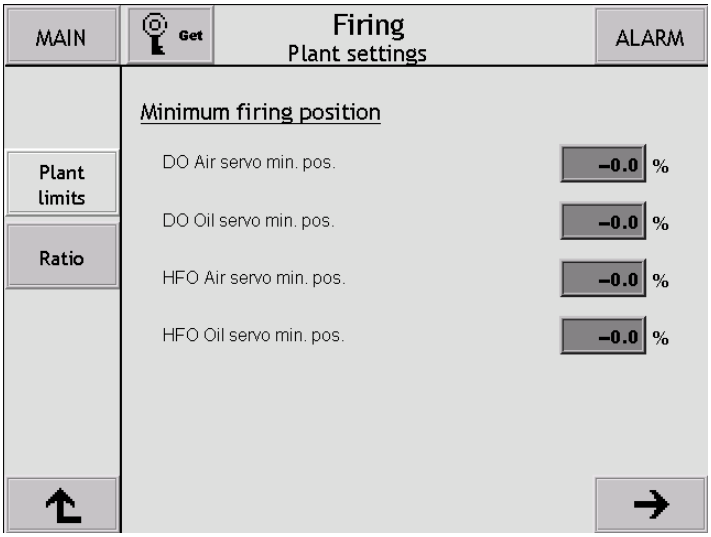


Figure 89 **om9306_56_pic_20x0062500en.wmf**

Notice that several pictures are available by pressing the arrow in the lower right corner.

Ratio

The Ratio submenu concerns air/fuel ratio for different load situations.The dialog window for heavy fuel oil is illustrated in Figure 90 . For each of the displayed load levels (oil flow) the corresponding air flow can be entered. Notice the corr. value in the lower right corner. This correction factor is multiplied on all flows allowing for a global displacement of the air/fuel curve. The factor is especially used for inert gas systems.

Flow ration - air/HFO

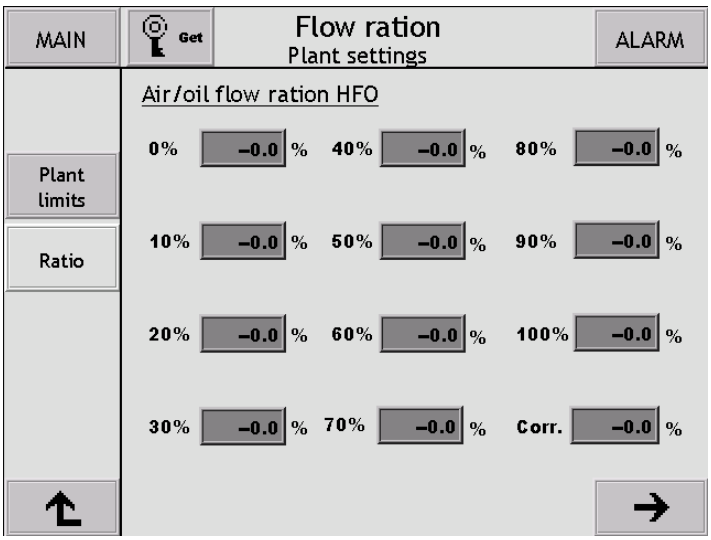


Figure 90 **om9306_56_pic_21x0062520en.wmf**

By pressing the arrow in the lower right corner the same picture is available for Diesel Oil.

Oil summarizer

The Oil summarizer button (See Figure 91) allows for quick access to the oil consumption monitoring picture.

Access to the oil summarizer

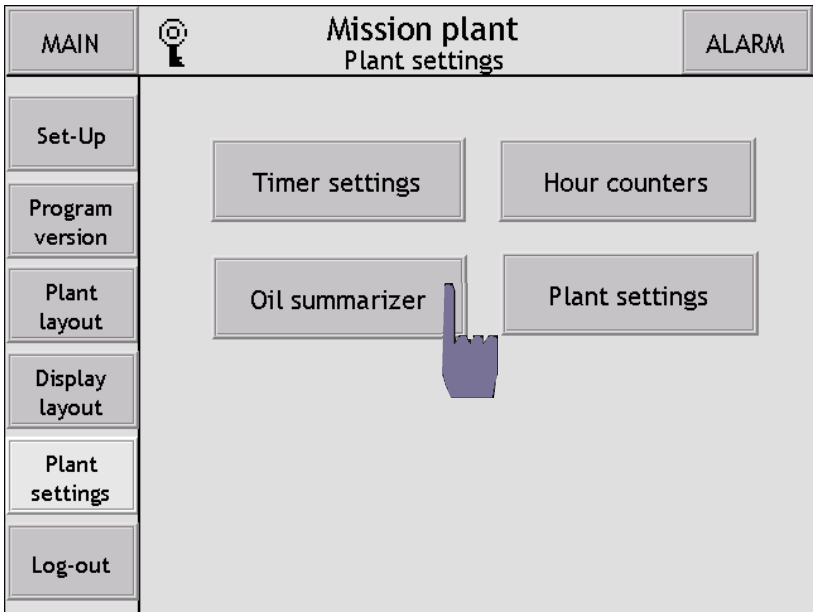


Figure 91 **contouch_104x0197810en.wmf**

The picture (See Figure 92) shows the total amount of fuel oil that has been used. The value is an integration of the flow meter measurement if available. Notice that the value will loop when the maximum number is reached much like a normal mechanical counter. The total service litre functions in the same way but like the other counters it is also here possible to enter a service value limit that will generate an alarm as well as reset the counter.

Oil summarizer picture

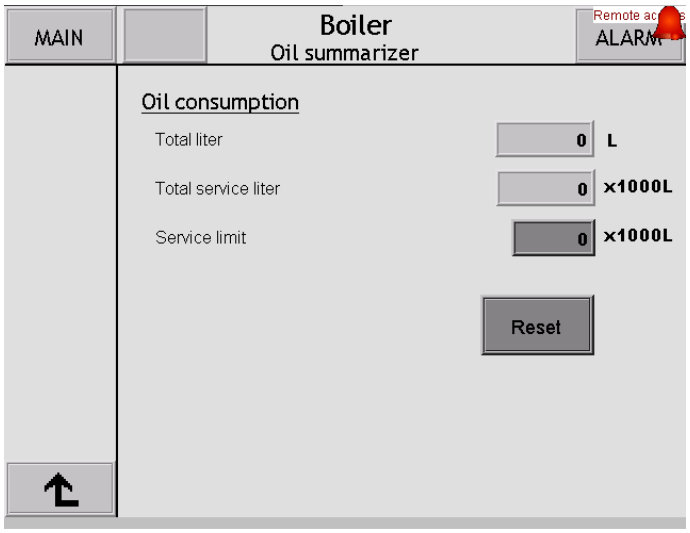


Figure 92 **om9306_56_hc_001x0062310en.wmf**

2.9.6 Log-out

Trying to change a parameter often requires a password. After the correct password has been entered access is granted for 60 minutes. As the 60 minutes time out the system again requires the password to be entered. It is possible to remove the grant before the 60 minutes by pressing the log-out button hence requiring the password to be entered.

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Burner sequence diagram

1 General

The following section describes the burner firing sequence for rotary cup burners. Figure 1 shows a guide to the diagrams, and Figure 2 to Figure 6 show the burner firing sequence.

The burner firing sequence, e.g. start, purge, ignition, etc., is handled by the control system. The sequence is divided into a number of steps, which are executed one by one. When a specified step is active, the control system activates a number of output signals and timers. In this way the necessary execution and surveillance of these actions can be performed. On the local panel the actual sequence step will be indicated.

The burner firing sequence consists of 13 steps. The steps 0-8 handle the burner start sequence, and the steps 10-13 concern the burner stop sequence. In the normal operation of the burner, step 8 (mod free) will be active. In this step the burner operates in modulation free mode, and the load is controlled by the steam pressure regulation output. If the steam pressure rises above the set point for stop of the burner, the control system initiates the burner stop sequence. When the stop sequence is completed, the burner will be in step 0 (ready). If the steam pressure falls below the set point for start of the burner, a new start-up sequence will be initiated.

In addition to these steps, the sequence is provided with a stop step and a shutdown step. The stop step must be selected on the local panel. In this step the burner remains stopped regardless of the steam pressure. The shutdown step is active if one or more safety interlock shut downs are present. If a safety interlock shut down arises in any one of the sequence steps, the burner firing sequence is immediately terminated interrupted. When the safety interlock circuit is restored, and the shut down is reset, the sequence returns to step 0 (ready).

Diagram

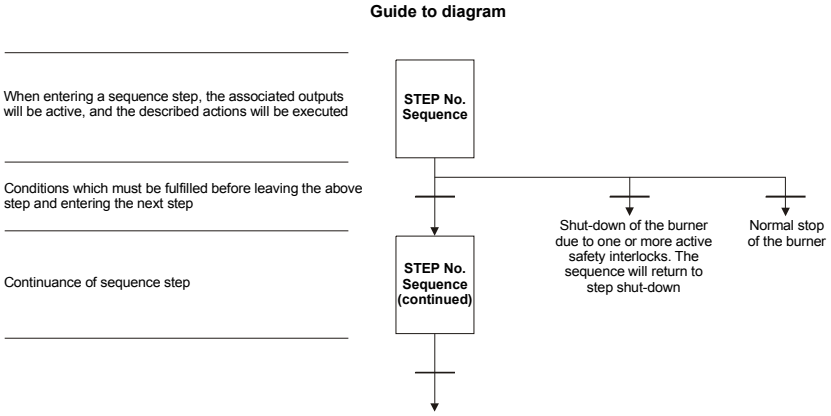


Figure 1 **om5560_93_seqguix0055820en.wmf**

Sequence diagram

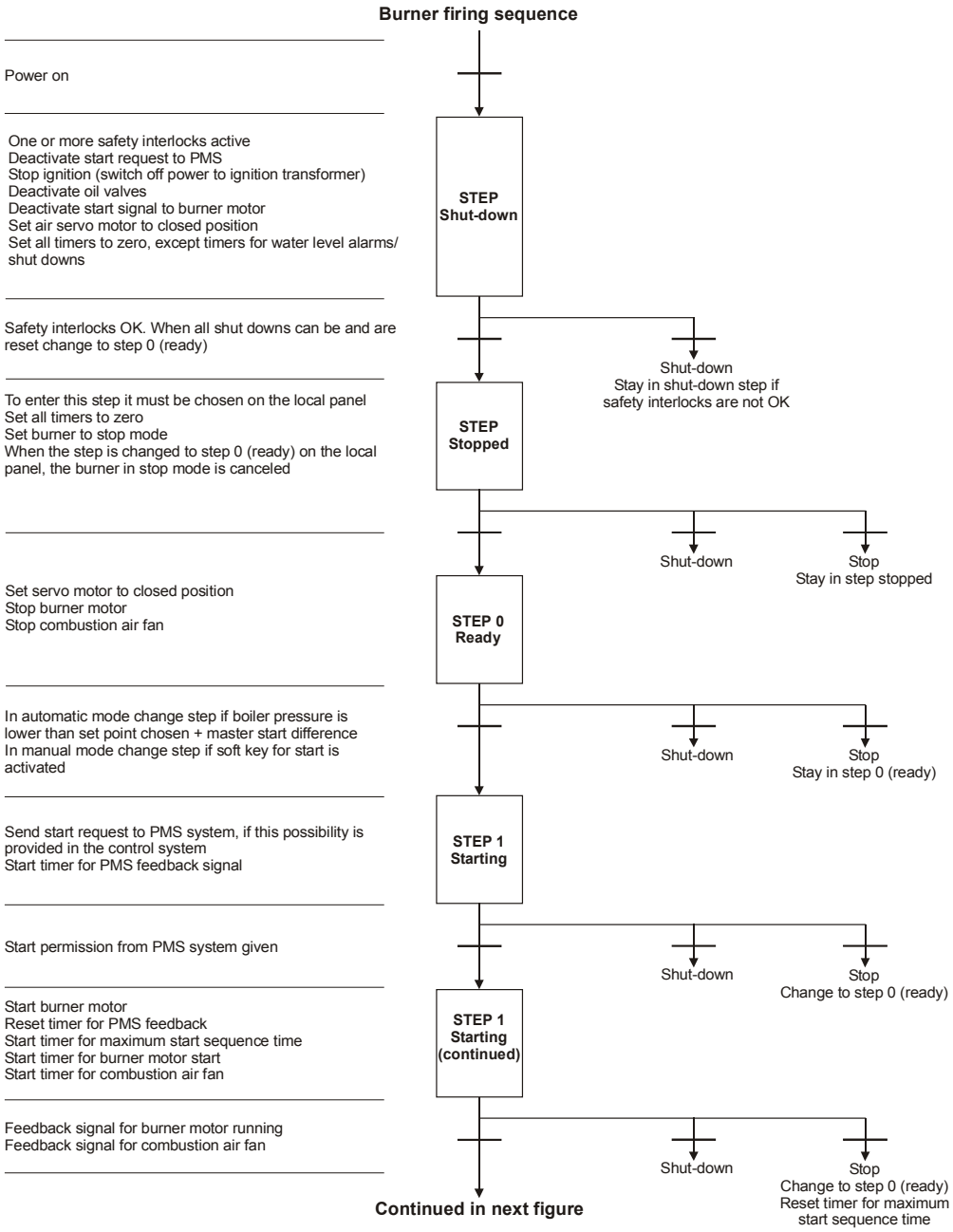


Figure 2 **om5560_93_seq_2x0200490en.wmf**

Sequence diagram, continued

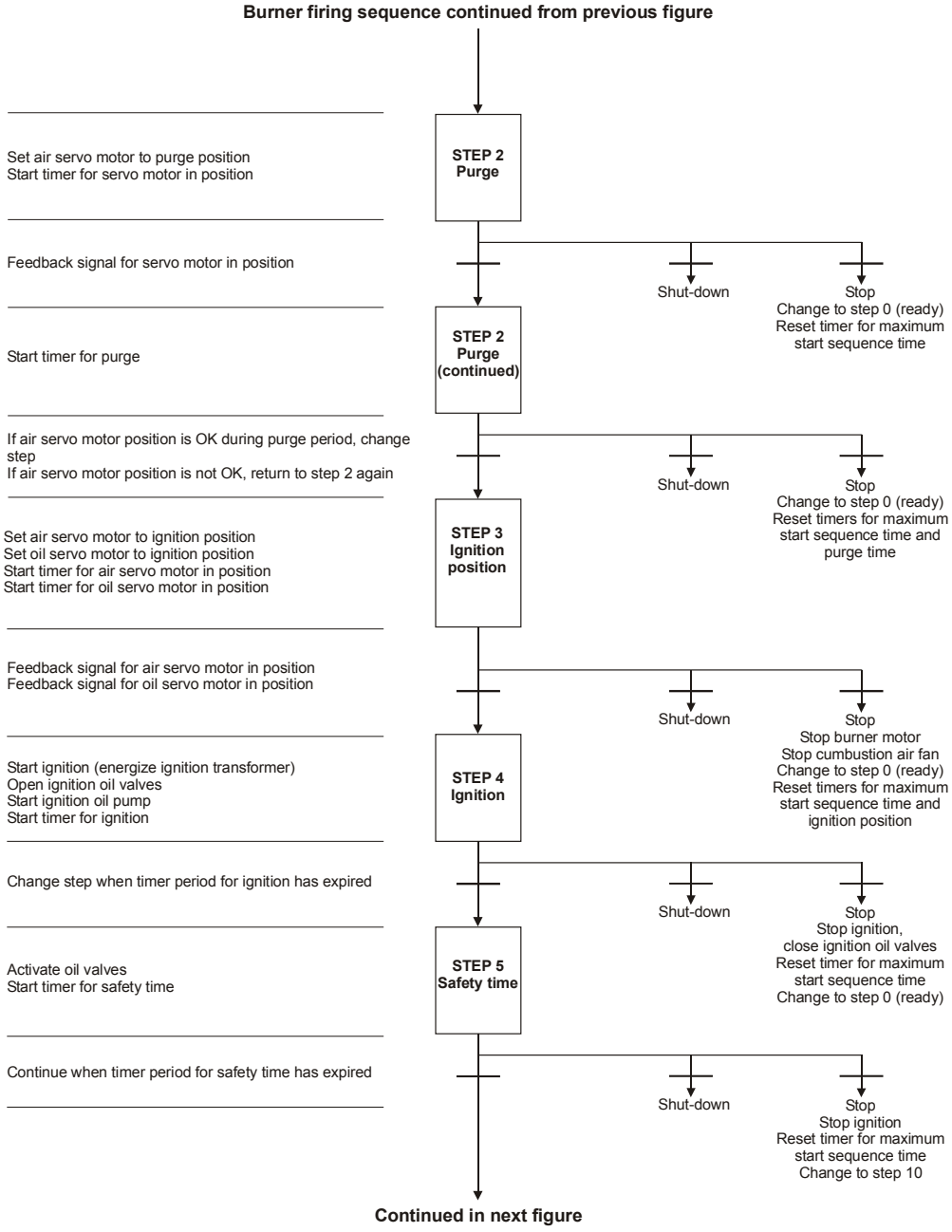


Figure 3 **om5560_93_seq_3x0200500en.wmf**

Sequence diagram, continued

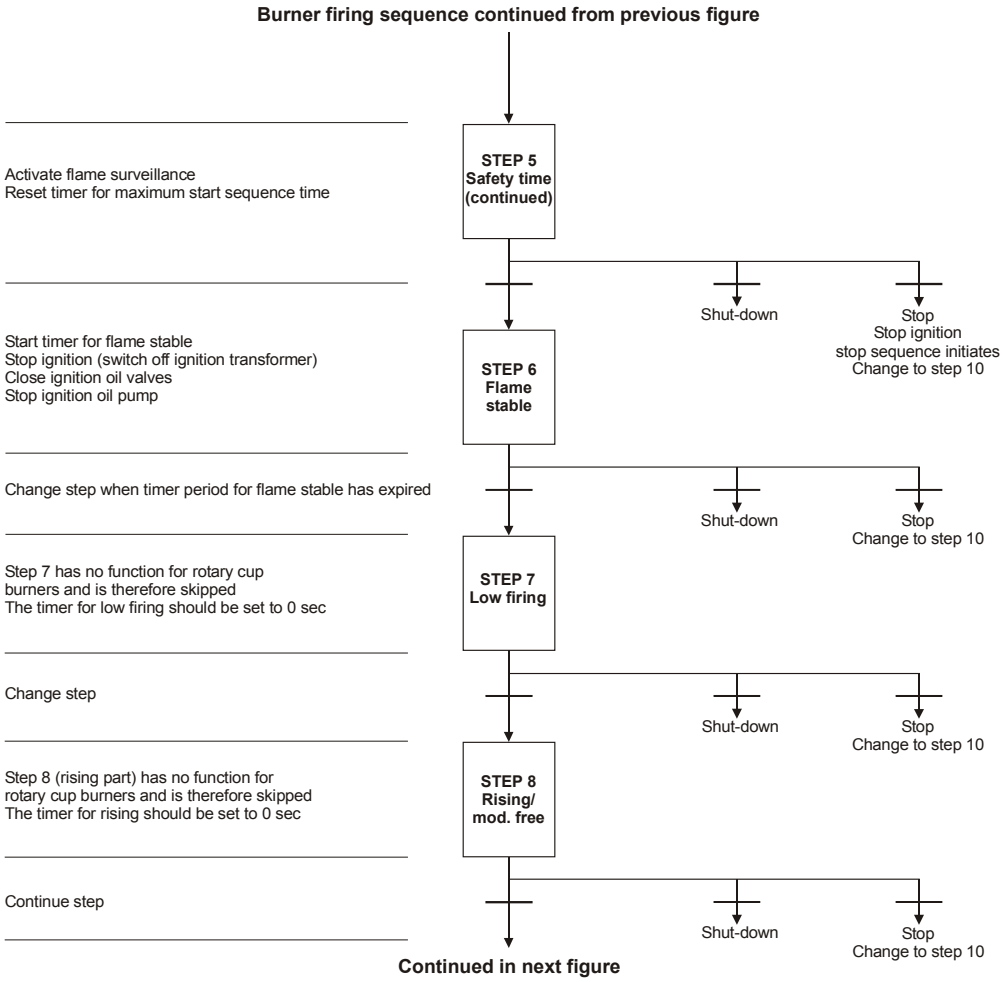


Figure 4 **om5560_93_seqx0055810en.wmf**

Sequence diagram, continued

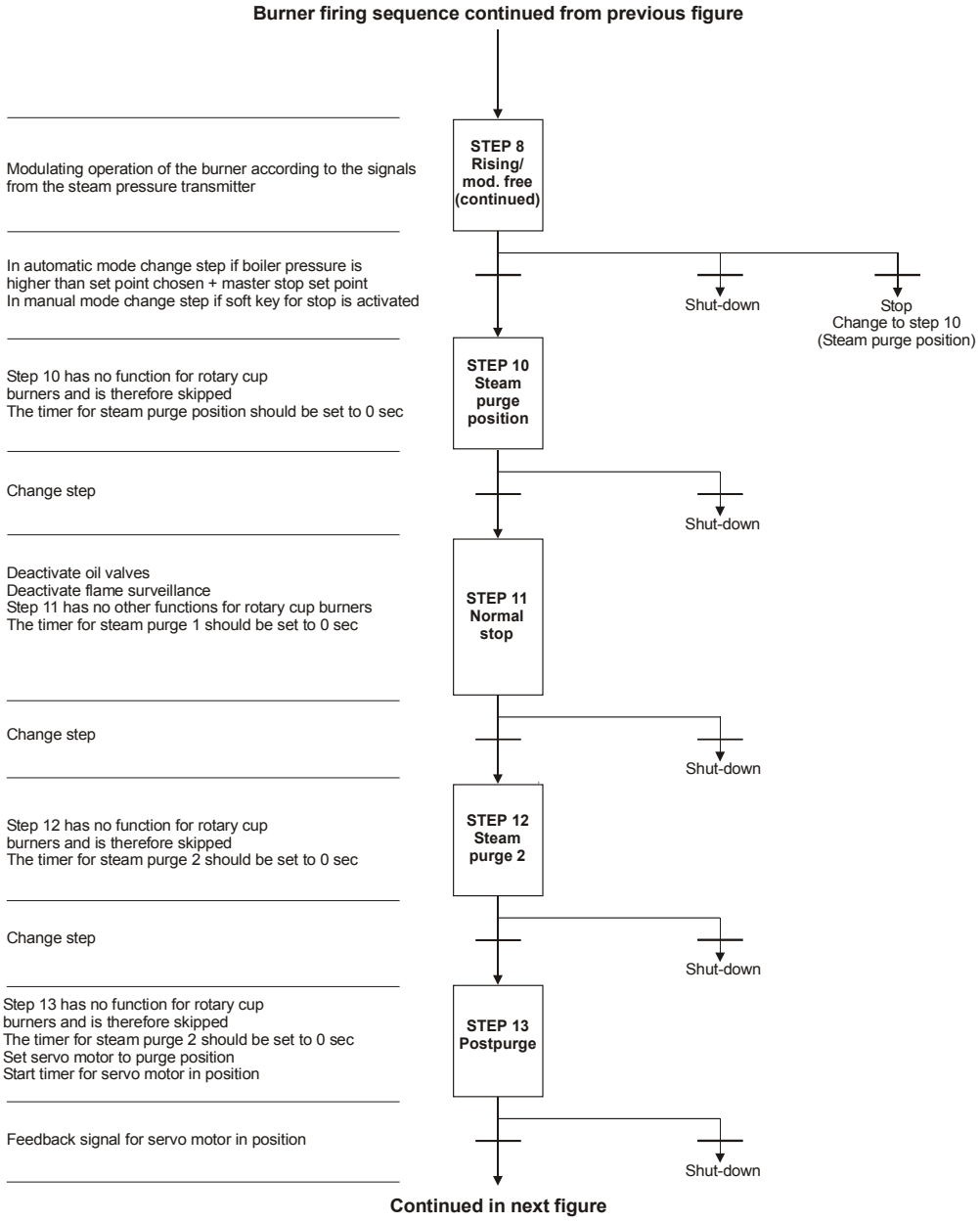


Figure 5 **om5560_93_seq_5x0200510en.wmf**

Sequence diagram, continued

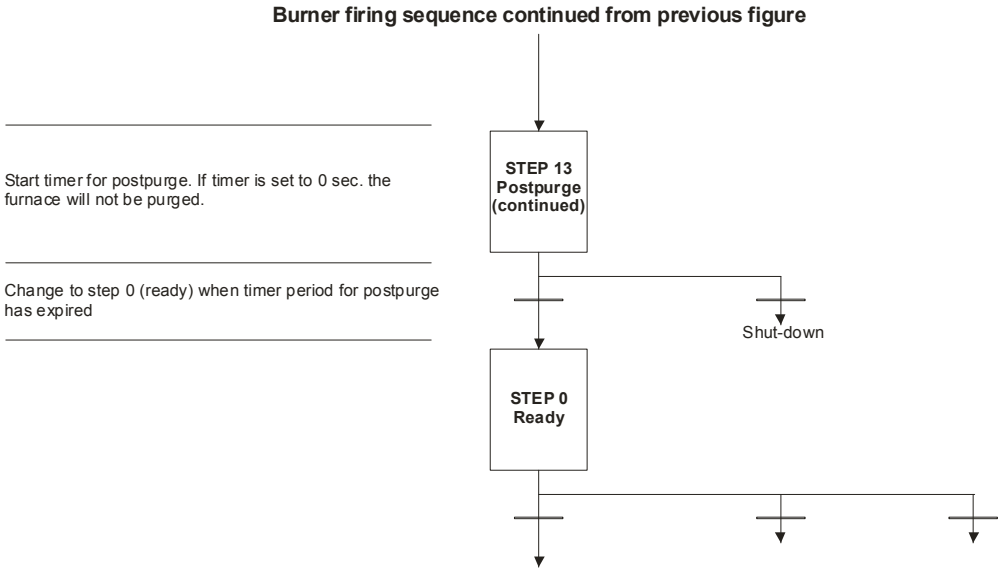


Figure 6 **om5560_93_seqkbex0055830en.wmf**

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Flame safeguard

OM8200_04 Flame safeguard.....39-2

Flame safeguard

1 Description

The flame safeguard LAE10 is designed for the supervision of the oil flame in connection with a photo cell when the burner is running in manual mode. It comprises a power section, a flame signal amplifier, a flame relay and a combined flame-present indicator lamp and reset button.

Note: The flame safeguard has no function when the burner is running in automatic mode.

In the event of non-ignition of the flame or loss of flame during burner operation, the supply of fuel is always interrupted instantaneously. The unit can be reset by pushing the reset button on the flame safeguard. Any flame signal - in normal operation or a faulty flame signal - is signalled by the indicator lamp. The switching function needed to enter the flame signal to the control circuit of the burner system is provided by the flame relay "FR" of the flame safeguard. Figure 1 shows an illustration of the connection diagram for the flame safeguard. The connection of the terminals can be found in the chapter containing the electric diagrams.

Connection diagram

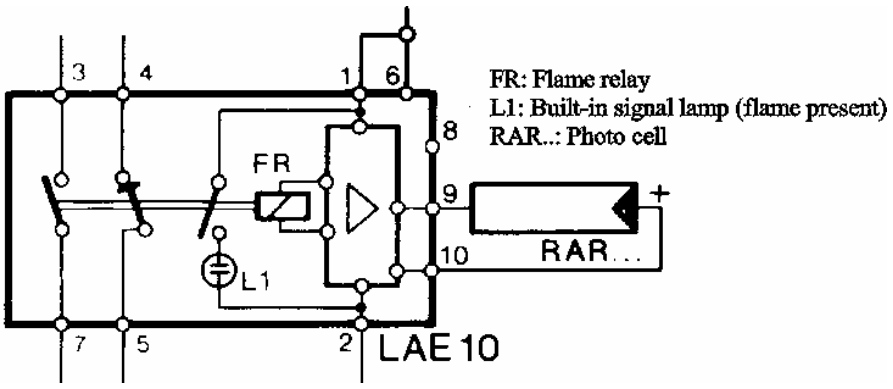


Figure 1 **om8200_04_lae10x0058160en.wmf**

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Menu structure for panels

OM9306_34 Explanation list for menu tree.....40-2
Menu tree 6_08 Menu tree.....40-37

Explanation list for menu tree

1 Description

In the following tables the menu item lines for a control panel configured as a local panel are listed and described. The lists are valid for boiler plants with modulating pressure atomising burners set-up and operated as a single boiler.

The lists are divided into three columns. The first two columns contain the line numbers and menu item lines which are directly copied from the actual menu tree. The last column contains the description for each of the menu item lines. If an explanation for a menu item line is requested the operator simply reads the line number in the actual menu tree and locates the same number in these tables for a description.

Description of the menu item lines for a local panel (1 x MODUL.)

No.	Menu item line	Description
1	[SELECT 1]	Displays a selected item. The items available for display can be selected from sub menu level 1 in the main menus: boiler, fuel oil, servo, and combust. A new item can be selected when the black bar is placed at the desired item. The selection is made by pressing the set soft key until the whole line has been emphasised.
2	[SELECT 2]	Displays a selected item.
3	[SELECT 3]	Displays a selected item. The last selected item will be shown in the third display line.
4	[STATE]	Displays the burner state (starting, rising, modulation free, etc.), mode (locked/unlocked panel).
5	KEY POSITION	Indicates the position of the key operation lock. The default position is PP1 (power panel 1) but this position can be changed in the request key menu item line.
6	REQUEST KEY	Unlocks the actual local panel and operation can take place from this panel. Please note that if any operation of the panel has not taken place for a period of time the key operation lock automatically changes back to the default position (PP1). The time period for non-operation can be set in the timer setup menu.
7	BOILER	Menu for control of the steam pressure and water level.
8	BOILER PRES	Menu for control of the boiler pressure. Please note that the transmitter is connected directly on the boiler.
9	HI.SHT.DWN.	Set point for high steam pressure shut down (burner cut off).
10	HIGH ALARM	Set point for high steam pressure alarm.
11	LOW ALARM	Set point for low steam pressure alarm.
12	ACTUAL SP.	Displays the chosen set point which is selected in the setup/ctrl mode menu.
13	SETP.	Set point for boiler operation in low pressure mode.
14	SETP.HIGH	Set point for boiler operation in high pressure mode.
15	P	Proportional gain for the regulation.
16	T.SAMPLE	Time interval between reading output signals from the transmitter.
17	T.INT.	Integral action time for the regulation.
18	T.DIFF.	Derivative action time for the regulation.
19	REG OUTPUT	Regulation output signal in %.

Description of the menu item lines for a local panel (1 x MODUL.)		
20	REMOTE CTRL	Selection between automatic (0) or manual (1) control of the regulator. In manual control mode (1) the regulator output can be increased or decreased by pressing the soft keys for manual increase or decrease. Alteration of the regulator output can only be performed if it takes place in the actual menu or in the previous menu step with the black bar placed on the actual menu item. An alarm will be present when the regulator is in manual control mode. Please note that the regulator must be active before the regulation output can be changed in manual control mode.
21	WATER LEVEL	Menu for control of the water level control.

Table 1

Description of the menu item lines for a local panel (1 x MODUL.), continued		
No.	**Menu item line**	**Description**
22	HI.SHT.DWN.	Set point for high water level shut down (burner cut off). If this shut down function is not required by the actual classification society, it should be set as high as possible.
23	HIGH ALARM	Set point for high water level alarm.
24	LOW ALARM	Set point for low water level alarm.
25	LO.SHT.DWN.	Set point for too low water level shut down (burner cut off).
26	ACTUAL SP.	Displays the active set point for normal water level.
27	SETP.OFFSET	Displays the actual ramp function set point as a positive value when the set point changes from "setp." to "setp.high" during burner start. The "setp.offset" function is not used for boiler plants that include pressure atomising burners.
28	SETP.	Set point for normal water level when the boiler is in starting, stopping or stopped mode. If the firing is off, the water level falls. To prevent refilling of feed water, this set point is active in these modes.
29	SETP.HIGH	Set point for normal water level during normal operation.
30	DEADZONE	Setting of dead zone for the water level regulation. The dead zone is used to ensure a steady regulator output when the water level is close to the set point. When the actual value is 0.5 dead zone away from the set point the calculation of the PID P-part is stopped, leaving the I-part to do the final tuning. In order to make this bump less the P-part distortion is calculated as the distance from the set point ±0.5 dead zone.
31	I-LOW LIMIT	Limitation of the I-part for the PID water level regulation. When the low limitation is active and the calculation exceeds -5% downwards, the I-part is limited and increased so that the PID calculation maximum is -5%.
32	I-HIGH LIMIT	Limitation of the I-part for the PID water level regulation. When the high limitation is active and the calculation exceeds 105%, the I-part is limited and decreased so that the PID calculation maximum is 105%.
33	P	Proportional gain for the regulation.
34	T.SAMPLE	Time interval between reading output signals from the transmitter.
35	T.INT.	Integral action time for the regulation.
36	T.DIFF.	Derivative action time for the regulation.
37	P.PART	Percentage value of the proportional part for the regulation. Used for commission purpose.
38	I.PART	Percentage value of the integral part for the regulation. Used for commission purpose.
39	D.PART	Percentage value of the derivative part for the regulation. Used for commission purpose.
40	REG OUTPUT	Regulation output signal in %.
41	REMOTE CTRL	Selection between automatic (0) or manual (1) control of the regulator. In manual control mode (1) the regulator output can be increased or decreased by pressing the soft keys for manual increase or decrease. Alteration of the regulator output can only be performed if it takes place in the actual menu or in the previous menu step with the black bar placed on the actual menu item. An alarm will be present when the regulator is in manual control mode. Please note that the regulator must be active before the regulation output can be changed in manual control mode.
42	FUEL OIL	Menu for control of the fuel oil temperature and pressure.
43	F.OIL TEMP	Menu for control of the fuel oil temperature. If “on/off” regulation is selected in the config/ burner option menu only the first five menu items will be displayed and active. When “PWR” is selected all menu items are displayed and active.
44	HIGH ALARM	Set point for high fuel oil temperature alarm.
45	LOW ALARM	Set point for low oil temperature alarm.
46	LO.SHT.DWN.	Set point for low fuel oil temperature shut down (burner cut off).
47	SETP.	Set point for heavy fuel oil temperature.

Description of the menu item lines for a local panel (1 x MODUL.), continued		
48	NEUTRALZONE	Within the plus and minus value of the limit set in this menu the regulator will not perform any regulation.
49	P	Proportional gain for the regulation.
50	T.SAMPLE	Time interval between reading output signals from the transmitter.
51	T.INT.	Integral action time for the regulation.
52	T.DIFF.	Derivative action time for the regulation.
53	P.PART	Percentage value of the proportional part for the regulation. Used for commission purpose.
54	I.PART	Percentage value of the integral part for the regulation. Used for commission purpose.
55	D.PART	Percentage value of the derivative part for the regulation. Used for commission purpose.
56	MIN PULSE	Setting of the minimum pulse time. The signal time from the regulator that must be exceeded before regulation is initiated.

Table 2

Description of the menu item lines for a local panel (1 x MODUL.), continued		
No.	**Menu item line**	**Description**
57	RUN TIME	Setting of the regulator run time. The time to carry out a full regulation.
58	REG OUTPUT	Regulation output signal in %.
59	REMOTE CTRL	Selection between automatic (0) or manual (1) control of the regulator. In manual control mode (1) the regulator output can be increased or decreased by pressing the soft keys for manual increase or decrease. Alteration of the regulator output can only be performed if it takes place in the actual menu or in the previous menu step with the black bar placed on the actual menu item. Furthermore, it is possible to set the regulation output manually from the computer, if provided. An alarm will be present when the regulator is in manual control mode. Please note that the regulator must be active before the regulation output can be changed in manual control mode.
60	F.OIL PRES	Menu for control of the fuel oil pressure.
61	LOW ALARM	Set point for low oil pressure alarm and start of the stand-by oil pump.
62	LO.SHT.DWN.	Set point for low oil pressure shut down (burner cut off).
63	SERVO	Menu for control of the servo motor.
64	SERVO POS.	Displays the actual position of the servo motor.
65	ACTUAL SP.	Start of the burner and operation of the nozzle are controlled by the actual set point from the boiler pres menu - the master start difference from the settings/m.start dif menu. Stop of the burner and operation of the nozzle are controlled by the actual set point + the master stop difference setting. Please note that master start/stop difference settings can be set to both positive and negative values. During start or stop of the burner the set point is taken from the pre-determined positions stated in the ignition position, purge position, minimum firing position.
66	NEUTRALZONE	Within the plus and minus value of the limit set in this menu the regulator will not perform any regulation.
67	REMOTE CTRL	Selection between automatic (0) or manual (1) control of the regulator. In manual control mode (1) the regulator output can be increased or decreased by pressing the soft keys for manual increase or decrease. Alteration of the regulator output can only be performed if it takes place in the actual menu or in the previous menu step with the black bar placed on the actual menu item. An alarm will be present when the regulator is in manual control mode. Please note that the regulator must be active before the regulation output can be changed in manual control mode.
68	COMBUST	Menu for display of combustion parameters.
69	SMK. DENSIT	Displays the smoke density measurement. This menu will not be displayed if smoke density monitor is not selected in the setup/burner option menu.
70	HIGH ALARM	Set point for alarm of high soot contents in the flue gas.
71	OXYGEN	Displays the oxygen sensor measurement. This menu will not be displayed if oxygen sensor is not selected in the setup/burner option menu.
72	HIGH ALARM	Set point for alarm of high oxygen contents in the flue gas.
73	TEMP. UPTAK	Displays the uptake temperature measurement. This menu will not be displayed if uptake temperature measurement is not selected in the setup/burner option menu.
74	HI.SHT.DWN.	Set point for shut down because of high temperature in uptake (burner cut off).
75	HIGH ALARM	Set point for alarm of high temperature in uptake.
76	CMN CTRL	Menu for common control of pumps, smoke blower, steam dump equipment, salinity equipment, inert gas mode, three point feed water regulation.
77	PUMP CTRL	Menu for common control of pumps.
78	OIL PUMP	Menu for control and display of the fuel oil pumps.
79	F.O.PMP1 SEL.	Selection of operation mode for fuel oil pump 1 (stop, start, stand-by).
80	STATE	Displays the state of fuel oil pump 1 (on/off).
81	F.O.PMP2 SEL.	Selection of operation mode for fuel oil pump 2 (stop, start, stand-by).

Description of the menu item lines for a local panel (1 x MODUL.), continued		
82	STATE	Displays the state of fuel oil pump 2 (on/off).
83	F.PMP1 REM START	Status for remote start of fuel oil pump 1. If provided, the remote start is placed at the pump.
84	F.PMP1 REM STOP	Status for remote stop of fuel oil pump 1. If provided, the remote stop is placed at the pump.
85	F.PMP2 REM START	Status for remote start of fuel oil pump 2. If provided, the remote start is placed at the pump.
86	F.PMP2 REM STOP	Status for remote stop of fuel oil pump 2. If provided, the remote stop is placed at the pump.
87	CHEM PMP	Menu for control of the chemical pumps. This menu will not be displayed if chemical pumps are not selected in the setup/burner option menu.
88	CHEM PMP1	Selection of operation mode for chemical pump 1 (start/stop).
89	CHEM PMP2	Selection of operation mode for chemical pump 2 (start/stop).

Table 3

Description of the menu item lines for a local panel (1 x MODUL.), continued		
No.	**Menu item line**	**Description**
90	WATER PUMP	Menu for control of water pumps. This menu will not be displayed if water pumps are not selected in the setup/burner option menu.
91	WATER PUMP	Menu for control and display of the feed water pumps.
92	PUMP 1_1 SEL.	Selection of operation mode for feed water pump 1 (stop, start, auto, stand-by).
93	MODE	Selection of operation type for feed water pump 1 (main, service, not def.).
94	STATE	Displays the state of feed water pump 1 (on/off).
95	PUMP 1_2 SEL.	Selection of operation mode for feed water pump 2 (stop, start, auto, stand-by).
96	MODE	Selection of operation type for feed water pump 2 (main, service, not def.).
97	STATE	Displays the state of feed water pump 2 (on/off).
98	PUMP 2_1 SEL.	Selection of operation mode for feed water pump 3 (stop, start, auto, stand-by).
99	MODE	Selection of operation type for feed water pump 3 (main, service, not def.).
100	STATE	Displays the state of feed water pump 3 (on/off).
101	PUMP 2_2 SEL.	Selection of operation mode for feed water pump 4 (stop, start, auto, stand-by).
102	MODE	Selection of operation type for feed water pump 4 (main, service, not def.).
103	STATE	Displays the state of feed water pump 4 (on/off).
104	F.PMP1 REM START	Status for remote start of feed water pump 1. If provided, the remote start is placed at the pump.
105	F.PMP1 REM STOP	Status for remote stop of feed water pump 1. If provided, the remote stop is placed at the pump.
106	F.PMP2 REM START	Status for remote start of feed water pump 2. If provided, the remote start is placed at the pump.
107	F.PMP2 REM STOP	Status for remote stop of feed water pump 2. If provided, the remote stop is placed at the pump.
108	F.PMP3 REM START	Status for remote start of feed water pump 3. If provided, the remote start is placed at the pump.
109	F.PMP3 REM STOP	Status for remote stop of feed water pump 3. If provided, the remote stop is placed at the pump.
110	F.PMP4 REM START	Status for remote start of feed water pump 4. If provided, the remote start is placed at the pump.
111	F.PMP4 REM STOP	Status for remote stop of feed water pump 4. If provided, the remote stop is placed at the pump.
112	CIRCULATION PUMP	Menu for control and display of the circulation pumps.
113	C.PMP1 SEL.	Selection of operation mode for circulation pump 1 (stop, start, stand-by).
114	STATE	Displays the state of circulation pump 1 (on/off).
115	C.PMP2 SEL.	Selection of operation mode for circulation pump 2 (stop, start, stand-by).
116	STATE	Displays the state of circulation pump 2 (on/off).
117	C.PMP1 REM START	Status for remote start of circulation pump 1. If provided, the remote start is placed at the pump.
118	C.PMP1 REM STOP	Status for remote stop of circulation pump 1. If provided, the remote stop is placed at the pump.
119	C.PMP2 REM START	Status for remote start of circulation pump 2. If provided, the remote start is placed at the pump.
120	C.PMP2 REM STOP	Status for remote stop of circulation pump 2. If provided, the remote stop is placed at the pump.
121	SMOKE BLOW	Displays the state of the smoke blower for the smoke density equipment.
122	SMOKE BLOWER 1	Displays the state of the smoke density equipment.
123	STEAM DUMP	Menu for control of the steam dump equipment. This menu will not be displayed if steam dump equipment is not selected in the setup/burner option menu.
124	STEAM DUMP	Menu for control and display of the steam dump equipment.
125	SETP.	Set point for the steam dump pressure (opening of the steam dump valve).
126	P	Proportional gain for the regulation.
127	T.SAMPLE	Time interval between reading output signals from the transmitter.

Description of the menu item lines for a local panel (1 x MODUL.), continued		
128	T.INT.	Integral action time for the regulation.
129	T.DIFF.	Derivative action time for the regulation.
130	REG OUTPUT	Regulation output signal in %.
131	REMOTE CTRL	Selection between automatic (0) or manual (1) control of the regulator. In manual control mode (1) the regulator output can be increased or decreased by pressing the soft keys for manual increase or decrease. Alteration of the regulator output can only be performed if it takes place in the actual menu or in the previous menu step with the black bar placed on the actual menu item. An alarm will be present when the regulator is in manual control mode. Please note that the regulator must be active before the regulation output can be changed in manual control mode.
132	SALINITY	Menu for control of the salinity alarm equipment. This menu will not be displayed if salinity alarm equipment is not selected in the setup/burner option menu.
133	SALINITY	Menu for control and display of the salinity alarm equipment.
134	HI.SHT.DWN.	Set point for shut down because of high salinity contents in feed water (burner cut off).
135	HIGH ALARM	Set point for alarm of high salinity contents in feed water.
136	INERT GAS	Menu for control of the inert gas mode.

Table 4

Description of the menu item lines for a local panel (1 x MODUL.), continued		
No.	**Menu item line**	**Description**
137	MIN LOAD	The minimum load for operation in inert gas mode. If changed to a different value during operation the burner load will be adjusted to the new set point. When inert gas mode is selected (internal or external) the burner will be forced to start, if not already started. The burner load will ramp up to minimum inert gas load. If the steam pressure drops below the set point the burner load follows the stream pressure regulator. However, if the stream pressure regulator sets the load below the minimum inert gas load the burner load is kept on minimum inert gas load. In inert gas mode the normal set point for stop is inactive and the burner is only stopped by an off signal for inert gas mode or the high steam pressure alarms.
138	FORCE	Forces the boiler "ON" or "OFF" in inert gas mode from the local control panel. Note that the external inert gas on/off function (switch) overrides the forced function.
139	[OIL OPERATION]	Indicates the fuel choice (diesel oil operation or heavy oil operation). Please note that the fuel type must be selected manually.
140	SURVEIL	Menu for display of shut downs and alarms.
141	SHT.DWN. INSPEC-TION	Menu for display of the first arising shut down out of the complete number of present shut downs. All arising shut downs initiate burner cut off. By pressing the up and down arrow soft keys on the right side of the panel all present shut downs can be viewed.
142	[SHT.DWN. NUM]	Displays shut down number.
143	[SHT.DWN. TEXT]	Displays shut down text.
144	ALARM INSPECTION	Menu for display of the first arising alarm out of the complete number of present alarms. By pressing the up and down arrow soft keys on the right side of the panel all present alarms can be viewed.
145	[ALARM NUM]	Displays alarm number.
146	[ALARM TEXT]	Displays alarm text.
147	SETUP	Menu for set-up of control mode, timers, settings, diagnoses, loggings, calibration, configu-ration, and language.
148	CTRL MODE	Menu for selection of burner mode and pressure mode.
149	BURNER CTRL MODE	Selection of burner control mode (stopped, auto, manual). If auto mode is selected, the burner mode can be switched directly between manual mode and automatic mode by pushing the soft key for manual operation. Light in the LED above this soft key indicates that manual mode is selected. Please note that during the start up sequence the burner control mode cannot be changed and that a number of menus can only be operated if the burner is in stop mode.
150	SETPOINT SELECT	Selection of pressure mode (low, high). If the boiler plant is not intended to operate at different pressure modes, the set points in the boiler pressure menu should be set to the same level.
151	TIMERS	Menu for readout and set-up of timers to sequences, surveillance, shared operation, power panels, and communication.
152	TIMERS	Menu for timer readout. The readouts are only shown when the individual steps and items are active.
153	SEQUENCE	Menu for sequence timer readout.
154	START START	Timer countdown for the minimum running time of the combustion air fan (steam atomising burners).
155	IGNITER POS	Timer countdown for positioning the ignition burner (steam atomising burners).
156	FD.FAN ST.	Timer countdown for the combustion air fan starting period (steam atomising burners).
157	PURGE	Timer countdown for the purge period.
158	FLUSH START	Timer countdown for the flush start period for pressure atomising burners (MS, RMS).
159	FLUSH BREAK	Timer countdown for the flush break period for pressure atomising burners (MS, RMS).
160	FLUSH END	Timer countdown for the flush end period for pressure atomising burners (MS, RMS).
161	IGNITION	Timer countdown for the ignition period.
162	SAFETY TIME	Timer countdown for the safety time period.

Description of the menu item lines for a local panel (1 x MODUL.), continued		
163	START SEQ	Timer countdown for the maximum permissible starting time of the burner.
164	FLAME STAB.	Timer countdown for the flame stabilising period.
165	LOW FIRING	Timer countdown for the low firing period.
166	RISING TIME	Timer countdown for the rising period.
167	STEAM PG.PO	Timer countdown for regulator positioning to steam purge position (steam atomising burners).
168	STEAM PURG1	Timer countdown for the steam purge 1 period (steam atomising burners). Oil valves close and steam purge valve opens.
169	STEAM PURG2	Timer countdown for the steam purge 2 period (steam atomising burners). Atomising steam valve closes, and steam purge valve remains open.
170	POSTPURGE	Timer countdown for the post purge period.

Table 5

Description of the menu item lines for a local panel (1 x MODUL.), continued		
No.	**Menu item line**	**Description**
171	SURVEILLANCE	Menu for readout of surveillance timers.
172	WATER HI.SD	Timer countdown for delay of the high water level shut down (burner cut off).
173	WATER HI.AL	Timer countdown for delay of the high water level alarm.
174	WATER LO.AL	Timer countdown for delay of the low water level alarm.
175	WATER LO.SD	Timer countdown for delay of the low water level shut down (burner cut off).
176	WATER SW LO	Timer countdown for delay of the low water level shut down switch (burner cut off).
177	PMS FEEDBAC	Timer countdown for maximum feedback signal time from the ships power management system (PMS), steam atomising burners.
178	SERVO POS	Timer countdown for feedback signal from servo position (pressure atomising burners).
179	B.MOT.STAR	Timer countdown for feedback signal from burner motor started (pressure atomising burners).
180	W. REG OUT	Timer countdown for signal to start/stop of feed water pumps in boiler plants with on/off feed water regulation.
181	SMOKE HI.AL	Timer countdown for delay of high alarm from the smoke density equipment.
182	TEMP HI.AL.	Timer countdown for delay of high alarm from the uptake temperature measurement.
183	TEMP HI.SD.	Timer countdown for delay of high shut down (burner cut off) from the uptake temperature measurement.
184	KEY HOLD	Timer countdown for delay of non-operation of an unlocked local panel.
185	BOOST.M.ST.	Timer countdown for feedback signal from booster pump motor started (large pressure atomising burners).
186	SHARED	Menu for readout of shared timers.
187	SAL HI.AL.	Timer countdown for delay of high alarm from the salinity alarm equipment.
188	SAL HI.SD.	Timer countdown for delay of high shut down (burner cut off) from the salinity alarm equipment.
189	OIL LO.AL.	Timer countdown for delay of low oil pressure alarm and start of the stand-by oil pump.
190	POWER PANEL 1	Menu for readout of power panel 1 timers.
191	F.O.PMP 1	Timer countdown for feedback signal from fuel oil pump 1.
192	F.O.PMP 2	Timer countdown for feedback signal from fuel oil pump 2.
193	FUEL PRESS	Timer countdown for feedback signal from start stand-by fuel oil pump. The start is effected by the low fuel oil pressure alarm.
194	F.O.PMP	Timer countdown for feedback signal from shut down and cut off functions during start of the fuel oil pumps.
195	DO TO HFO	Timer countdown for feedback signal from positioning the three way valve from diesel oil operation to heavy fuel oil operation.
196	HFO TO DO	Timer countdown for feedback signal from positioning the three way valve from heavy fuel oil operation to diesel oil operation.
197	KEY TIMEOUT	Timer countdown for communication feedback signal between the panels.
198	POWER PANEL 2	Menu for readout of power panel 1 timers.
199	F.W.PMP 1	Timer countdown for feedback signal from feed water pump 1.
200	F.W.PMP 2	Timer countdown for feedback signal from feed water pump 2.
201	F.W.PMP 3	Timer countdown for feedback signal from feed water pump 3.
202	F.W.PMP 4	Timer countdown for feedback signal from feed water pump 4.
203	F.W. DELAY	Timer countdown for delay of start stand-by feed water pump in case of low pressure. The timer is active when the pumps are configured as 2+1 pumps in the burner option menu.
204	F.W. M. RUN	Timer countdown for change of feed water pump (main/service pump) after stop of the burner.
205	F.W. DELAY2	Timer countdown for delay of start stand-by feed water pump in case of low pressure. The timer is active when the pumps are configured as 2+2 pumps in the burner option menu. Normally used for three point feed water regulation.
206	C.PUMP 1	Timer countdown for feedback signal from circulation pump 1.

Description of the menu item lines for a local panel (1 x MODUL.), continued		
207	C.PUMP 2	Timer countdown for feedback signal from circulation pump 2.
208	COMMUNICATION	Menu for readout of communication timers. The timers continuously count down until they are reset by the feedback signals. After resetting the timers commence a new countdown.
209	PANEL1 OFFL	Timer countdown for communication feedback signal from local panel 1.
210	PANEL2 OFFL	Timer countdown for communication feedback signal from local panel 2.
211	TIMERS SETUP	Menu for timer set-up.
212	SEQUENCE	Menu for set-up of sequence timers.
213	START START	Setting of the minimum running time for the combustion air fan (steam atomising burners).

Table 6

Description of the menu item lines for a local panel (1 x MODUL.), continued		
No.	**Menu item line**	**Description**
214	IGNITER POS	Setting of the maximum time for positioning the ignition burner (steam atomising burners).
215	FD.FAN ST.	Setting of the maximum start time for the combustion air fan (steam atomising burners).
216	PURGE	Setting of the purge time period.
217	FLUSH START	Setting of the flush start time period for pressure atomising burners (MS, RMS). If the cold/ warm start thermostat is activated during start up the safety solenoid valves positioned before and after the pre-heater and nozzle head open. Hereby the oil system on the burner is flushed with heavy fuel oil and the temperature is increased by the pre-heater.
218	FLUSH BREAK	Setting of the flush break time period for pressure atomising burners (MS, RMS). After the flush start time period has expired the solenoid valves close and the heavy fuel oil which is contained inside the pre-heater is heated to the correct temperature.
219	FLUSH END	Setting of the flush end time period for pressure atomising burners (MS, RMS). When the flush break time period is completed the solenoid valves open for a time period before the burner is started. In this way the heavy fuel oil contained inside the pre-heater will reach nozzle head when the oil is ignited.
220	IGNITION	Setting of the ignition time period.
221	SAFETY TIME	Setting of the safety time period.
222	START SEQ	Setting of the maximum start time for the burner.
223	FLAME STAB.	Setting of the flame stabilising time period.
224	LOW FIRING	Setting of the low firing time.
225	RISING TIME	Setting of the rising time.
226	STEAM PG.PO	Setting of the time for regulator positioning to steam purge position (steam atomising burners).
227	STEAM PURG1	Setting of the steam purge 1 time period (steam atomising burners). Oil valves close and steam purge valve opens.
228	STEAM PURG2	Setting of the steam purge 2 time period (steam atomising burners). Atomising steam valve closes, and steam purge valve remains open.
229	POSTPURGE	Setting of the postpurge time period.
230	SURVEILLANCE	Menu for set-up of surveillance timers.
231	WATER HI.SD	Setting of the timer delay for high water level shut down (burner cut off).
232	WATER HI.AL	Setting of the timer delay for high water level alarm.
233	WATER LO.AL	Setting of the timer delay for low water level alarm.
234	WATER LO.SD	Setting of the timer delay for low water level shut down (burner cut off).
235	WATER SW LO	Setting of the timer delay for low water level shut down switch (burner cut off).
236	PMS FEEDBAC	Setting of the timer delay from the power management system (PMS) of the ship, steam atomising burners.
237	SERVO POS	Setting of the timer delay for servo position (pressure atomising burners).
238	B.MOT.STAR	Setting of the timer delay for burner motor started (pressure atomising burners).
239	W. REG OUT	Setting of the time delay for start/stop of feed water pumps in boiler plants with on/off feed water regulation.
240	SMOKE HI.AL	Setting of the timer delay for high alarm from the smoke density equipment.
241	TEMP HI.AL.	Setting of the timer delay for high temperature alarm in uptake.
242	TEMP HI.SD.	Setting of the timer delay for high temperature shut down in uptake (burner cut off).
243	KEY HOLD	Setting of the timer delay for non-operation of an unlocked local panel.
244	BOOST.M.ST.	Setting of the timer delay for booster pump motor started (large pressure atomising burners).
245	SHARED	Menu for set-up of shared timers.
246	SAL HI.AL.	Setting of the timer delay for high alarm from the salinity alarm equipment.
247	SAL HI.SD.	Setting of the timer delay for high shut down (burner cut off) from the salinity alarm equipment.
248	OIL LO.AL.	Setting of the timer delay for low pressure alarm and start of the stand-by oil pump.

Description of the menu item lines for a local panel (1 x MODUL.), continued		
249	POWER PANEL 1	Menu for set-up of power panel 1 timers.
250	F.O.PMP 1	Time period for delay of feedback signal from fuel oil pump 1.
251	F.O.PMP 2	Time period for delay of feedback signal from fuel oil pump 2.
252	FUEL PRESS	Time period for delay of start stand-by fuel oil pump. The start is effected by the low fuel oil pressure alarm.
253	F.O.PMP	Time period for delay of shut down and cut off functions during start of the fuel oil pumps.
254	DO TO HFO	Time period for positioning the three way valve from diesel oil operation to heavy fuel oil operation.
255	HFO TO DO	Time period for positioning the three way valve from heavy fuel oil operation to diesel oil operation.

Table 7

Description of the menu item lines for a local panel (1 x MODUL.), continued		
No.	**Menu item line**	**Description**
256	KEY TIMEOUT	Time period in which absent communication between the panels is accepted before setting the key operation lock to power panel 1.
257	POWER PANEL 2	Menu for set-up of power panel 2 timers.
258	F.W.PMP 1	Time period for delay of feedback signal from feed water pump 1.
259	F.W.PMP 2	Time period for delay of feedback signal from feed water pump 2.
260	F.W.PMP 3	Time period for delay of feedback signal from feed water pump 3.
261	F.W.PMP 4	Time period for delay of feedback signal from feed water pump 4.
262	F.W. DELAY	Time period for delay of start stand-by feed water pump in case of low pressure. The timer is active when the pumps are configured as 2+1 pumps in the burner option menu.
263	F.W. M. RUN	Time period for change of feed water pump (main/service pump) after stop of the burner.
264	F.W. DELAY2	Time period for delay of start stand-by feed water pump in case of low pressure. The timer is active when the pumps are configured as 2+2 pumps in the burner option menu. Normally used for three point feed water regulation.
265	C.PUMP 1	Time period for delay of feedback signal from circulation pump 1.
266	C.PUMP 2	Time period for delay of feedback signal from circulation pump 2.
267	COMMUNICATION	Menu for set-up of communication timers.
268	PANEL1 OFFL	Time period in which absent communication from local panel 1 is accepted.
269	PANEL2 OFFL	Time period in which absent communication from local panel 2 is accepted.
270	DATE/TIME	The date/time is used to indicate time for the event and alarm system. It might be advantageous to adjust the date/time for GMT in order to have a fixed time during sailing. The date/time is stored in the control system and remembered even if the system is switched off for a period of time.
271	HOUR	Must be adjusted as a 24 hour watch.
272	MIN	Adjustment of minutes.
273	SEC	Adjustment of seconds.
274	DAY	Adjustment of date.
275	MONTH	Adjustment of month.
276	YEAR	Adjustment of year (4 digits).
277	HOUR/START CNT	Main menu for hour counters.
278	LOAD >25%	Hour counter menu for burner load below 25% (from minimum/ignition load to 100%).
279	LOAD >25%	Hour counter sub menu. When the service hours exceed the set interval an alarm is given. Note that the service time continues to count irrespectively of the alarm condition. In case of burner or burner parts replacement the total/service running hours can be manually reset in the sub menus by setting of new values via entering of the super user password.
280	TOT.HOUR	Counts and displays the total running hours for the burner at operation below 25%.
281	SRV.HOUR	Counts and displays accumulated running hours below 25% since the last reset of service hours.
282	SRV.VAL	Setting of the service interval in hours.
283	RESET	Reset of the service counters
284	LOAD >50%	Hour counter menu for burner load below 50% (from 25% to 100%).
285	LOAD >50%	Hour counter sub menu. When the service hours exceed the set interval an alarm is given. Note that the service time continues to count irrespectively of the alarm condition. In case of burner or burner parts replacement the total/service running hours can be manually reset in the sub menus by setting of new values via entering of the super user password.
286	TOT.HOUR	Counts and displays the total running hours for the burner at operation below 50%.
287	SRV.HOUR	Counts and displays accumulated running hours below 50% load since the last reset of service hours.
288	SRV.VAL	Setting of the service interval in hours.

Description of the menu item lines for a local panel (1 x MODUL.), continued		
289	RESET	Reset of the service counters
290	LOAD >75%	Hour counter menu for burner load below 75% (from 50% to 100%).
291	LOAD >75%	Hour counter sub menu. When the service hours exceed the set interval an alarm is given. Note that the service time continues to count irrespectively of the alarm condition. In case of burner or burner parts replacement the total/service running hours can be manually reset in the sub menus by setting of new values via entering of the super user password.
292	TOT.HOUR	Counts and displays the total running hours for the burner at operation below 75%.
293	SRV.HOUR	Counts and displays accumulated running hours below 75% load since the last reset of service hours.
294	SRV.VAL	Setting of the service interval in hours.

Table 8

Description of the menu item lines for a local panel (1 x MODUL.), continued		
No.	**Menu item line**	**Description**
295	RESET	Reset of the service counters
296	LOAD	Hour counter menu for burner load above 75% (from 75% to 100%).
297	LOAD	Hour counter sub menu. When the service hours exceed the set interval an alarm is given. Note that the service time continues to count irrespectively of the alarm condition. In case of burner or burner parts replacement the total/service running hours and number of starts can be manually reset in the sub menus by setting of new values via entering of the super user password.
298	TOT.HOUR	Counts and displays the total running hours for the burner at operation above 75%.
299	SRV.HOUR	Counts and displays accumulated running hours above 75% load since the last reset of service hours.
300	SRV.VAL	Setting of the service interval in hours.
301	RESET	Reset of the service counters
302	TOT.START	Counts and displays the total number of starts for the burner.
303	SRV.START	Counts and displays accumulated number of starts since the last reset of service hours.
304	SMOKE BLOW	Hour counter menu for smoke density blower.
305	SMOKE BLOW	Hour counter sub menu. When the service hours exceed the set interval an alarm is given. Note that the service time continues to count irrespectively of the alarm condition. In case of blower replacement the total/service running hours and number of starts can be manually reset in the sub menus by setting of new values via entering of the super user password.
306	TOT.HOUR	Counts and displays the total running hours for the connected blower/motor.
307	SRV.HOUR	Counts and displays accumulated running hours since the last reset of service hours.
308	SRV.VAL	Setting of the service interval in hours.
309	RESET	Reset of the service counters
310	TOT.START	Counts and displays the total number of starts for the connected blower/motor.
311	SRV.START	Counts and displays accumulated number of starts since the last reset of service hours.
312	BOOST PUMP	Hour counter menu for booster pump. Note only used for large pressure atomising burners.
313	BOOST PUMP	Hour counter sub menu. When the service hours exceed the set interval an alarm is given. Note that the service time continues to count irrespectively of the alarm condition. In case of pump replacement the total/service running hours and number of starts can be manually reset in the sub menus by setting of new values via entering of the super user password.
314	TOT.HOUR	Counts and displays the total running hours for the connected pump/motor.
315	SRV.HOUR	Counts and displays accumulated running hours since the last reset of service hours.
316	SRV.VAL	Setting of the service interval in hours.
317	RESET	Reset of the service counters
318	TOT.START	Counts and displays the total number of starts for the connected pump/motor.
319	SRV.START	Counts and displays accumulated number of starts since the last reset of service hours.
320	BURN.MOTOR	Hour counter menu for burner motor.
321	BURN.MOTOR	Hour counter sub menu. When the service hours exceed the set interval an alarm is given. Note that the service time continues to count irrespectively of the alarm condition. In case of motor replacement the total/service running hours and number of starts can be manually reset in the sub menus by setting of new values via entering of the super user password.
322	TOT.HOUR	Counts and displays the total running hours for the connected motor.
323	SRV.HOUR	Counts and displays accumulated running hours since the last reset of service hours.
324	SRV.VAL	Setting of the service interval in hours.
325	RESET	Reset of the service counters
326	TOT.START	Counts and displays the total number of starts for the connected motor.
327	SRV.START	Counts and displays accumulated number of starts since the last reset of service hours.
328	FUEL PUMP 1	Hour counter menu for fuel oil pump 1.

Description of the menu item lines for a local panel (1 x MODUL.), continued		
329	FUEL PUMP 1	Hour counter sub menu. When the service hours exceed the set interval an alarm is given. Note that the service time continues to count irrespectively of the alarm condition. In case of pump replacement the total/service running hours and number of starts can be manually reset in the sub menus by setting of new values via entering of the super user password.
330	TOT.HOUR	Counts and displays the total running hours for the connected pump/motor.
331	SRV.HOUR	Counts and displays accumulated running hours since the last reset of service hours.
332	SRV.VAL	Setting of the service interval in hours.
333	RESET	Reset of the service counters
334	TOT.START	Counts and displays the total number of starts for the connected pump/motor.
335	SRV.START	Counts and displays accumulated number of starts since the last reset of service hours.

Table 9

Description of the menu item lines for a local panel (1 x MODUL.), continued		
No.	**Menu item line**	**Description**
336	FUEL PUMP 2	Hour counter menu for fuel oil pump 2.
337	FUEL PUMP 2	Hour counter sub menu. When the service hours exceed the set interval an alarm is given. Note that the service time continues to count irrespectively of the alarm condition. In case of pump replacement the total/service running hours and number of starts can be manually reset in the sub menus by setting of new values via entering of the super user password.
338	TOT.HOUR	Counts and displays the total running hours for the connected pump/motor.
339	SRV.HOUR	Counts and displays accumulated running hours since the last reset of service hours.
340	SRV.VAL	Setting of the service interval in hours.
341	RESET	Reset of the service counters
342	TOT.START	Counts and displays the total number of starts for the connected pump/motor.
343	SRV.START	Counts and displays accumulated number of starts since the last reset of service hours.
344	CIRC.PUMP 1	Hour counter menu for circulation pump 1.
345	CIRC.PUMP 1	Hour counter sub menu. When the service hours exceed the set interval an alarm is given. Note that the service time continues to count irrespectively of the alarm condition. In case of pump replacement the total/service running hours and number of starts can be manually reset in the sub menus by setting of new values via entering of the super user password.
346	TOT.HOUR	Counts and displays the total running hours for the connected pump/motor.
347	SRV.HOUR	Counts and displays accumulated running hours since the last reset of service hours.
348	SRV.VAL	Setting of the service interval in hours.
349	RESET	Reset of the service counters
350	TOT.START	Counts and displays the total number of starts for the connected pump/motor.
351	SRV.START	Counts and displays accumulated number of starts since the last reset of service hours.
352	CIRC.PUMP 2	Hour counter menu for circulation pump 2.
353	CIRC.PUMP 2	Hour counter sub menu. When the service hours exceed the set interval an alarm is given. Note that the service time continues to count irrespectively of the alarm condition. In case of pump replacement the total/service running hours and number of starts can be manually reset in the sub menus by setting of new values via entering of the super user password.
354	TOT.HOUR	Counts and displays the total running hours for the connected pump/motor.
355	SRV.HOUR	Counts and displays accumulated running hours since the last reset of service hours.
356	SRV.VAL	Setting of the service interval in hours.
357	RESET	Reset of the service counters
358	TOT.START	Counts and displays the total number of starts for the connected pump/motor.
359	SRV.START	Counts and displays accumulated number of starts since the last reset of service hours.
360	CHEM.PUMP 1	Hour counter menu for chemical pump 1.
361	CHEM.PUMP 1	Hour counter sub menu. When the service hours exceed the set interval an alarm is given. Note that the service time continues to count irrespectively of the alarm condition. In case of pump replacement the total/service running hours and number of starts can be manually reset in the sub menus by setting of new values via entering of the super user password.
362	TOT.HOUR	Counts and displays the total running hours for the connected pump/motor.
363	SRV.HOUR	Counts and displays accumulated running hours since the last reset of service hours.
364	SRV.VAL	Setting of the service interval in hours.
365	RESET	Reset of the service counters
366	TOT.START	Counts and displays the total number of starts for the connected pump/motor.
367	SRV.START	Counts and displays accumulated number of starts since the last reset of service hours.
368	CHEM.PUMP 2	Hour counter menu for chemical pump 2.

Description of the menu item lines for a local panel (1 x MODUL.), continued		
369	CHEM.PUMP 2	Hour counter sub menu. When the service hours exceed the set interval an alarm is given. Note that the service time continues to count irrespectively of the alarm condition. In case of pump replacement the total/service running hours and number of starts can be manually reset in the sub menus by setting of new values via entering of the super user password.
370	TOT.HOUR	Counts and displays the total running hours for the connected pump/motor.
371	SRV.HOUR	Counts and displays accumulated running hours since the last reset of service hours.
372	SRV.VAL	Setting of the service interval in hours.
373	RESET	Reset of the service counters
374	TOT.START	Counts and displays the total number of starts for the connected pump/motor.
375	SRV.START	Counts and displays accumulated number of starts since the last reset of service hours.
376	F.W.PUMP 1	Hour counter menu for feed water pump 1.

Table 10

Description of the menu item lines for a local panel (1 x MODUL.), continued		
No.	**Menu item line**	**Description**
377	F.W.PUMP 1	Hour counter sub menu. When the service hours exceed the set interval an alarm is given. Note that the service time continues to count irrespectively of the alarm condition. In case of pump replacement the total/service running hours and number of starts can be manually reset in the sub menus by setting of new values via entering of the super user password.
378	TOT.HOUR	Counts and displays the total running hours for the connected pump/motor.
379	SRV.HOUR	Counts and displays accumulated running hours since the last reset of service hours.
380	SRV.VAL	Setting of the service interval in hours.
381	RESET	Reset of the service counters
382	TOT.START	Counts and displays the total number of starts for the connected pump/motor.
383	SRV.START	Counts and displays accumulated number of starts since the last reset of service hours.
384	F.W.PUMP 2	Hour counter menu for feed water pump 2.
385	F.W.PUMP 2	Hour counter sub menu. When the service hours exceed the set interval an alarm is given. Note that the service time continues to count irrespectively of the alarm condition. In case of pump replacement the total/service running hours and number of starts can be manually reset in the sub menus by setting of new values via entering of the super user password.
386	TOT.HOUR	Counts and displays the total running hours for the connected pump/motor.
387	SRV.HOUR	Counts and displays accumulated running hours since the last reset of service hours.
388	SRV.VAL	Setting of the service interval in hours.
389	RESET	Reset of the service counters
390	TOT.START	Counts and displays the total number of starts for the connected pump/motor.
391	SRV.START	Counts and displays accumulated number of starts since the last reset of service hours.
392	F.W.PUMP 3	Hour counter menu for feed water pump 3.
393	F.W.PUMP 3	Hour counter sub menu. When the service hours exceed the set interval an alarm is given. Note that the service time continues to count irrespectively of the alarm condition. In case of pump replacement the total/service running hours and number of starts can be manually reset in the sub menus by setting of new values via entering of the super user password.
394	TOT.HOUR	Counts and displays the total running hours for the connected pump/motor.
395	SRV.HOUR	Counts and displays accumulated running hours since the last reset of service hours.
396	SRV.VAL	Setting of the service interval in hours.
397	RESET	Reset of the service counters
398	TOT.START	Counts and displays the total number of starts for the connected pump/motor.
399	SRV.START	Counts and displays accumulated number of starts since the last reset of service hours.
400	F.W.PUMP 4	Hour counter menu for feed water pump 4.
401	F.W.PUMP 4	Hour counter sub menu. When the service hours exceed the set interval an alarm is given. Note that the service time continues to count irrespectively of the alarm condition. In case of pump replacement the total/service running hours and number of starts can be manually reset in the sub menus by setting of new values via entering of the super user password.
402	TOT.HOUR	Counts and displays the total running hours for the connected pump/motor.
403	SRV.HOUR	Counts and displays accumulated running hours since the last reset of service hours.
404	SRV.VAL	Setting of the service interval in hours.
405	RESET	Reset of the service counters
406	TOT.START	Counts and displays the total number of starts for the connected pump/motor.
407	SRV.START	Counts and displays accumulated number of starts since the last reset of service hours.
408	SETTINGS	Menu for setting start/stop limits and servo motor positions in different states.
409	START/STOP LIMITS	Menu for start and stop set points for the boiler.

Description of the menu item lines for a local panel (1 x MODUL.), continued		
410	M.START DIF	Setting of the start difference for the boiler. The set point for start of the boiler consists of the actual set point from the boiler pres menu and the pressure difference, which is set in this menu. This means that when the steam pressure is equal to the actual set point + start difference set point, the boiler starts.
411	M.STOP DIFF	Setting of the stop difference for the boiler. The set point for stop of the boiler consists of actual set point from the boiler pres menu and the pressure difference, which is set in this menu. This means that when the steam pressure is equal to the actual set point + stop difference set point, the boiler stops.
412	MIN.FIRING POSITION	Menu for setting the servo motor position when the burner is in minimum firing position.
413	SERVO POS.	Setting of the servo motor position.
414	PURGE POSITION	Menu for setting the servo motor position when the burner is in purge position.

Table 11

Description of the menu item lines for a local panel (1 x MODUL.), continued		
No.	**Menu item line**	**Description**
415	SERVO POS.	Setting of the servo motor position.
416	IGNITION POSITION	Menu for setting the servo motor position when the burner is in ignition position.
417	SERVO POS.	Setting of the servo motor position.
418	DIAGNOSES	Menu for viewing software information, digital input/output status, setting digital output for testing, and password changes.
419	SOFTWARE VERSION	Menu for general system information.
420	[PANEL TYPE]	Displays panel type.
421	[VERSION]	Displays date and time for installation and software version number.
422	[INFO 1]	Displays information text.
423	[INFO 2]	Displays information text.
424	DIGITAL INPUT	Menu for viewing the status of the digital inputs (0/1).
425	EXTERN SHUTDOWN 1	Status for extern shutdown 1.
426	HI STM PRESS SWITCH	Status for the high steam pressure switch.
427	LANCE REDRAWN	Status for burner lance redrawn (steam atomising burners) or burner swing out (pressure atomising burners).
428	WATER LEVEL LOW	Status for too low water level shut down.
429	FLAME SCANNER 1	Status for flame scanner 1.
430	FLAME SCANNER 2	Status for flame scanner 2.
431	START PERM.PMS	Status for the power management system of the ship (PMS) (steam atomising burners).
432	IGN.INS./O.TEMP.L	Status for ignition burner inserted (steam atomising burners) or oil temperature low (pressure atomising/rotary cup burners).
433	AIR CLOSED/ O.TEMP.H	Status for air inlet vanes closed (steam atomising burners) or oil temperature high (pressure atomising burners).
434	OIL V.POS/Q.C.VALVE	Status for oil valves closed (steam atomising burners) or quick closing valves (pressure atomising/rotary cup burners).
435	H.OIL PRS/IGN.F.SUV	Status for ignition flame surveillance (steam atomising burners) or high oil pressure in return line (pressure atomising burners).
436	F.IN WB./O.TEMP CTR	Status for fire in wind box (steam atomising/rotary cup burners) or oil temperature control on/ off (pressure atomising burners).
437	HIGH TEMP UPTAKE	Status for high temperature in uptake switch.
438	LOW COMB AIR PRESS	Status for low combustion air pressure switch.
439	LOW OIL PRESS NOZZL	Status for low oil pressure at the nozzle.
440	L.OIL TEMP N/LOW AT	Status for low oil temperature at the nozzle (pressure atomising burners) or low atomising air pressure (rotary cup burners).
441	COLD/WARM START	Status for cold/warm start.
442	INERT GAS	Status for inert gas mode.
443	EXTERN STOP 1	Status for extern stop 1.
444	EXTERN STOP 2	Status for extern stop 2.
445	EXTERN SHUTDOWN 2	Status for extern shutdown 2.
446	HEAVY FUEL OPERAT	Status for position of heavy fuel oil/diesel oil operation.
447	F.O.PMP1 FB	Status of feedback signal for fuel oil pump 1 running.
448	F.O.PMP2 FB	Status of feedback signal for fuel oil pump 2 running.
449	BURNER MOTOR 1 FB	Status of feedback signal for burner motor 1 running.
450	BURNER MOTOR 1 OL	Status for burner motor 1 overload.
451	SALINITY	Status for the salinity shut down.
452	OIL CONTENT	Status for high oil content in the feed water.
453	HIGH GAS TEMP.AT EG	Status for high gas temperature at the exhaust gas boiler.

Description of the menu item lines for a local panel (1 x MODUL.), continued		
454	F.O.PMP1 REM STOP	Status for remote stop of fuel oil pump 1. If provided, the remote stop is placed at the pump.
455	F.O.PMP1 REM START	Status for remote start of fuel oil pump 1. If provided, the remote start is placed at the pump.
456	F.O.PMP2 REM STOP	Status for remote stop of fuel oil pump 2. If provided, the remote stop is placed at the pump.
457	F.O.PMP2 REM START	Status for remote start of fuel oil pump 2. If provided, the remote start is placed at the pump.
458	F.W.PMP1 FB	Status of feedback signal for feed water pump 1 running.
459	F.W.PMP1 STBY	Status of feedback signal for selecting feed water pump 1 to stand-by mode.
460	F.W.PMP2 FB	Status of feedback signal for feed water pump 2 running.
461	F.W.PMP2 STBY	Status of feedback signal for selecting feed water pump 2 to stand-by mode.

Table 12

Description of the menu item lines for a local panel (1 x MODUL.), continued		
No.	**Menu item line**	**Description**
462	F.W.PMP3 FB	Status of feedback signal for feed water pump 3 running.
463	F.W.PMP3 STBY	Status of feedback signal for selecting feed water pump 3 to stand-by mode.
464	F.W.PMP4 FB	Status of feedback signal for feed water pump 4 running.
465	F.W. PMP4 STBY	Status of feedback signal for selecting feed water pump 4 to stand-by mode.
466	CIRC.PMP1 FB	Status of feedback signal for circulation pump 1 running.
467	CIRC.PMP STBY	Status of feedback signal for start of stand-by circulation pump.
468	CIRC.PMP LF	Status of feedback signal for low circulation flow.
469	CIRC.PMP2 FB	Status of feedback signal for circulation pump 2 running.
470	C.PMP1 REM STOP	Status for remote stop of circulation pump 1. If provided, the remote stop is placed at the pump.
471	C.PMP1 REM START	Status for remote start of circulation pump 1. If provided, the remote start is placed at the pump.
472	C.PMP2 REM STOP	Status for remote stop of circulation pump 2. If provided, the remote stop is placed at the pump.
473	C.PMP2 REM START	Status for remote start of circulation pump 2. If provided, the remote start is placed at the pump.
474	F.W.PMP1 REM STOP	Status for remote stop of feed water pump 1. If provided, the remote stop is placed at the pump.
475	F.W.PMP1 REM START	Status for remote start of feed water pump 1. If provided, the remote start is placed at the pump.
476	F.W.PMP2 REM STOP	Status for remote stop of feed water pump 2. If provided, the remote stop is placed at the pump.
477	F.W.PMP2 REM START	Status for remote start of feed water pump 2. If provided, the remote start is placed at the pump.
478	F.W.PMP3 REM STOP	Status for remote stop of feed water pump 3. If provided, the remote stop is placed at the pump.
479	F.W.PMP3 REM START	Status for remote start of feed water pump 3. If provided, the remote start is placed at the pump.
480	F.W.PMP4 REM STOP	Status for remote stop of feed water pump 4. If provided, the remote stop is placed at the pump.
481	F.W.PMP4 REM START	Status for remote start of feed water pump 4. If provided, the remote start is placed at the pump.
482	DIGITAL OUTPUT	Menu for viewing the status of the digital outputs (0/1).
483	ATM.S.P/SERVO UP	Status for output signal to atomising steam pressure up (steam atomising burners) or servo motor load up (pressure atomising/rotary cup burners).
484	ATM.S.P/SERVO DW	Status for output signal to atomising steam pressure down (steam atomising burners) or servo motor load down (pressure atomising/rotary cup burners).
485	IGNITION	Status for output signal to ignition system.
486	NOZZLE2/W.MAN AU-TO	Status for output signal for nozzle 2 (two-stage pressure atomising burners) or auto/manual operation of external water level regulation.
487	OIL V/ NOZZLE 1	Status for output signal to oil valves (steam atomising burners) or solenoid valve for nozzle 1 (two-stage pressure atomising burners).
488	ATM STEAM/SAFETY V	Status for output signal to atomising steam valve (steam atomising burners) or safety valves 1 and 2 in nozzle head (pressure atomising burners).
489	S.PURGE/HEATING E	Status for output signal to steam purge (steam atomising burners) or heating elements (pressure atomising/rotary cup burners).
490	BOILER PRESS HI.SET	Status for boiler operation in high pressure mode.
491	SOOTBLOWER	Status for the IGS interlock control valve (if provided)
492	SHT.DWN.	Status for common shut down.
493	START REQ TO PMS	Status for output signal for start request to the power management system (PMS) of the ship, steam atomising burners.
494	ALARM	Status for alarm presence.

Description of the menu item lines for a local panel (1 x MODUL.), continued		
495	ALARM H.WATER L	Status for high water level alarm.
496	ALARM L.WATER L	Status for low water level alarm.
497	BURNER IN STOP	Status for output signal to burner in stop mode.
498	F. W. REG. ON/OFF	Status for output signal to feed water regulation.
499	F.O.PMP 1	Status for output signal to fuel oil pump 1.
500	F.O.PMP 2	Status for output signal to fuel oil pump 2.
501	SMOKE BLOWER 1	Status for output signal to the smoke density blower 1 (actual boiler).
502	SMOKE BLOWER 2	Status for output signal to the smoke density blower 2 (connected boiler).
503	F.O.PMP.STB.STRT	Status for output signal to fuel oil pump stand-by start.
504	BURNER MOTOR 1	Status for output signal to burner motor (pressure atomising/rotary cup burners).
505	F.D FAN1/F.SAFETY	Status for output signal to combustion air fan 1 (pressure atomising/rotary cup burners) or pre-heater safety thermostat (pressure atomising burners).
506	F.D FAN2/F.HEAT	Status for output signal to combustion air fan 2 (pressure atomising/rotary cup burners) or pre-heater release function (pressure atomising burners).
507	CHEMICAL ST 1	Status for output signal to chemical station 1.

Table 13

Description of the menu item lines for a local panel (1 x MODUL.), continued		
No.	**Menu item line**	**Description**
508	CHEMICAL ST 2	Status for output signal to chemical station 2.
509	OIL TRACING	Status for output signal to the oil tracing system.
510	F.W.PMP1	Status for output signal to feed water pump 1.
511	F.W.PMP2	Status for output signal to feed water pump 2.
512	F.W.PMP3	Status for output signal to feed water pump 3.
513	F.W.PMP4	Status for output signal to feed water pump 4.
514	CIRC.PMP1	Status for output signal to circulation pump 1.
515	CICR.PMP2	Status for output signal to circulation pump 2.
516	F.W.PMP.STB.STRT	Status for output signal to feed water pump stand-by start.
517	CIRC.PMP.STB.STRT	Status for output signal to circulation pump stand-by start.
518	SUPERUSER KEY-WORD	Menu for display of latest use of super user password.
519	[USED]	Display the date and time for the latest entering of the super user password.
520	SERIAL NUMBER	Menu for software information.
521	SERIAL NO	Displays the EPROM serial number. The number must not be 0.
522	COMMISSIONED	Displays the commissioning date for the EPROM.
523	ERASE EEPROM	Erases the EEPROM. If the EEPROM is erased the original factory settings from the EPROM will be active (default settings).
524	NO OF SHT.DWN.	Menu for displays of the total number of shut downs since commissioning.
525	NO OF SHT.DWN.	Displays of the total number of shut downs since commissioning.
526	DIGITAL OUTPUT TEST	Menu for digital output test. By applying 1/0 signals to the digital output, the pumps, regulators, etc. can be tested, which might be useful during commissioning. The burner(s) must be in stop mode before this menu can be entered.
527	ATM.S.P/SERVO UP	Setting of the output signal to atomising steam pressure up (steam atomising burners) or servo motor load up (pressure atomising/rotary cup burners).
528	ATM.S.P/SERVO DW	Setting of the output signal to atomising steam pressure down (steam atomising burners) or servo motor load down (pressure atomising/rotary cup burners).
529	IGNITION	Setting of the output signal to ignition system.
530	NOZZLE2/W.MAN AUTO	Setting of the output signal to nozzle 2 (two-stage pressure atomising burners) or auto/manual operation of external water level regulation.
531	OIL V/ NOZZLE 1	Setting of the output signal to oil valves (steam atomising burners) or solenoid valve for nozzle 1 (two stage pressure atomising burners).
532	ATM STEAM/SAFETY V	Setting of the output signal to atomising steam valve (steam atomising burners) or safety valves 1 and 2 in nozzle head (pressure atomising burners).
533	S.PURGE/HEATING E	Setting of the output signal to steam purge (steam atomising burners) or heating elements (pressure atomising/rotary cup burners).
534	BOILER PRESS HI.SET	Setting of the output signal for boiler operation in high pressure mode.
535	SOOTBLOWER	Setting of the output signal for the IGS interlock control valve (if provided)
536	SHT.DWN.	Setting of the output signal for shut down.
537	START REQ TO PMS	Setting of the output signal for start request to the power management system (PMS) of the ship, steam atomising burners.
538	ALARM	Setting of the output signal for alarms.
539	ALARM H.WATER L	Setting of the output signal for high water level alarm.
540	ALARM L.WATER L	Setting of the output signal for low water level alarm.
541	BURNER IN STOP	Setting of the output signal to burner in stop mode.
542	F. W. REG. ON/OFF	Setting of the output signal to feed water regulation.
543	F.O.PMP 1	Setting of the output signal to fuel oil pump 1.
544	F.O.PMP 2	Setting of the output signal to fuel oil pump 2.

Description of the menu item lines for a local panel (1 x MODUL.), continued		
545	SMOKE BLOWER 1	Setting of the output signal to the smoke density blower 1 (actual boiler).
546	SMOKE BLOWER 2	Setting of the output signal to the smoke density blower 2 (connected boiler).
547	F.O.PMP.STB.STRT	Setting of the output signal to fuel oil pump stand-by start.
548	BURNER MOTOR 1	Setting of the output signal to burner motor (pressure atomising/rotary cup burners).
549	F.D FAN1/F.SAFETY	Setting of the output signal to combustion air fan 1 (pressure atomising/rotary cup burners) or pre-heater safety thermostat (pressure atomising burners).
550	F.D FAN2/F.HEAT	Setting of the output signal to combustion air fan 2 (pressure atomising/rotary cup burners) or pre-heater release function (pressure atomising burners).

Table 14

Description of the menu item lines for a local panel (1 x MODUL.), continued		
No.	**Menu item line**	**Description**
551	CHEMICAL ST 1	Setting of the output signal to chemical station pump 1.
552	CHEMICAL ST 2	Setting of the output signal to chemical station pump 2.
553	OIL TRACING	Setting of the output signal to the oil tracing system.
554	F.W.PMP1	Setting of the output signal to feed water pump 1.
555	F.W.PMP2	Setting of the output signal to feed water pump 2.
556	F.W.PMP3	Setting of the output signal to feed water pump 3.
557	F.W.PMP4	Setting of the output signal to feed water pump 4.
558	CIRC.PMP1	Setting of the output signal to circulation pump 1.
559	CIRC.PMP2	Setting of the output signal to circulation pump 2.
560	F.W.PMP.STB.STRT	Setting of the output signal to feed water pump stand-by start.
561	CIRC.PMP.STB.STRT	Setting of the output signal to circulation pump stand-by start.
562	NEW PASSWORD	Menu for change and reset of password.
563	NEW PASSWORD	The user and/or super user passwords can be changed. The change will only be effective for the entered password.
564	RESET PASSWORDS	Reset of both the user and super user passwords to factory setting. A special password is necessary to enter the menu. This password, as well as the super user password, will only be known by Aalborg Industries. The factory setting of the user password is 1234.
565	LOGGINGS	Menu for shut down log and oil flow counter.
566	INSPECT SHT.DWN. LOG	Menu for display of the last 20 shut downs.
567	[SHT.DWN. NUM]	Date and time for the shut down.
568	[SHT.DWN. TEXT]	Displays shut down text.
569	CALIBRATE	Menu for calibrating operating ranges for transmitters, servo motor, etc.
570	WATER LEVEL	Menu for setting the water level transmitter operating range.
571	WATER LEVEL	Actual value of the water level in mm.
572	RANGE HIGH	The high water level point (in mm) set during commission should be used as the high range level.
573	RANGE LOW	The low water level (in mm) set during commission should be used as the low range level.
574	RND.1/10MM	Calculation resolution for the water level controller.
575	BOILER PRES	Menu for setting the boiler pressure transmitter operating range.
576	BOILER PRES	Actual value of the boiler pressure in bar.
577	RANGE HIGH	Appears from the set point diagram for the local panel.
578	RANGE LOW	Appears from the set point diagram for the local panel.
579	FUEL O.PRES	Menu for setting the fuel oil pressure transmitter operating range.
580	FUEL O.PRES	Actual value of the fuel oil pressure in bar.
581	RANGE HIGH	Appears from the set point diagram for the power panel.
582	RANGE LOW	Appears from the set point diagram for the power panel.
583	OXYGEN SENS	Menu for setting the oxygen sensor operating range.
584	OXYGEN SENS	Actual value of the oxygen content in %.
585	RANGE HIGH	Should be calibrated according to configuration of the oxygen sensor.
586	RANGE LOW	Should be calibrated according to configuration of the oxygen sensor.
587	SMOKE DENS.	Menu for setting the smoke density operating range.
588	SMOKE DENS.	Actual value of the smoke density in %.
589	RANGE HIGH	Should be calibrated according to configuration of the smoke density equipment.
590	RANGE LOW	Should be calibrated according to configuration of the smoke density equipment.
591	SALINITY	Menu for setting the salinity equipment operating range.
592	SALINITY	Actual value of the salinity equipment.
593	RANGE HIGH	Appears from the set point diagram for the power panel.

Description of the menu item lines for a local panel (1 x MODUL.), continued		
594	RANGE LOW	Appears from the set point diagram for the power panel.
595	ST.PRES.COM	Menu for setting the common pressure transmitter operating range. Please note that if the common steam pressure transmitter and the boiler pressure transmitter are mounted at different height levels and far apart, the pressure loss resulting from the height difference and friction should be taken into consideration. Adjustments of the low and high ranges should always be carried out to fit the actual pressure at the boiler.
596	ST.PRES.COM	Actual value of the common steam pressure in bar.
597	RANGE HIGH	Appears from the set point diagram for the power panel.
598	RANGE LOW	Appears from the set point diagram for the power panel.

Table 15

Description of the menu item lines for a local panel (1 x MODUL.), continued		
No.	**Menu item line**	**Description**
599	SERVO MOTOR	Menu for setting the servo motor operating range.
600	SERVO MOTOR	Actual value of the servo motor position in percent.
601	RAW DATA	Actual value of the servo motor position indicated as a resistance signal.
602	RANGE HIGH	Setting of the resistance signal value when the air dampers are fully open (90°). The value is displayed in the raw data menu item line when the air dampers are in this position (90°).
603	RANGE LOW	Setting of the resistance signal value when the air dampers are fully closed (0°). The value is displayed in the raw data menu item line when the air dampers are in this position (0°).
604	T.MIN->MAX	Setting of the time to operate the servo motor from 0° - 90°. Appears from the name plate on the servo motor (normally 30 seconds).
605	CONFIG	Menu for set-up of hardware configuration, burner type, additional operating parameters, and selection of system options.
606	PANEL SYSTEM	Menu for set-up of panel type, burner type, and communication. Operation in this menu is only possible if the burner(s) is in stop mode.
607	PANEL TYPE	Selection between panel type: LOCAL 1, LOCAL 2, POWER 1, POWER 2 (if provided), EGB, or not def. During the initial commissioning in double boiler plants, it should be decided which boiler is number 1 and which boiler is number 2. The number of the local panels should then be selected according to the boiler number.
608	BURNER TYPE	Selection between burner type: KB, MODUL., 2-STAGE, KBSA, KBSD, or not def.
609	BURNER FAMILY	Selection between MULTI or ALONE operation. If the boiler is part of a double boiler plant and master/slave operation is possible (and intended) MULTI must be selected. If not ALONE must be selected.
610	NODE NO.OFFSET	Setting of the communication signal between panels. All included panels in a single boiler plant or a multi boiler plant with common supply systems must be set to the same node number in order to communicate together. In a multi boiler plant with separate supply systems the node number must be divided into groups. This means that all included panels for the first boiler should have the same identical number and all included panels for the second boiler should have another identical number. The difference in the number value must always be minimum 12. E.g. if the node number for the first group of panels is 1, then the second group of panels must be set to 1 + 12 = 13.
611	PART NO.OFFSET	The node No.offset of the partner boiler panels in a multi boiler plant must be entered in the menu item line. In case of a single boiler plant it is advisable also to enter the node number in this menu item line.
612	BAUD RATE	Speed of the signal transmission. The baud rate should be set as high as possible.
613	BURNER SYSTEM	Menu for setting additional regulation parameters.
614	MAN STEP	Defines the step size for the ramp function in manual operation. The value is added to or subtracted from the regulation output each time the soft keys for manual operation are pressed in the increase or decrease directions respectively. If the soft keys are continuously pressed, the load alteration increases rapidly because the step size will be continuously added or subtracted.
615	REDUCED PRS	Setting of the reduced pressure. If the boiler pressure is below the pressure set in this menu, the boiler load is limited by the setting in the menu config/burner system/load limit.
616	LOAD LIMIT	Setting of the maximum load limit. If the boiler pressure is below the pressure set in the menu config/burner system/reduced prs, the maximum load (oil flow) can be limited by the setting in this menu. This action contributes to a reduction of the pressure overswing during pressure rising.
617	TAU W.LEVEL	Makes an average value of the number of measurements which are set. The pick-up rate is in 1/100 sec. This prevents sudden uncontrolled regulations caused by a faulty measurement.
618	OIL SAMPLING	This menu item has no function and must be set to the default value.

Description of the menu item lines for a local panel (1 x MODUL.), continued		
619	BURNER OPTIONS	Menu for additional choice of equipment and pressure units.
620	PRESS UNIT	Selection of pressure units (bar, Mpa, or kg/cm^2).
621	OXYGEN	Additional choice of oxygen sensor equipment.
622	SMOKE MONITOR	Additional choice of smoke density equipment.
623	STEAM DUMP	Additional choice of steam dump equipment.
624	FW.PUMP CTRL	Additional choice of feed water pumps.
625	FW.REG.OUT.LIM	Limits for start/stop of feed water pumps in boiler plants with on/off feed water regulation. The entered value is divided into two equal levels that represent the start and stop set points below and above normal water level respectively.

Table 16

Description of the menu item lines for a local panel (1 x MODUL.), continued		
No.	**Menu item line**	**Description**
626	FW.OUTPUT CFG	Selection of I/P positioner for the feed water regulation. Some boiler plants may be provided with two feed water control valves of different sizes. If OFF is selected the output signal will only be active on I/P positioner 1 and If EXH is selected the output signal will only be active on I/P positioner 2. If OIL is selected the output signal will change between I/P positioner 1 and I/P positioner 2 depending on the burner state. When the burner is in operation I/P positioner 1 is active and when the burner is stopped I/P positioner 2 is active. Please note that if high pressure mode is selected, the output signal is maintained at the largest control valve.
627	FW.REG.TYPE	Selection of feed water regulation type between PID (ordinary regulation), 3PT (three point regulation), EXT (external regulation), or 2PT (two point regulation). In boiler plants that include pressure atomising burners only PID regulation should be selected.
628	W.CIRC.PUMPS	Additional choice of water circulation pumps by selecting number of pumps.
629	CHEM. PUMPS	Additional choice of chemical pumps by selecting number of pumps.
630	EXHAUST GAS	Additional choice of an exhaust gas boiler. This will only effect the graphic pictures for the PC monitoring and control system. If a PC is not provided this menu item has no function.
631	SALINITY	Additional choice of salinity alarm equipment. Selection between OFF, MON, and If MON is selected the control system only monitors the salinity equipment. If SUR is selected the alarm and shut down for the salinity equipment are also active.
632	TEMP. UPTAKE	Additional choice of uptake temperature measurement. Selection between OFF, MON, and If MON is selected the control system only monitors the uptake measurement. If SUR is selected the alarm and shut down for the uptake measurement are also active.
633	INERT GAS	Additional choice of inert gas mode.
634	KEY DISABLE	Disable the key operation lock. Operation can take place from all operation places. However, the time period for non-operation of the panels is still active. This timer can be set in the timer setup menu.
635	FLAME SURV. ON	Activates flame surveillance. If "early" is selected the flame surveillance is activated before continuing to step 5 (safety time) in the burner start-up sequence. If "late" is selected the flame surveillance is activated in step 5 (safety time).
636	WINDOWS	Selection of windows platform in connection with the PC monitoring and control system. If a PC is provided check the platform and set the same platform (win 2000/3.11) for the controller software in this menu point.
637	SMALL GUN	Additional choice of two burner lance operation. Selection between "no" or "yes". Note that this menu item line has no function for boiler plants that include pressure atomising burners.
638	F.OIL T.CTRL	Selection of on/off or PWR (pulse wide reg.) temperature regulation for pressure atomising burners. On/off should be selected for WH burners and PWR for KBO burners.
639	HOUR/START CNT.	Activation of hour counters.
640	BOOSTER PUMP	Additional choice of booster pump. Note only used for large pressure atomising burners
641	ANALOG OPTIONS	Menu for setting analogue inputs.
642	BOILER PRES	Activates or deactivates the analogue input for the boiler pressure transmitter. It should only be deactivated if the panel type is selected as EGB and the exhaust gas boiler is without separate steam space.
643	OIL PRESS NZ	Activates or deactivates the analogue input for the nozzle oil pressure transmitter. Some steam atomising burners may be provided with a pressure transmitter while others with a pressure gauge.
644	WATER LEVEL	Activates or deactivates the analogue input for the water level controller. It should only be deactivated if the panel type is selected as EGB and the exhaust gas boiler is without separate steam space.

Description of the menu item lines for a local panel (1 x MODUL.), continued		
645	DIFF.PRESS.	Activates or deactivates the analogue input for the differential pressure transmitter used for exhaust gas measurement if the panel type is selected as EGB. Some exhaust gas boilers may be provided with a differential pressure transmitter while others with a U-tube differential pressure gauge.
646	ME LOAD	Activates or deactivates the analogue input for main engine load if the panel type is selected as EGB.
647	EDIT TEXT	Menu for assigning new texts to existing alarms and shut downs. In the following menu item lines it is possible to enter new texts which can overwrite already existing alarm and shut down texts.
648	FREE TEXT	Indication of which editable text is currently edited (free text #xx). It is possible to enter 10 editable text lines each with a maximum of 20 characters.
649	[TYPED TEXT]	New text for the specific free text No. is indicated in this menu item line.

Table 17

Description of the menu item lines for a local panel (1 x MODUL.), continued		
No.	**Menu item line**	**Description**
650	[TEXT]	Line for keyboard from which characters are entered. Navigation on the keyboard is done with the left and right arrow keys. When the set key is pressed a character is entered and shown in the typed text menu item line. Shifting between free text lines is done with the "↑" and "↓" characters. When the editing of text is completed the "end" character must be activated to exit these menu item lines.
651	LINK TEXT	Menu for linking and clearing new alarm/shut down texts. The new texts entered in the "edit text" menu can be assigned to existing alarm and shut down numbers. By means of the set key each of the ten possible free text lines can be entered. At first selection is made between alarm link "AL.", shut down link "SD.", or no link "NO". Then the desired alarm or shut number is entered. Default numbers appear from the alarm and shut down lists. When a new free text has been linked and the specific alarm or shut down state arises it will be displayed in the surveillance menu. The new text as well as free text number and link number are indicated. Note that any entered texts and links will only be displayed on the local panels, and not on a connected PC. Entered texts and links can be erased by means of the clear function. Here selection is made between clearing all texts "text", all link info "link", or both "all". If "all" is selected the system is set back to the default values for alarm and shut down texts.
652	[#01 FREE TEXT]	Setting of link info (alarm link, shut down link, or no link) and number (alarm No. or shut down No.) for entered free text number 01.
653	[#02 FREE TEXT]	Setting of link info (alarm link, shut down link, or no link) and number (alarm No. or shut down No.) for entered free text number 02.
654	[#03 FREE TEXT]	Setting of link info (alarm link, shut down link, or no link) and number (alarm No. or shut down No.) for entered free text number 03.
655	[#04 FREE TEXT]	Setting of link info (alarm link, shut down link, or no link) and number (alarm No. or shut down No.) for entered free text number 04.
656	CLEAR	Clearing of texts, link info, or both.
657	LANGUAGE	Menu for language and LCD display contrast selection.
658	CONTRAST	Setting of the light contrast in the LCD display.
659	LANGUAGE	It is only possible to choose GB (English).

Table 18

MENU TREE FOR BOILER PLANT (LOCAL PANEL)									Version no/data: 6.08/071004		Burnertype: All		Platform: All				Settings: All	
LINE NO.					FRONT MENU	LOCK MENU	MAIN MENU	SUB MENU LEVEL 1	SUB MENU LEVEL 2	SUB MENU LEVEL 3	SUB MENU LEVEL 4	[VAL]	PASSW.	LOWEST	HIGHEST	DEFAULT	COMMISSIONING
-					[SELECT 1]							N					
-					[SELECT 2]							N					
-					[SELECT 3]							N					
-					[STATE]							N					
-					[STATE][LOAD]							N					
-					[STATE][LOAD%]							N					
-						KEY POSITION						N					
-						REQUEST KEY						N					
-						[STATE]						N					
-						[STATE][LOAD]						N					
-						[STATE][LOAD%]						N					
1							BOILER										
1		2						BOILER PRES				N BAR					
1	-	2	-	1							HI.SHT.DWN.	N BAR	pw:cu	lo: 0	hi: 27	def: 8.5	
1	-	2	-	2							HIGH ALARM	N BAR	pw:cu	lo: 0	hi: 27	def: 8.3	
1	-	2	-	3							LOW ALARM	N BAR	pw:cu	lo: 0	hi: 27	def: 4	
1	-	2	-	7							ACTUAL SP.	N BAR	np				
1	-	2	-	8							SETP.	N BAR	pw:cu	lo: 0	hi: 27	def: 7	
1	-	2	-	9							SETP.HIGH	N BAR	pw:cu	lo: 0	hi: 27	def: 16	
1	-	2	-	10							P	N	pw:cu	lo: 0.1	hi: 10	def: 5	
1	-	2	-	11							T.SAMPLE	N SEC	pw:cu	lo: 0.1	hi: 10	def: 1	
1	-	2	-	12							T.INT.	N SEC	pw:cu	lo: 0.5	hi: 999.9	def: 10	
1	-	2	-	13							T.DIFF.	N SEC	pw:cu	lo: -100	hi: 100	def: 0	
1	-	2	-	14							REG OUTPUT	N %	np				
1	-	2	-	15							NEUTRALZONE	N BAR	pw:cu	lo: 0	hi: 5	def: 0,5	
1	-	2	-	16							REMOTE CTRL	N	pw:cu				
1	-	3						WATER LEVEL				N mm					
1	-	3	-	1							HI.SHT.DWN.	N mm	pw:cu	lo: -1000	hi: 1500	def: 250	
1	-	3	-	2							HIGH ALARM	N mm	pw:cu	lo: -1000	hi: 1500	def: 150	
1	-	3	-	3							LOW ALARM	N mm	pw:cu	lo: -1000	hi: 1500	def: -100	
1	-	3	-	4							LO.SHT.DWN.	N mm	pw:cu	lo: -1000	hi: 1500	def: -150	
1	-	3	-	12							ACTUAL SP.	N mm	np				
1	-	3	-	13							SETP.OFFSET	N mm	np				
1	-	3	-	14							SETP.	N mm	pw:cu	lo: -1000	hi: 1500	def: -30	
1	-	3	-	15							SETP.HIGH	N mm	pw:cu	lo: -1000	hi: 1500	def: 0	
1	-	3	-	9							DEADZONE	N mm	pw:cu	lo: 0	hi: 100	def: 0	
1	-	3	-	10							I-LOW LIMIT	N mm	pw:cu	lo: 0	hi: 1	def: 0	
1	-	3	-	11							I-HIGH LIMIT	N mm	pw:cu	lo: 0	hi: 1	def: 0	
1	-	3	-	16							P	N	pw:cu	lo: 0.1	hi: 10	def: 3	
1	-	3	-	17							T.SAMPLE	N SEC	pw:cu	lo: 0.1	hi: 10	def: 0.5	
1	-	3	-	18							T.INT.	N SEC	pw:cu	lo: 0.5	hi: 999.9	def: 130	
1	-	3	-	19							T.DIFF.	N SEC	pw:cu	lo: -100	hi: 100	def: 0	
1	-	3	-	20							P.PART	N %	np				
1	-	3	-	21							I.PART	N %	np				
1	-	3	-	22							D.PART	N %	np				
1	-	3	-	23							REG OUTPUT	N %	np				
1	-										REMOTE CTRL	N %	np				
1	-										NORMAL LIMIT	N mm	np	lo: -100	hi: 100	def: 0	
1	-	3	-	24							STBY LIMIT	N mm	np	lo: -100	hi: 100	def: 0	
1	-	4	-	1				WATER FLOW				N					
1	-	4	-	2							ACTUAL SP.	N	np				
1	-	4	-	3							P	N	pw:cu	lo: 0,1	hi: 10	def: 0,3	
1	-	4	-	4							T.SAMPLE	N SEC	pw:cu	lo: 0,1	hi: 10	def: 0,5	
1	-	4	-	5							T.INT.	N SEC	pw:cu	lo: 0.5	hi: 999.9	def: 7	
1	-	4	-	6							T.DIFF.	N SEC	pw:cu	lo: -100	hi: 100	def: 0	
1	-	4	-	7							REG OUTPUT	N %					
1	-	5	-	1				COMMON PRES				N BAR					
1	-	5	-	2							HI.SHT.DWN.	N BAR	pw:cu	lo: 0	hi: 27	def: 8.5	

MENU TREE FOR BOILER PLANT (LOCAL PANEL)				Version no/data: 6.08/071004				Burnertype: All		Platform: All				Settings: All	
LINE NO.	FRONT MENU	LOCK MENU	MAIN MENU	SUB MENU LEVEL 1	SUB MENU LEVEL 2	SUB MENU LEVEL 3	SUB MENU LEVEL 4	[VAL]	PASSW.	LOWEST	HIGHEST	DEFAULT	COMMISSIONING
1 - 5 - 3							LOW ALARM	N BAR	pw:cu	lo: 0	hi: 27	def: 4	
1 - 5 - 6							ACTUAL SP.	N BAR					
1 - 5 - 7							SETP.	N BAR	pw:cu	lo: 0	hi: 27	def: 6	
1 - 5 - 8							SETP.HIGH	N BAR	pw:cu	lo: 0	hi: 27	def: 15	
1 - 5 - 9							P	N	pw:cu	lo: 0.1	hi: 10	def: 16	
1 - 5 - 10							T.SAMPLE	N SEC	pw:cu	lo: 0.1	hi: 10	def: 0.5	
1 - 5 - 11							T.INT.	N SEC	pw:cu	lo: 0.5	hi: 999.9	def: 60	
1 - 5 - 12							T.DIFF.	N SEC	pw:cu	lo: -100	hi: 100	def: 0	
1 - 5 - 13							REG OUTPUT	N %	np				
1 - 5 - 14							REMOTE CTRL	N	pw:cu				
1 - 6 - 1				TEMP. INLET				N ºC					
1 - 6 - 2							HI.SHT.DWN	N ºC	pw:cu	lo: 0	hi: 600	def: 450	
1 - 6 - 3							HIGH ALARM	N ºC	pw:cu	lo: 0	hi: 600	def: 450	
1 - 6 - 4							LOW ALARM	N ºC	pw:cu	lo: 0	hi: 600	def: 0	
1 - 6 - 5							LO.SHT.DWN	N ºC	pw:cu	lo: 0	hi: 600	def: 0	
1 - 7 - 1				TEMP. OUTLET				N ºC					
1 - 7 - 2							HI.SHT.DWN	N ºC	pw:cu	lo: 0	hi: 600	def: 450	
1 - 7 - 3							HIGH ALARM	N ºC	pw:cu	lo: 0	hi: 600	def: 450	
1 - 7 - 4							LOW ALARM	N ºC	pw:cu	lo: 0	hi: 600	def: 0	
1 - 7 - 5							LO.SHT.DWN	N ºC	pw:cu	lo: 0	hi: 600	def: 0	
1 - 8 - 1				DIFF. PRESS.				N mm					
1 - 8 - 2							HI.SHT.DWN	N mm	pw:cu	lo: 0	hi: 250	def: 150	
1 - 8 - 3							HIGH ALARM	N mm	pw:cu	lo: 0	hi: 250	def: 130	
1 - 8 - 4							LOW ALARM	N mm	pw:cu	lo: 0	hi: 250	def: 0	
1 - 8 - 5							LO.SHT.DWN	N mm	pw:cu	lo: 0	hi: 250	def: 0	
1 - 9 - 1				ME LOAD				N %					
1 - 9 - 2							HI.SHT.DWN	N %	pw:cu	lo: 0	hi: 110	def: 110	
1 - 9 - 3							HIGH ALARM	N %	pw:cu	lo: 0	hi: 110	def: 110	
1 - 9 - 4							LOW ALARM	N %	pw:cu	lo: 0	hi: 100	def: 0	
1 - 9 - 5							LO.SHT.DWN	N %	pw:cu	lo: 0	hi: 100	def: 0	
-				[STATE]				N					
-				[STATE][LOAD]				N					
-				[STATE][LOAD%]				N					
2 -			FUEL OIL										
2 - 1				F.OIL TEMP				N ºC					
2 - 1 - 1							HI.SHT.DWN.	N ºC	pw:cu	lo: 0	hi: 250	def: 145	
2 - 1 - 2							HIGH ALARM	N ºC	pw:cu	lo: 0	hi: 250	def: 140	
2 - 1 - 3							LOW ALARM	N ºC	pw:cu	lo: 0	hi: 250	def: 110	
2 - 1 - 4							LO.SHT.DWN.	N ºC	pw:cu	lo: 0	hi: 250	def: 95	
2 - 1 - 9							SETP.	N ºC	pw:cu	lo: 0	hi: 250	def: 130	
2							SETP. HIGH	N ºC	pw:cu	lo: 0	hi: 250	def: 130	
2 - 1 - 10							P	N	pw:cu	lo: 0.1	hi: 10	def: 2	
2 - 1 - 11							T.SAMPLE	N SEC	pw:cu	lo: 0.1	hi: 10	def: 0.5	
2 - 1 - 12							T.INT.	N SEC	pw:cu	lo: 0.5	hi: 999.9	def: 160	
2 - 1 - 13							T.DIFF.	N SEC	pw:cu	lo: -100	hi: 100	def: 0	
2 - 1 - 14							MIN PULSE	N SEC	pw:cu	lo: 0.2	hi: 5	def: 0.5	
2 - 1 - 15							RUN TIME	N SEC	pw:cu	lo: 10	hi: 180	def: 35	
2 - 1 - 16							REMOTE CTRL	N	pw:cu				
2 - 1 - 17							NEUTRALZONE	N ºC	pw:cu	lo: 0	hi: 10	def: 2	
2 - 2				F.OIL PRES				N BAR					
2 - 2 - 1							HI.SHT.DOWN	N BAR	pw:cu	lo: 0	hi: 40	def: 4	
2 - 2 - 1							LOW ALARM	N BAR	pw:cu	lo: 0	hi: 40	def: 1,5	
2 - 2 - 2							LOW ALARM	N BAR	pw:cu	lo: 0	hi: 40	def: 1,6	
2 - 2 - 3							LO.SHT.DWN.	N BAR	pw:cu	lo: 0	hi: 40	def: 1	
2 - 2 - 4							LO.SHT.DWN.	N BAR	pw:cu	lo: 0	hi: 40	def: 1,5	
2 - 2 - 9							SETP.	N BAR	pw:cu	lo: 0	hi: 40	def: 22	
2 - 2 - 10							I-LOW LIMIT	N	pw:cu	lo: 0	hi: 1	def: 1	
2 - 2 - 11							I-HIGH LIMIT	N	pw:cu	lo: 0	hi: 1	def: 1	

MENU TREE FOR BOILER PLANT (LOCAL PANEL)							Version no/data: 6.08/071004		Burnertype: All		Platform: All				Settings: All	
LINE NO.					FRONT MENU	LOCK MENU	MAIN MENU	SUB MENU LEVEL 1	SUB MENU LEVEL 2	SUB MENU LEVEL 3	SUB MENU LEVEL 4	[VAL]	PASSW.	LOWEST	HIGHEST	DEFAULT	COMMISSIONING
2	-	2	-	12							P	N	pw:cu	lo: 0.1	hi: 10	def: 1.5	
2	-	2	-	13							T.SAMPLE	N SEC	pw:cu	lo: 0.1	hi: 10	def: 0.5	
2	-	2	-	14							T.INT.	N SEC	pw:cu	lo: 0.5	hi: 999.9	def: 15	
2	-	2	-	15							T.DIFF.	N SEC	pw:cu	lo: -100	hi: 100	def: 0	
2	-	2	-	16							MIN PULSE	N SEC	pw:cu	lo: 0.2	hi: 50	def: 0.5	
2	-	2	-	17							RUN TIME	N SEC	pw:cu	lo: 10	hi: 180	def: 30	
2	-	2	-	18							REMOTE CTRL	N	pw:cu				
2	-	3						F.OIL FLOW				N %					
2	-	3	-	1							ACTUAL SP.	N %	np				
2	-	3	-	2							P	N	pw:cu	lo: 0.1	hi: 10	def: 0.4	
2	-	3	-	3							T.SAMPLE	N SEC	pw:cu	lo: 0.1	hi: 100	def: 0.5	
2	-	3	-	4							T.INT.	N SEC	pw:cu	lo: 0.5	hi: 999.9	def: 4	
2	-	3	-	5							T.DIFF.	N SEC	pw:cu	lo: -100	hi: 100	def: 0	
2	-	3	-	6							P.PART	N %	np				
2	-	3	-	7							I.PART	N %	np				
2	-	3	-	8							D.PART	N %	np				
2	-	3	-	9							MV SAVE	N %	np				
2	-	3	-	10							REG OUTPUT	N %	np				
2	-	3	-	11							REMOTE CTRL	N	pw:cu				
2	-	2						F.O. BURNER T				N BAR					
2	-	2	-	1							HI.SHT.DOWN	N BAR	pw:cu	lo: 0	hi: 250	def: 200	
2	-	2	-	3							LO.SHT.DWN.	N BAR	pw:cu	lo: 0	hi: 250	def: 95	
-	-	-	-	-				[STATE]					np				
-	-	-	-	-				[STATE][LOAD]				N	np				
-	-	-	-	-				[STATE][LOAD%]				N	np				
3							AIR										
3	-	1						AIR FLOW				N %					
3	-	1	-	1							LO.SHT.DWN.	N %	pw:cu	lo: 0	hi: 100	def: 5	
3	-	1	-	3							ACTUAL SP.	N %	np				
3	-	1	-	4							P	N	pw:cu	lo: 0.1	hi: 10	def: 0.4	
3	-	1	-	5							T.SAMPLE	N SEC	pw:cu	lo: 0.1	hi: 100	def: 0.5	
3	-	1	-	6							T.INT.	N SEC	pw:cu	lo: 0.5	hi: 999.9	def: 4	
3	-	1	-	7							T.DIFF.	N SEC	pw:cu	lo: -100	hi: 100	def: 0	
3	-	1	-	8							REG OUTPUT	N %	np				
3	-	1	-	9							REMOTE CTRL	N	pw:cu				
3	-	2	-	1				ATM.STM.PRS				N BAR					
3	-	2	-	2							LOW ALARM	N BAR	pw:cu	lo: 0	hi: 11	def: 2	
3	-	2	-	3							LO.SHT.DWN.	N BAR	pw:cu	lo: 0	hi: 11	def: 1.5	
3	-	2	-	6							ACTUAL SP.	N BAR	np				
3	-	2	-	7							P	N	pw:cu	lo: 0.01	hi: 10	def: 3.5	
3	-	2	-	8							T.SAMPLE	N SEC	pw:cu	lo: 0.5	hi: 999.9	def: 0.5	
3	-	2	-	9							T.INT.	N SEC	pw:cu	lo: 0.1	hi: 600	def: 3	
3	-	2	-	10							T.DIFF.	N SEC	pw:cu	lo: -100	hi: 100	def: 0	
3	-	2	-	11							MIN PULSE	N SEC	pw:cu	lo: 0.2	hi: 5	def: 0.5	
3	-	2	-	12							RUN TIME	N SEC	pw:cu	lo: 10	hi: 180	def: 35	
3	-	2	-	13							REG OUTPUT	N %	np				
3	-	2	-	14							REMOTE CTRL	N	pw:cu				
-	-	-	-	-				[STATE]				N	np				
-								[STATE][LOAD]									
-	-	-	-	-				[STATE][LOAD%]				N	np				
4	-	1	-				SERVO										
4	-	1						SERVO POS.				N %					
4	-	1	-	1							ACTUAL SP.	N %	np				
4	-	1	-	2							NEUTRALZONE	N %	pw:cu	lo: 0	hi: 100	def: 5	
4	-	1	-	3							REMOTE CTRL	N	pw:cu				
-	-	1	-					[STATE][LOAD]									
-	-	-	-	-				[STATE][LOAD%]				N	np				
4	-	1	-														

MENU TREE FOR BOILER PLANT (LOCAL PANEL)							Version no/data: 6.08/071004		Burnertype: All		Platform: All				Settings: All	
LINE NO.					FRONT MENU	LOCK MENU	MAIN MENU	SUB MENU LEVEL 1	SUB MENU LEVEL 2	SUB MENU LEVEL 3	SUB MENU LEVEL 4	[VAL]	PASSW.	LOWEST	HIGHEST	DEFAULT	COMMISSIONING
4	-	1						AIR SERVO				N %					
4	-	1	-	1							ACTUAL SP.	N %	np				
4	-	1	-	2							NEUTRALZONE	N %	pw:cu	lo: 0	hi: 100	def: 5	
4	-	1	-	3							P	N	pw:cu	lo: 0.01	hi: 10	def: 3.5	
4	-	1	-	4							T.SAMPLE	N SEC	pw:cu	lo: 0.5	hi: 999.9	def: 0.5	
4	-	1	-	5							T.INT	N SEC	pw:cu	lo: 0.1	hi: 600	def: 3	
4	-	1	-	6							T.DIFF	N SEC	pw:cu	lo: -100	hi: 100	def: 0	
4	-	1	-	7							MIN PULSE	N SEC	pw:cu	lo: 0.2	hi: 5	def: 0.5	
4	-	1	-	8							RUN TIME	N SEC	pw:cu	lo: 10	hi: 180	def: 35	
4	-	1	-								REG OUTPUT	N %	np				
4	-	1	-	3							REMOTE CTRL	N	pw:cu				
-	-	-	-	-				[STATE][LOAD%]				N	np				
4	-	1	-														
4	-	1						OIL SERVO				N %					
4	-	1	-	1							ACTUAL SP.	N %	np				
4	-	1	-	2							NEUTRALZONE	N %	pw:cu	lo: 0	hi: 100	def: 5	
4	-	1	-	3							P	N	pw:cu	lo: 0.01	hi: 10	def: 3.5	
4	-	1	-	4							T.SAMPLE	N SEC	pw:cu	lo: 0.5	hi: 999.9	def: 0.5	
4	-	1	-	5							T.INT	N SEC	pw:cu	lo: 0.1	hi: 600	def: 3	
4	-	1	-	6							T.DIFF	N SEC	pw:cu	lo: -100	hi: 100	def: 0	
4	-	1	-	7							MIN PULSE	N SEC	pw:cu	lo: 0.2	hi: 5	def: 0.5	
4	-	1	-	8							RUN TIME	N SEC	pw:cu	lo: 10	hi: 180	def: 35	
4	-	1	-								REG OUTPUT	N %	np				
4	-	1	-	3							REMOTE CTRL	N	pw:cu				
-	-	-	-	-				[STATE][LOAD%]				N	np				
5							COMBUST										
5	-	1						OIL PRESS N	½			N BAR	np				
5	-	1	-	1				SMK. DENSIT				N %					
5	-	1	-	1	-						HIGH ALARM	N %	pw:cu	lo: 0	hi: 100	def: 40	
5	-	1	-	2				OXYGEN				N %					
5	-	1	-	2	-						HIGH ALARM	N %	pw:cu	lo: 0,0	hi: 100,0	def: 100,0	
5	-	1	-	3				TEMP. UPTAK				N °C					
5	-	1	-	3	-						HI.SHT.DWN.	N °C	pw:cu	lo: 0	hi: 500	def: 450	
5	-	1	-	3	-						HIGH ALARM	N °C	pw:cu	lo: 0	hi: 500	def: 450	
5	-	2						WINDBOX				N °C					
5	-	2	-	1							HI.SHT.DOWN	N °C	pw:cu	lo: 0,0	hi: 400,0	def: 150	
5	-	2	-	1							HIGH ALARM	N °C	pw:cu	lo: 0,0	hi: 400,0	def: 140	
-	-	-	-	-	-			[STATE]					np				
-	-	-	-	-	-			[STATE][LOAD]				N	np				
-	-	-	-	-	-			[STATE][LOAD%]				N	np				
6							PARTNER						np				
6	-	1									1 BOILER PRES	N BAR	np				
6	-	2									2 WATER LEVEL	N mm	np				
6	-	3									3 F.OIL FLOW	N %	np				
6	-	4									4 AIR FLOW	N %	np				
6											5 OIL SERVO	N %	np				
6											6 AIR SERVO	N %	np				
6	-	5									7 ATM.STM.PRS	N BAR	np				
6	-	6									8 OIL PRS NZ.	N BAR	np				
6	-	7									9 OXYGEN	N %	np				
6	-	8									10 SMOKE DENS	N %	np				
6	-	9									11 INERT GAS	N	np				
6	-	10									12 STATE	N	np				
6	-	11									13 CTRL MODE	N	np				
7							CMN CTRL										
7	-	1						PUMP CTRL									
7	-	1	-	1	-				OIL PUMP				np				
7	-	1	-	1	-						F.O.PMP1 SEL.	N	np				

MENU TREE FOR BOILER PLANT (LOCAL PANEL)							Version no/data: 6.08/071004		Burnertype: All			Platform: All					Settings: All
LINE NO.					FRONT MENU	LOCK MENU	MAIN MENU	SUB MENU LEVEL 1	SUB MENU LEVEL 2	SUB MENU LEVEL 3	SUB MENU LEVEL 4	[VAL]	PASSW.	LOWEST	HIGHEST	DEFAULT	COMMISSIONING
7	-	1	-	1							STATE	N	np				
7	-	1	-	1							F.O.PMP2 SEL.	N	np				
7	-	1	-	1							STATE	N	np				
7	-	1	-	1							F.PMP1 REM START	N	np				
7	-	1	-	1							F.PMP1 REM STOP	N	np				
7	-	1	-	1							F.PMP2 REM START	N	np				
7	-	1	-	1							F.PMP2 REM STOP	N	np				
7	-	1	-	2					CHEM PMP				np				
7	-	1	-	2							CHEM PMP1	N	np				
7	-	1	-	2							CHEM PMP2	N	np				
7	-	1	-	3					WATER PUMP				np				
7	-	1	-	3						WATER PUMP			np				
7	-	1	-	3							PUMP 1_1 SEL.	N	np				
7	-	1	-	3							MODE	N	np				
7	-	1	-	3							STATE	N	np				
7	-	1	-	3							PUMP 1_2 SEL.	N	np				
7	-	1	-	3							MODE	N	np				
7	-	1	-	3							STATE	N	np				
7	-	1	-	3							PUMP 2_1 SEL.	N	np				
7	-	1	-	3							MODE	N	np				
7	-	1	-	3							STATE	N	np				
7	-	1	-	3							PUMP 2_2 SEL.	N	np				
7	-	1	-	3							MODE	N	np				
7	-	1	-	3							STATE	N	np				
7	-	1	-	3							F.PMP1 REM START	N	np				
7	-	1	-	3							F.PMP1 REM STOP	N	np				
7	-	1	-	3							F.PMP2 REM START	N	np				
7	-	1	-	3							F.PMP2 REM STOP	N	np				
7	-	1	-	3							F.PMP3 REM START	N	np				
7	-	1	-	3							F.PMP3 REM STOP	N	np				
7	-	1	-	3							F.PMP4 REM START	N	np				
7	-	1	-	3							F.PMP4 REM STOP	N	np				
7	-	1	-	3						CIRCULATION PUMP			np				
7	-	1	-	3							C.PMP1 SEL.	N	np				
7	-	1	-	3							STATE	N	np				
7	-	1	-	3							C.PMP2 SEL.	N	np				
7	-	1	-	3							STATE	N	np				
7	-	1	-	3							C.PMP1 REM START	N	np				
7	-	1	-	3							C.PMP1 REM STOP	N	np				
7	-	1	-	3							C.PMP2 REM START	N	np				
7	-	1	-	3							C.PMP2 REM STOP	N	np				
7	-	1	-	3						WATER PUMP EGB			np				
7	-	1	-	3							PUMP 5 SEL.	N	np				
7											MODE	N	np				
7											STATE	N	np				
7	-	1	-	3							PUMP 6 SEL.	N	np				
7	-	1	-	3							MODE	N	np				
7	-	1	-	3							STATE	N	np				
-	-	-	-	-						CHEM PMP							
-											CHEM PMP1	N	np				
7	-	2						SMOKE BLOW					np				
7	-	2	-	1							SMOKE BLOWER 1	N	np			def: ON	
7	-	3						STEAM DUMP									
7	-	3	-	1					STEAM DUMP			N BAR					
7	-	3	-	1							HI.SHT.DWN	N BAR	pw:cu	lo: 0	hi: 27	def: 8.5	
7	-	3	-	1							LOW ALARM	N BAR	pw:cu	lo: 0	hi: 27	def: 4	
7	-	3	-	1							ACTUAL SP.	N BAR	pw:cu	lo: 0	hi: 27	def: 8	
7	-	3	-	1							SETP.	N BAR	pw:cu	lo: 0	hi: 27	def: 8	

MENU TREE FOR BOILER PLANT (LOCAL PANEL)								Version no/data: 6.08/071004	Burnertype: All		Platform: All				Settings: All	
LINE NO.					FRONT MENU	LOCK MENU	MAIN MENU	SUB MENU LEVEL 1	SUB MENU LEVEL 2	SUB MENU LEVEL 3	SUB MENU LEVEL 4	[VAL]	PASSW.	LOWEST	HIGHEST	DEFAULT	COMMISSIONING
7	- 3	- 1	-								SETP.HIGH	N BAR	pw:cu	lo: 0	hi: 27	def: 8	
7	- 3	- 1	-								P	N	pw:cu	lo: 0.1	hi: 10	def: 5	
7	- 3	- 1	-								T.SAMPLE	N SEC	pw:cu	lo: 0.1	hi: 10	def: 0.5	
7	- 3	- 1	-								T.INT.	N SEC	pw:cu	lo: 0.5	hi: 999.9	def: 3	
7	- 3	- 1	-								T.DIFF	N SEC	pw:cu	lo: -100	hi: 100	def: 0	
7	- 3	- 1	-								REG OUTPUT	N %	np				
7	- 3	- 1	-								REMOTE CTRL.	N	pw:cu				
-	- -	- -	-						[STATE]				np				
-	- -	- -	-						[STATE][LOAD]			N	np				
-	- -	- -	-						[STATE][LOAD%]			N	np				
7	- 4							SALINITY									
7	- 4	- 1	-						SALINITY			N ppm					
7	- 4	- 1	-								HI.SHT.DWN.	N ppm	pw:cu	lo: 0	hi: 50	def: 25	
7	- 4	- 1	-								HIGH ALARM	N ppm	pw:cu	lo: 0	hi: 50	def: 15	
-	- -	- -	-						[STATE]				np				
-	- -	- -	-						[STATE][LOAD]			N	np				
-	- -	- -	-						[STATE][LOAD%]			N	np				
7	- 5							INERT GAS									
7	- 5	- 1	-								MIN LOAD	N %	pw:cu	lo: 0	hi: 100	def: 40	
7	- 5	- 2									FORCE	N	pw:cu				
7	- 6							FEED WATER	(3pt. texts / 2pt. texts)								
7	- 6	- 1							VALVE CORRECTION / CURVE FUNCTION		(3pt. texts / 2pt. texts)						
7	- 6	- 1	-								FW OUTPUT /	N %	np				
7	- 6	- 1	-								FW OPEN /	N	np				
7	- 6	- 1	-								0%FW OPEN / 0%	N %	pw:cu	lo: 0	hi: 250	def: 0	
7	- 6	- 1	-								10%FW OPEN / 10%	N %	pw:cu	lo: 0	hi: 250	def: 10	
7	- 6	- 1	-								20%FW OPEN / 20%	N %	pw:cu	lo: 0	hi: 250	def: 20	
7	- 6	- 1	-								30%FW OPEN / 30%	N %	pw:cu	lo: 0	hi: 250	def: 30	
7	- 6	- 1	-								40%FW OPEN / 40%	N %	pw:cu	lo: 0	hi: 250	def: 40	
7	- 6	- 1	-								50%FW OPEN / 50%	N %	pw:cu	lo: 0	hi: 250	def: 50	
7	- 6	- 1	-								60%FW OPEN / 60%	N %	pw:cu	lo: 0	hi: 250	def: 60	
7	- 6	- 1	-								70%FW OPEN / 70%	N %	pw:cu	lo: 0	hi: 250	def: 70	
7	- 6	- 1	-								80%FW OPEN / 80%	N %	pw:cu	lo: 0	hi: 250	def: 80	
7	- 6	- 1	-								90%FW OPEN / 90%	N %	pw:cu	lo: 0	hi: 250	def: 90	
7	- 6	- 1	-								100%FW OPEN /	N %	pw:cu	lo: 0	hi: 250	def: 100	
7	- 6	- 2							CONSTANT								
7	- 6	- 2	-								CALC.METHOD	N	pw:cu			def:ADD	
7	- 6	- 2	-								CALC.FLOW	N	pw:cu				
7	- 6	- 2	-								FLOW INPUT	N	pw:cu			def:STM	
7	- 6	- 2	-								FOLLOW OIL.V	N	pw:cu			def:NO	
7	- 6	- 2	-								AV.TIME 1/10S	N	pw:cu	lo:0	hi: 64	def:20	
7	- 6	- 2	-								W.OUT.RAMP	N %	pw:cu	lo: 1	hi: 100	def: 10	
7	- 6	- 2	-								FLOW ERROR	N	pw:cu	lo: 0	hi: 300	def: 10	
7	- 6	- 2	-								FLOW OFFSET	N	pw:cu	lo: 0	hi: 10	def: 1	
7	- 6	- 2	-								W.REG.RAMP	N mm	pw:cu	lo: 0,1	hi: 2	def: 1	
7	- 6	- 2	-								WL.REG.MAX	N %	pw:cu	lo: -100	hi: 100	def: 30	
7	- 6	- 2	-								WL.REG.MIN	N %	pw:cu	lo: -100	hi: 100	def: -30	
7	- 7	- 3							PID PARAMETERS								
7	- 7	- 3	-								1:P	N	pw:cu	lo: 0.1	hi: 10	def: 3	
7	- 7	- 3	-								1:T.SAMPLE	N SEC	pw:cu	lo: 0.1	hi: 10	def: 0.5	
7	- 7	- 3	-								1:T.INT.	N SEC	pw:cu	lo: 0.5	hi: 999.9	def: 130	
7	- 7	- 3	-								1:T.DIFF.	N SEC	pw:cu	lo: -100	hi: 100	def: 0	
7	- 7	- 3	-								2:P	N	pw:cu	lo: 0.1	hi: 10	def: 3	
7	- 7	- 3	-								2:T.SAMPLE	N SEC	pw:cu	lo: 0.1	hi: 10	def: 0.5	
7	- 7	- 3	-								2:T.INT.	N SEC	pw:cu	lo: 0.5	hi: 999.9	def: 130	
7	- 7	- 3	-								2:T.DIFF.	N SEC	pw:cu	lo: -100	hi: 100	def: 0	
7	- 8							FD FAN CONTROL									
7	- 8	- 1	-								FORCED RUN	N	pw:cu			def: no	

MENU TREE FOR BOILER PLANT (LOCAL PANEL)							Version no/data: 6.08/071004	Burnertype: All		Platform: All				Settings: All	
LINE NO.	FRONT MENU	LOCK MENU	MAIN MENU	SUB MENU LEVEL 1	SUB MENU LEVEL 2	SUB MENU LEVEL 3	SUB MENU LEVEL 4	[VAL]	PASSW.	LOWEST	HIGHEST	DEFAULT	COMMISSIONING
7 - 9				AIR FLOW	(only if SMALL GUN								
7 - 9 - 1							LO.SHT.DWN.	N %	pw:cu	lo: 0	hi: 100	def: 5	
7 - 9 - 3							LO.SD.S.GUN.	N %	pw:cu	lo: 0	hi: 100	def: 5	
- - - - - -				[OIL OPERATION]					np				
- - - - - -				[SETPOINT SELECT]				N	np				
1				EGE, EGB									
1 2					WATER LEVEL			N mm					
1 - 2 - 2							HIGH ALARM	N mm	pw:cu	lo: 0	hi: 27	def: 8.3	
1 - 2 - 3							LOW ALARM	N mm	pw:cu	lo: 0	hi: 27	def: 4	
1 - 2 - 8							SETP.	N mm	pw:cu	lo: 0	hi: 27	def: 7	
1 - 2 - 9							SETP.HIGH	N mm	pw:cu	lo: 0	hi: 27	def: 16	
1 - 2 - 10							P	N	pw:cu	lo: 0.1	hi: 10	def: 5	
1 - 2 - 11							T.SAMPLE	N SEC	pw:cu	lo: 0.1	hi: 10	def: 1	
1 - 2 - 12							T.INT.	N SEC	pw:cu	lo: 0.5	hi: 999.9	def: 10	
1 - 2 - 13							T.DIFF.	N SEC	pw:cu	lo: -100	hi: 100	def: 0	
1 - 2 - 14							REG OUTPUT	N %	np				
1							NEUTRALZONE	N BAR	pw:cu	lo: 0	hi: 5	def: 0,5	
1							NORMAL LI	N mm	pw:cu	lo: -100	hi: 100	def: 50	
1 - 2 - 15							STBY LIMIT	N mm	pw:cu	lo: -100	hi: 100	def: 50	
1 - 3					BOILER PRES			N BAR					
1 - 3 - 2							HIGH ALARM	N BAR	pw:cu	lo: -1000	hi: 1500	def: 150	
1 - 3 - 3							LOW ALARM	N BAR	pw:cu	lo: -1000	hi: 1500	def: -100	
1 - 6 - 1					TEMP. INLET			N ºC					
1 - 6 - 2							HI.SHT.DWN	N ºC	pw:cu	lo: 0	hi: 600	def: 450	
1 - 7 - 1					TEMP. OUTLET			N ºC					
1 - 7 - 2							HI.SHT.DWN	N ºC	pw:cu	lo: 0	hi: 600	def: 450	
1					ME LOAD			N %					
1							SETP.	N %	pw:cu	lo: 0	hi: 100	def: 50	
1				ALARM GROUPS	SHUTDOWN								
1 2													
1					ALARM								
1													
1				AUXILLARY			AUX. PMP SEL.						
1							STATE						
8			SURVEIL						np				
8 - 1				SHT.DWN. INSPECTION					np				
8 - 1 - 1							[SHT.DWN. NUM]	N	np				
8 - 1 - 2							[SHT.DWN. TEXT]	N	np				
8 - 2				ALARM INSPECTION					np				
8 - 2 - 1							[ALARM NUM]	N	np				
8 - 2 - 2							[ALARM TEXT]	N	np				
9			SETUP										
9 - 1				CTRL MODE					np				
9 - 1 - 1							BURNER CTRL MODE	N	np				
9 - 1 - 2							SYSTEM CTRL	N	np				
9 - 1 - 3							SETPOINT SELECT	N	np				
9 - 2 - 3					TIMERS SETUP								
9 - 2 - 3 -						SEQUENCE							
9 - 2 - 3 -							0 START START	N SEC	pw:cu	lo: 0	hi: 3600	def: 1200	
9 - 2 - 3 -							1 AIR SERVO	N SEC	pw:cu	lo: 0	hi: 3600	def: 60	
9 - 2 - 3 -							2 OIL SERVO	N SEC	pw:cu	lo: 0	hi: 3600	def: 60	
9 - 2 - 3 -							3 IGNITER POS	N SEC	pw:cu	lo: 0	hi: 3600	def: 10	
9 - 2 - 3 -							4 FD.FAN ST.	N SEC	pw:cu	lo: 1	hi: 3600	def: 25	
9 - 2 - 3 -							5 PURGE	N SEC	pw:su	lo: 23	hi: 3600	def: 60	
9 - 2 - 3 -							6 IGNITION	N SEC	pw:cu	lo: 1	hi: 30	def: 10	
9 - 2 - 3 -							7 SAFETY TIME	N SEC	pw:su	lo: 2	hi: 15	def: 5	
9 - 2 - 3 -							8 START SEQ	N SEC	pw:cu	lo: 1	hi: 3600	def: 180	
9 - 2 - 3 -							9 FLAME STAB.	N SEC	pw:cu	lo: 1	hi: 120	def: 10	

MENU TREE FOR BOILER PLANT (LOCAL PANEL)					Version no/data: 6.08/071004			Burnertype: All			Platform: All				Settings: All	
LINE NO.	FRONT MENU	LOCK MENU	MAIN MENU	SUB MENU LEVEL 1	SUB MENU LEVEL 2	SUB MENU LEVEL 3	SUB MENU LEVEL 4	[VAL]	PASSW.	LOWEST	HIGHEST	DEFAULT	COMMISSIONING
9 - 2 - 3 -							10 LOW FIRING	N SEC	pw:cu	lo: 1	hi: 120	def: 10	
9 - 2 - 3 -							11 RISING TIME	N SEC	pw:cu	lo: 300	hi: 3600	def: 600	
9 - 2 - 3 -							12 STEAM PG.PO	N SEC	pw:cu	lo: 5	hi: 120	def: 20	
9 - 2 - 3 -							13 STEAM PURG1	N SEC	pw:cu	lo: 1	hi: 120	def: 30	
9 - 2 - 3 -							14 STEAM PURG2	N SEC	pw:cu	lo: 1	hi: 1200	def: 20	
9							15 POSTPURGE	N SEC	np	lo: 1	hi: 1200	def: 0	
9							16 IG.PURGE VLV	N SEC	np	lo: 0	hi: 10	def: 10	
9							17 OIL CIRC T.	N SEC	pw:cu	lo: 1	hi: 300	def: 60	
9 - 2 - 3 -						SURVEILLANCE							
9 - 2 - 3 -							0 AIRFAN STAR	N SEC	pw:cu	lo: 5	hi: 120	def: 20	
9 - 2 - 3 -							1 WATER HI.SD	N SEC	pw:cu	lo: 0	hi: 120	def: 5	
9 - 2 - 3 -							2 WATER HI.AL	N SEC	pw:su	lo: 0	hi: 120	def: 5	
9 - 2 - 3 -							3 WATER.LO.AL	N SEC	pw:su	lo: 0	hi: 120	def: 5	
9 - 2 - 3 -							4 WATER LO.SD	N SEC	pw:cu	lo: 0	hi: 60	def: 5	
9 - 2 - 3 -							5 WATER SW LO	N SEC	pw:cu	lo: 0	hi: 60	def: 5	
9 - 2 - 3 -							6 OIL VLV CLS	N SEC	pw:cu	lo: 1	hi: 30	def: 3	
9 - 2 - 3 -							7 IGNITER OUT	N SEC	pw:cu	lo: 0	hi: 3600	def: 50	
9 - 2 - 3 -							8 PMS FEEDBAC	N SEC	pw:cu	lo: 0	hi: 1200	def: 160	
9 - 2 - 3 -							9 SERVO POS	N SEC	pw:su	lo: 1	hi: 1200	def: 120	
9 - 2 - 3 -							10 B.MOT.STAR	N SEC	pw:su	lo: 1	hi: 30	def: 10	
9 - 2 - 3 -							11 W. REG OUT	N SEC	pw:su	lo: 1	hi: 120	def: 10	
9 - 2 - 3 -							12 SMOKE HI.AL	N SEC	pw:su	lo: 0	hi: 60	def: 20	
9 - 2 - 3 -							13 TEMP HI.AL.	N SEC	pw:su	lo: 0	hi: 60	def: 15	
9 - 2 - 3 -							14 TEMP.HI.SD.	N SEC	pw:cu	lo: 0	hi: 60	def: 10	
9 - 2 - 3 -							15 KEY HOLD	N SEC	pw:su	lo: 60	hi: 3600	def: 60	
9 - 2 - 3 -							16 AIR FLOW LO	N SEC	pw:cu	lo: 0	hi: 30	def: 5	
9 - 2 - 3 -							17 CIRC LO.FLOW	N SEC	pw:cu	lo: 0	hi: 60	def: 10	
9 - 2 - 3 -							18 BOOST.M.ST	N SEC	pw:cu	lo: 1	hi: 30	def: 10	
9 - 2 - 3 -							19 L. COMB AIR	N SEC	pw:cu	lo: 0	hi: 60	def: 10	
9 - 2 - 3 -							20 LOW ATM PR.	N SEC	pw:cu	lo: 0	hi: 60	def: 5	
9 - 2 - 3 -							21 CUP CLEANER	N SEC	pw:cu	lo: 0	hi: 600	def: 120	
9 - 2 - 3 -							22 EGB LO.LE	N SEC	½	lo: 1	hi: 120	def: 5	
9 - 2 - 3 -							23 EGB HI.LE	N SEC	½	lo: 1	hi: 120	def: 5	
9 - 2 - 3 -							24 OXYGEN	N SEC	not used				
9 - 2 - 3 -							25 T.IL.HI.AL.	N SEC	pw:cu	lo: 0	hi: 60	def: 10	
9 - 2 - 3 -							26 T.OL.HI.AL.	N SEC	pw:cu	lo: 0	hi: 60	def: 10	
9 - 2 - 3 -							27 W.L.C.NO	N SEC	pw:cu	lo: 1	hi: 120	def: 2	
9 - 2 - 3 -							28 W.L.C.STBY	N SEC	pw:cu	lo: 1	hi: 120	def: 2	
9 - 2 - 3 -							29 DF.PR.HI.AL	N SEC	pw:cu	lo: 0	hi: 60	def: 10	
9 - 2 - 3 -						SHARED							
9 - 2 - 3 -							0 SAL HI.AL.	N SEC	pw:su	lo: 0	hi: 60	def: 15	
9 - 2 - 3 -							1 SAL HI.SD.	N SEC	pw:cu	lo: 0	hi: 60	def: 10	
9 - 2 - 3 -							2 OIL LO.AL.	N SEC	pw:cu	lo: 0	hi: 60	def: 10	
9 - 2 - 3 -						POWER PANEL 1							
9 - 2 - 3 -							0 F.O.PMP 1	N SEC	pw:cu	lo: 1	hi: 120	def: 15	
9 - 2 - 3 -							1 F.O.PMP 2	N SEC	pw:cu	lo: 1	hi: 120	def: 15	
9 - 2 - 3 -							2 FUEL PRESS	N SEC	pw:cu	lo: 1	hi: 30	def: 2	
9 - 2 - 3 -							3 F.O.PMP DEL	N SEC	pw:cu	lo: 1	hi: 3600	def: 60	
9 - 2 - 3 -							4 DO TO HFO	N SEC	pw:cu	lo: 1	hi: 1200	def: 300	
9 - 2 - 3 -							5 HFO TO DO	N SEC	pw:cu	lo: 1	hi: 1200	def: 300	
9 - 2 - 3 -							6 KEY TIMEOUT	N SEC	pw:cu	lo: 15	hi: 100	def: 45	
9 - 2 - 1 -							7 F.W.PMP 1	N SEC	np				
9 - 2 - 1 -							8 F.W.PMP 2	N SEC	np				
9 - 2 - 1 -							9 F.W. DELAY	N SEC	np				
9 - 2 - 1 -							10 F.W. M. RUN	N SEC	np				
9 - 2 - 1 -							11 F.W. DELAY2	N SEC	np				
9 - 2 - 1 -							12 C.PUMP 1	N SEC	np				
9							13 C.PUMP 2	N SEC	np				

MENU TREE FOR BOILER PLANT (LOCAL PANEL)					Version no/data: 6.08/071004			Burnertype: All			Platform: All				Settings: All	
LINE NO.	FRONT MENU	LOCK MENU	MAIN MENU	SUB MENU LEVEL 1	SUB MENU LEVEL 2	SUB MENU LEVEL 3	SUB MENU LEVEL 4	[VAL]	PASSW.	LOWEST	HIGHEST	DEFAULT	COMMISSIONING
9							14 HI OIL PRS	N SEC	np				
9 - 2 - 1							15 F.W.PMP 5	N SEC	np				
9 - 2 - 1							16 F.W.PMP 6	N SEC	np				
9							17 W.L.C NO EGB	N SEC	pw:cu	lo: 1	hi: 120	def: 2	
9							18 W.L.C STBY EGB	N SEC	pw:cu	lo: 1	hi: 120	def: 2	
9							19 W. REG OUT EGB	N SEC	pw:cu	lo: 1	hi: 120	def: 10	
9							20 AUX PMP START	N SEC	pw:cu	lo: 1	hi: 120	def: 15	
9							21 AUX PMP DELAY	N SEC	pw:cu	lo: 1	hi: 120	def: 10	
9							22 F.O.PRE.SHT	N SEC	pw:cu	lo: 1	hi: 60	def: 3	
9 - 2 - 3						POWER PANEL 2							
9 - 2 - 3							0 F.W.PMP 1	N SEC	pw:cu	lo: 1	hi: 120	def: 15	
9 - 2 - 3							1 F.W.PMP 2	N SEC	pw:cu	lo: 1	hi: 120	def: 15	
9 - 2 - 3							2 F.W.PMP 3	N SEC	pw:cu	lo: 1	hi: 120	def: 15	
9 - 2 - 3							3 F.W.PMP 4	N SEC	pw:cu	lo: 1	hi: 120	def: 15	
9 - 2 - 3							4 F.W. DELAY	N SEC	pw:cu	lo: 1	hi: 3600	def: 60	
9 - 2 - 3							5 F.W. M. RUN	N SEC	pw:cu	lo: 1	hi: 3600	def: 60	
9 - 2 - 3							6 F.W. DELAY2	N SEC	pw:su	lo: 1	hi: 3600	def: 60	
9 - 2 - 3							7 C.PUMP 1	N SEC	pw:cu	lo: 1	hi: 120	def: 15	
9 - 2 - 3							8 C.PUMP 2	N SEC	pw:cu	lo: 1	hi: 120	def: 15	
9 - 2 - 3						COMMUNICATION							
9 - 2 - 3							0 PANEL1 OFFL	N SEC	pw:su	lo: 1	hi: 30	def: 10	
9 - 2 - 3							1 PANEL2 OFFL	N SEC	pw:su	lo: 1	hi: 30	def: 10	
9 - 2 - 3							2 PARTNER OFF	N SEC	pw:cu	lo: 1	hi: 30	def: 10	
9 - 2 - 4						EGB PANEL TIMERS			np				
9 - 2 - 4							0 KEY TIME OUT	N SEC	pw:cu	lo: 15	hi: 100	def: 45	
9 - 2 - 4							1 KEY HOLD	N SEC	pw:su	lo: 60	hi: 3600	def: 60	
9 - 2 - 4							2 W. REG OUT	N SEC	pw:su	lo: 1	hi: 120	def: 30	
9 - 2 - 4							3 F.W.PMP 1	N SEC	pw:cu	lo: 1	hi: 120	def: 15	
9 - 2 - 4							4 F.W.PMP 2	N SEC	pw:cu	lo: 1	hi: 120	def: 15	
9 - 2 - 4							5 F.W.PMP 3	N SEC	pw:cu	lo: 1	hi: 120	def: 15	
9 - 2 - 4							6 F.W.PMP 4	N SEC	pw:cu	lo: 1	hi: 120	def: 15	
9 - 2 - 4							7 F.W. DELAY	N SEC	pw:cu	lo: 1	hi: 3600	def: 60	
9 - 2 - 4							8 F.W. M. RUN	N SEC	pw:cu	lo: 1	hi: 3600	def: 60	
9 - 2 - 4							9 F.W. DELAY2	N SEC	pw:su	lo: 1	hi: 3600	def: 60	
9 - 2 - 4							10 C.PUMP 1	N SEC	pw:cu	lo: 1	hi: 120	def: 15	
9 - 2 - 4							11 C.PUMP 2	N SEC	pw:cu	lo: 0	hi: 120	def: 15	
9 - 2 - 4							12 WATER HI.SD	N SEC	pw:cu	lo: 0	hi: 120	def: 5	
9 - 2 - 4							13 WATER HI.AL	N SEC	pw:su	lo: 0	hi: 120	def: 5	
9 - 2 - 4							14 WATER LO.AL	N SEC	pw:su	lo: 0	hi: 120	def: 5	
9 - 2 - 4							15 WATER LO.SD	N SEC	pw:cu	lo: 0	hi: 120	def: 5	
9 - 2 - 4							16 WATER SW LO	N SEC	pw:cu	lo: 0	hi: 60	def: 0	
9 - 2 - 4							17 T.IL.HI.AL.	N SEC	pw:cu	lo: 0	hi: 60	def: 10	
9 - 2 - 4							18 T.IL.HI.SD.	N SEC	pw:cu	lo: 0	hi: 60	def: 10	
9 - 2 - 4							19 T.IL.LO.AL.	N SEC	pw:cu	lo: 0	hi: 60	def: 10	
9 - 2 - 4							20 T.IL.LO.SD.	N SEC	pw:cu	lo: 0	hi: 60	def: 10	
9 - 2 - 4							21 T.OL.HI.AL.	N SEC	pw:cu	lo: 0	hi: 60	def: 10	
9 - 2 - 4							22 T.OL.HI.SD.	N SEC	pw:cu	lo: 0	hi: 60	def: 10	
9 - 2 - 4							23 T.OL.LO.AL.	N SEC	pw:cu	lo: 0	hi: 60	def: 10	
9 - 2 - 4							24 T.OL.LO.SD.	N SEC	pw:cu	lo: 0	hi: 60	def: 10	
9 - 2 - 4							25 DF.PR.HI.AL	N SEC	pw:cu	lo: 0	hi: 60	def: 10	
9 - 2 - 4							26 DF.PR.HI.SD	N SEC	pw:cu	lo: 0	hi: 60	def: 10	
9 - 2 - 4							27 DF.PR.LO.AL	N SEC	pw:cu	lo: 0	hi: 60	def: 10	
9 - 2 - 4							28 DF.PR.LO.SD	N SEC	pw:cu	lo: 0	hi: 60	def: 10	
9 - 2 - 4							29 ME.LO.HI.AL	N SEC	pw:cu	lo: 0	hi: 60	def: 10	
9 - 2 - 4							30 ME.LO.HI.SD	N SEC	pw:cu	lo: 0	hi: 60	def: 10	
9 - 2 - 4							31 ME.LO.LO.AL	N SEC	pw:cu	lo: 0	hi: 60	def: 10	
9 - 2 - 4							32 ME.LO.LO.SD	N SEC	pw:cu	lo: 0	hi: 60	def: 10	
9 - 2 - 4							32 ME SLOW DOW	N SEC	pw:cu	lo: 0	hi: 60	def: 10	

MENU TREE FOR BOILER PLANT (LOCAL PANEL)					Version no/data: 6.08/071004		Burnertype: All			Platform: All				Settings: All	
LINE NO.	FRONT MENU	LOCK MENU	MAIN MENU	SUB MENU LEVEL 1	SUB MENU LEVEL 2	SUB MENU LEVEL 3	SUB MENU LEVEL 4	[VAL]	PASSW.	LOWEST	HIGHEST	DEFAULT	COMMISSIONING
9 - 2 - 4						33 CIRC LO.FLO		N SEC	pw:cu	lo: 0	hi: 60	def: 3	
9 - 2 - 5					DATE/TIME								
9 - 2 - 5							HOUR	N	pw:no	lo: 0	hi: 23	def: 0	
9 - 2 - 5							MIN	N	pw:no	lo: 0	hi: 59	def: 0	
9 - 2 - 5							SEC	N	pw:no	lo: 0	hi: 59	def: 0	
9 - 2 - 5							DAY	N	pw:no	lo: 1	hi: 31	def: 0	
9 - 2 - 5							MONTH	N	pw:no	lo: 1	hi: 12	def: 0	
9 - 2 - 5							YEAR	N	pw:no	lo: 1992	hi: 2091	def: 0	
9 - 2 - 6					HOUR/START CNT								
9 - 2 - 6						NOZZLE 1							
9 - 2 - 6							NOZZLE 1						
9 - 2 - 6							TOT.HOUR	N HOUR	pw:su	lo: 0	hi: 30000	def: 0	
9 - 2 - 6							SRV.HOUR	N HOUR	pw:su	lo: 0	hi: 30000	def: 0	
9 - 2 - 6							SRV.VAL	N HOUR	pw:cu	lo: 0	hi: 22760	def: 0	
9 - 2 - 6							RESET	N	pw:cu				
9 - 2 - 6							TOT.START	N	pw:su	lo: 0	hi: 22760	def: 0	
9 - 2 - 6							SRV.START	N	pw:su	lo: 0	hi: 22760	def: 0	
9 - 2 - 6						NOZZLE 2							
9 - 2 - 6							NOZZLE 2						
9 - 2 - 6							TOT.HOUR	N HOUR	pw:su	lo: 0	hi: 30000	def: 0	
9 - 2 - 6							SRV.HOUR	N HOUR	pw:su	lo: 0	hi: 30000	def: 0	
9 - 2 - 6							SRV.VAL	N HOUR	pw:cu	lo: 0	hi: 22760	def: 0	
9 - 2 - 6							RESET	N	pw:cu				
9 - 2 - 6						LOAD >25%							
9 - 2 - 6							LOAD >25%						
9 - 2 - 6							TOT.HOUR	N HOUR	pw:su	lo: 0	hi: 30000	def: 0	
9 - 2 - 6							SRV.HOUR	N HOUR	pw:su	lo: 0	hi: 30000	def: 0	
9 - 2 - 6							SRV.VAL	N HOUR	pw:cu	lo: 0	hi: 22760	def: 0	
9 - 2 - 6							RESET	N	pw:cu				
9 - 2 - 6						LOAD >50%							
9 - 2 - 6							LOAD >50%						
9 - 2 - 6							TOT.HOUR	N HOUR	pw:su	lo: 0	hi: 30000	def: 0	
9 - 2 - 6							SRV.HOUR	N HOUR	pw:su	lo: 0	hi: 30000	def: 0	
9 - 2 - 6							SRV.VAL	N HOUR	pw:cu	lo: 0	hi: 22760	def: 0	
9 - 2 - 6							RESET	N	pw:cu				
9 - 2 - 6						LOAD >75%							
9 - 2 - 6							LOAD >75%						
9 - 2 - 6							TOT.HOUR	N HOUR	pw:su	lo: 0	hi: 30000	def: 0	
9 - 2 - 6							SRV.HOUR	N HOUR	pw:su	lo: 0	hi: 30000	def: 0	
9 - 2 - 6							SRV.VAL	N HOUR	pw:cu	lo: 0	hi: 22760	def: 0	
9 - 2 - 6							RESET	N	pw:cu				
9 - 2 - 6						LOAD							
9 - 2 - 6							LOAD						
9 - 2 - 6							TOT.HOUR	N HOUR	pw:su	lo: 0	hi: 30000	def: 0	
9 - 2 - 6							SRV.HOUR	N HOUR	pw:su	lo: 0	hi: 30000	def: 0	
9 - 2 - 6							SRV.VAL	N HOUR	pw:cu	lo: 0	hi: 22760	def: 0	
9 - 2 - 6							RESET	N	pw:cu				
9 - 2 - 6							TOT.START	N	pw:su	lo: 0	hi: 22760	def: 0	
9 - 2 - 6							SRV.START	N	pw:su	lo: 0	hi: 22760	def: 0	
9 - 2 - 6						SMOKE BLOW							
9 - 2 - 6							SMOKE BLOW						
9 - 2 - 6							TOT.HOUR	N HOUR	pw:su	lo: 0	hi: 30000	def: 0	
9 - 2 - 6							SRV.HOUR	N HOUR	pw:su	lo: 0	hi: 30000	def: 0	
9 - 2 - 6							SRV.VAL	N HOUR	pw:cu	lo: 0	hi: 22760	def: 0	
9 - 2 - 6							RESET	N	pw:cu				
9 - 2 - 6							TOT.START	N	pw:su	lo: 0	hi: 22760	def: 0	
9 - 2 - 6							SRV.START	N	pw:su	lo: 0	hi: 22760	def: 0	
9 - 2 - 6						BOOST PUMP							

MENU TREE FOR BOILER PLANT (LOCAL PANEL)				Version no/data: 6.08/071004				Burnertype: All		Platform: All				Settings: All	
LINE NO.	FRONT MENU	LOCK MENU	MAIN MENU	SUB MENU LEVEL 1	SUB MENU LEVEL 2	SUB MENU LEVEL 3	SUB MENU LEVEL 4	[VAL]	PASSW.	LOWEST	HIGHEST	DEFAULT	COMMISSIONING
9 - 2 - 6 -							BOOST PUMP						
9 - 2 - 6 -							TOT.HOUR	N HOUR	pw:su	lo: 0	hi: 30000	def: 0	
9 - 2 - 6 -							SRV.HOUR	N HOUR	pw:su	lo: 0	hi: 30000	def: 0	
9 - 2 - 6 -							SRV.VAL	N HOUR	pw:cu	lo: 0	hi: 22760	def: 0	
9 - 2 - 6 -							RESET	N	pw:cu				
9 - 2 - 6 -							TOT.START	N	pw:su	lo: 0	hi: 22760	def: 0	
9 - 2 - 6 -							SRV.START	N	pw:su	lo: 0	hi: 22760	def: 0	
9 - 2 - 6 -						COMBUST.FAN							
9 - 2 - 6 -							COMBUST.FAN						
9 - 2 - 6 -							TOT.HOUR	N HOUR	pw:su	lo: 0	hi: 30000	def: 0	
9 - 2 - 6 -							SRV.HOUR	N HOUR	pw:su	lo: 0	hi: 30000	def: 0	
9 - 2 - 6 -							SRV.VAL	N HOUR	pw:cu	lo: 0	hi: 22760	def: 0	
9 - 2 - 6 -							RESET	N	pw:cu				
9 - 2 - 6 -							TOT.START	N	pw:su	lo: 0	hi: 22760	def: 0	
9 - 2 - 6 -							SRV.START	N	pw:su	lo: 0	hi: 22760	def: 0	
9 - 2 - 6 -						BURN.MOTOR							
9 - 2 - 6 -							BURN.MOTOR						
9 - 2 - 6 -							TOT.HOUR	N HOUR	pw:su	lo: 0	hi: 30000	def: 0	
9 - 2 - 6 -							SRV.HOUR	N HOUR	pw:su	lo: 0	hi: 30000	def: 0	
9 - 2 - 6 -							SRV.VAL	N HOUR	pw:cu	lo: 0	hi: 22760	def: 0	
9 - 2 - 6 -							RESET	N	pw:cu				
9 - 2 - 6 -							TOT.START	N	pw:su	lo: 0	hi: 22760	def: 0	
9 - 2 - 6 -							SRV.START	N	pw:su	lo: 0	hi: 22760	def: 0	
9 - 2 - 6 -						IGNI.MOTOR							
9 - 2 - 6 -							IGNI.MOTOR						
9 - 2 - 6 -							TOT.HOUR	N HOUR	pw:su	lo: 0	hi: 30000	def: 0	
9 - 2 - 6 -							SRV.HOUR	N HOUR	pw:su	lo: 0	hi: 30000	def: 0	
9 - 2 - 6 -							SRV.VAL	N HOUR	pw:cu	lo: 0	hi: 22760	def: 0	
9 - 2 - 6 -							RESET	N	pw:cu				
9 - 2 - 6 -							TOT.START	N	pw:su	lo: 0	hi: 22760	def: 0	
9 - 2 - 6 -							SRV.START	N	pw:su	lo: 0	hi: 22760	def: 0	
9 - 2 - 6 -						FUEL PUMP 1							
9 - 2 - 6 -							FUEL PUMP 1						
9 - 2 - 6 -							TOT.HOUR	N HOUR	pw:su	lo: 0	hi: 30000	def: 0	
9 - 2 - 6 -							SRV.HOUR	N HOUR	pw:su	lo: 0	hi: 30000	def: 0	
9 - 2 - 6 -							SRV.VAL	N HOUR	pw:cu	lo: 0	hi: 22760	def: 0	
9 - 2 - 6 -							RESET	N	pw:cu				
9 - 2 - 6 -							TOT.START	N	pw:su	lo: 0	hi: 22760	def: 0	
9 - 2 - 6 -							SRV.START	N	pw:su	lo: 0	hi: 22760	def: 0	
9 - 2 - 6 -						FUEL PUMP 2							
9 - 2 - 6 -							FUEL PUMP 2						
9 - 2 - 6 -							TOT.HOUR	N HOUR	pw:su	lo: 0	hi: 30000	def: 0	
9 - 2 - 6 -							SRV.HOUR	N HOUR	pw:su	lo: 0	hi: 30000	def: 0	
9 - 2 - 6 -							SRV.VAL	N HOUR	pw:cu	lo: 0	hi: 22760	def: 0	
9 - 2 - 6 -							RESET	N	pw:cu				
9 - 2 - 6 -							TOT.START	N	pw:su	lo: 0	hi: 22760	def: 0	
9 - 2 - 6 -							SRV.START	N	pw:su	lo: 0	hi: 22760	def: 0	
9 - 2 - 6 -						CIRC.PUMP 1							
9 - 2 - 6 -							CIRC.PUMP 1						
9 - 2 - 6 -							TOT.HOUR	N HOUR	pw:su	lo: 0	hi: 30000	def: 0	
9 - 2 - 6 -							SRV.HOUR	N HOUR	pw:su	lo: 0	hi: 30000	def: 0	
9 - 2 - 6 -							SRV.VAL	N HOUR	pw:cu	lo: 0	hi: 22760	def: 0	
9 - 2 - 6 -							RESET	N	pw:cu				
9 - 2 - 6 -							TOT.START	N	pw:su	lo: 0	hi: 22760	def: 0	
9 - 2 - 6 -							SRV.START	N	pw:su	lo: 0	hi: 22760	def: 0	
9 - 2 - 6 -						CIRC.PUMP 2							
9 - 2 - 6 -							CIRC.PUMP 2						
9 - 2 - 6 -							TOT.HOUR	N HOUR	pw:su	lo: 0	hi: 30000	def: 0	

MENU TREE FOR BOILER PLANT (LOCAL PANEL)				Version no/data: 6.08/071004			Burnertype: All			Platform: All				Settings: All	
LINE NO.	FRONT MENU	LOCK MENU	MAIN MENU	SUB MENU LEVEL 1	SUB MENU LEVEL 2	SUB MENU LEVEL 3	SUB MENU LEVEL 4	[VAL]	PASSW.	LOWEST	HIGHEST	DEFAULT	COMMISSIONING
9 - 2 - 6 -							SRV.HOUR	N HOUR	pw:su	lo: 0	hi: 30000	def: 0	
9 - 2 - 6 -							SRV.VAL	N HOUR	pw:cu	lo: 0	hi: 22760	def: 0	
9 - 2 - 6 -							RESET	N	pw:cu				
9 - 2 - 6 -							TOT.START	N	pw:su	lo: 0	hi: 22760	def: 0	
9 - 2 - 6 -							SRV.START	N	pw:su	lo: 0	hi: 22760	def: 0	
9 - 2 - 6 -						CHEM.PUMP 1							
9 - 2 - 6 -							CHEM.PUMP 1						
9 - 2 - 6 -							TOT.HOUR	N HOUR	pw:su	lo: 0	hi: 30000	def: 0	
9 - 2 - 6 -							SRV.HOUR	N HOUR	pw:su	lo: 0	hi: 30000	def: 0	
9 - 2 - 6 -							SRV.VAL	N HOUR	pw:cu	lo: 0	hi: 22760	def: 0	
9 - 2 - 6 -							RESET	N	pw:cu				
9 - 2 - 6 -							TOT.START	N	pw:su	lo: 0	hi: 22760	def: 0	
9 - 2 - 6 -							SRV.START	N	pw:su	lo: 0	hi: 22760	def: 0	
9 - 2 - 6 -						CHEM.PUMP 2							
9 - 2 - 6 -							CHEM.PUMP 2						
9 - 2 - 6 -							TOT.HOUR	N HOUR	pw:su	lo: 0	hi: 30000	def: 0	
9 - 2 - 6 -							SRV.HOUR	N HOUR	pw:su	lo: 0	hi: 30000	def: 0	
9 - 2 - 6 -							SRV.VAL	N HOUR	pw:cu	lo: 0	hi: 22760	def: 0	
9 - 2 - 6 -							RESET	N	pw:cu				
9 - 2 - 6 -							TOT.START	N	pw:su	lo: 0	hi: 22760	def: 0	
9 - 2 - 6 -							SRV.START	N	pw:su	lo: 0	hi: 22760	def: 0	
9 - 2 - 6 -						F.W. PUMP 1							
9 - 2 - 6 -							F.W. PUMP 1						
9 - 2 - 6 -							TOT.HOUR	N HOUR	pw:su	lo: 0	hi: 30000	def: 0	
9 - 2 - 6 -							SRV.HOUR	N HOUR	pw:su	lo: 0	hi: 30000	def: 0	
9 - 2 - 6 -							SRV.VAL	N HOUR	pw:cu	lo: 0	hi: 22760	def: 0	
9 - 2 - 6 -							RESET	N	pw:cu				
9 - 2 - 6 -							TOT.START	N	pw:su	lo: 0	hi: 22760	def: 0	
9 - 2 - 6 -							SRV.START	N	pw:su	lo: 0	hi: 22760	def: 0	
9 - 2 - 6 -						F.W. PUMP 2							
9 - 2 - 6 -							F.W. PUMP 2						
9 - 2 - 6 -							TOT.HOUR	N HOUR	pw:su	lo: 0	hi: 30000	def: 0	
9 - 2 - 6 -							SRV.HOUR	N HOUR	pw:su	lo: 0	hi: 30000	def: 0	
9 - 2 - 6 -							SRV.VAL	N HOUR	pw:cu	lo: 0	hi: 22760	def: 0	
9 - 2 - 6 -							RESET	N	pw:cu				
9 - 2 - 6 -							TOT.START	N	pw:su	lo: 0	hi: 22760	def: 0	
9 - 2 - 6 -							SRV.START	N	pw:su	lo: 0	hi: 22760	def: 0	
9 - 2 - 6 -						F.W. PUMP 3							
9 - 2 - 6 -							F.W. PUMP 3						
9 - 2 - 6 -							TOT.HOUR	N HOUR	pw:su	lo: 0	hi: 30000	def: 0	
9 - 2 - 6 -							SRV.HOUR	N HOUR	pw:su	lo: 0	hi: 30000	def: 0	
9 - 2 - 6 -							SRV.VAL	N HOUR	pw:cu	lo: 0	hi: 22760	def: 0	
9 - 2 - 6 -							RESET	N	pw:cu				
9 - 2 - 6 -							TOT.START	N	pw:su	lo: 0	hi: 22760	def: 0	
9 - 2 - 6 -							SRV.START	N	pw:su	lo: 0	hi: 22760	def: 0	
9 - 2 - 6 -						F.W. PUMP 4							
9 - 2 - 6 -							F.W. PUMP 4						
9 - 2 - 6 -							TOT.HOUR	N HOUR	pw:su	lo: 0	hi: 30000	def: 0	
9 - 2 - 6 -							SRV.HOUR	N HOUR	pw:su	lo: 0	hi: 30000	def: 0	
9 - 2 - 6 -							SRV.VAL	N HOUR	pw:cu	lo: 0	hi: 22760	def: 0	
9 - 2 - 6 -							RESET	N	pw:cu				
9 - 2 - 6 -							TOT.START	N	pw:su	lo: 0	hi: 22760	def: 0	
9 - 2 - 6 -							SRV.START	N	pw:su	lo: 0	hi: 22760	def: 0	
9 - 2 - 6 -						F.W. PUMP 5							
9 - 2 - 6 -							F.W. PUMP 5						
9 - 2 - 6 -							TOT.HOUR	N HOUR	pw:su	lo: 0	hi: 30000	def: 0	
9 - 2 - 6 -							SRV.HOUR	N HOUR	pw:su	lo: 0	hi: 30000	def: 0	
9 - 2 - 6 -							SRV.VAL	N HOUR	pw:cu	lo: 0	hi: 22760	def: 0	

MENU TREE FOR BOILER PLANT (LOCAL PANEL)					Version no/data: 6.08/071004		Burnertype: All		Platform: All				Settings: All	
LINE NO.	FRONT MENU	LOCK MENU	MAIN MENU	SUB MENU LEVEL 1	SUB MENU LEVEL 2	SUB MENU LEVEL 3	SUB MENU LEVEL 4	[VAL]	PASSW.	LOWEST	HIGHEST	DEFAULT	COMMISSIONING
9 - 2 - 6 -							RESET	N	pw:cu				
9 - 2 - 6 -							TOT.START	N	pw:su	lo: 0	hi: 22760	def: 0	
9 - 2 - 6 -							SRV.START	N	pw:su	lo: 0	hi: 22760	def: 0	
9 - 2 - 6 -						F.W. PUMP 6							
9 - 2 - 6 -							F.W. PUMP 6						
9 - 2 - 6 -							TOT.HOUR	N HOUR	pw:su	lo: 0	hi: 30000	def: 0	
9 - 2 - 6 -							SRV.HOUR	N HOUR	pw:su	lo: 0	hi: 30000	def: 0	
9 - 2 - 6 -							SRV.VAL	N HOUR	pw:cu	lo: 0	hi: 22760	def: 0	
9 - 2 - 6 -							RESET	N	pw:cu				
9 - 2 - 6 -							TOT.START	N	pw:su	lo: 0	hi: 22760	def: 0	
9 - 2 - 6 -							SRV.START	N	pw:su	lo: 0	hi: 22760	def: 0	
9 - 3				SETTINGS									
9 - 3 - 1					START/STOP LIMITS								
9 - 3 - 1 -							M.START DIF LOW	N BAR	pw:no	lo: 0	hi: 27	def: 0.2	
9 - 3							M.START DIF HIGH	N BAR	pw:no	lo: 0	hi: 27	def: 0.7	
9 - 3 - 1 -							M.STOP DIFF LOW	N BAR	pw:no	lo: 0	hi: 27	def: 2	
9 - 3							M.STOP DIFF HIGH	N BAR	pw:no	lo: 0	hi: 27	def: 7	
9 - 3 - 1 -							SLV M.START	N BAR	pw:no	lo: -27	hi: 10	def: -2	
9 - 3							DIFF HIGH	N BAR	pw:no	lo: -27	hi: 10	def: -2	
9 - 3 - 1 -							SLV M.STOP	N BAR	pw:no	lo: -27	hi: 10	def: -0.5	
9 - 3							DIFF HIGH	N BAR	pw:no	lo: -27	hi: 10	def: -0.5	
9 - 3 - 1 -							SLAVE START	N %	pw:no	lo: 0	hi: 100	def: 75	
9 - 3 - 1 -							SLAVE STOP	N %	pw:no	lo: 0	hi: 100	def: 25	
9 - 3 - 1 -							START SLAVE	N SEC	pw:no	lo: 0	hi: 3600	def: 60	
9 - 3 - 1 -							STOP SLAVE	N SEC	pw:no	lo: 0	hi: 3600	def: 60	
9 - 3 - 2					MIN.FIRING								
9 - 3 - 2 -							AIR POS.	N %	pw:no	lo: 0	hi: 100	def: 15	
9 - 3 - 2 -							OIL POS.	N %	pw:no	lo: 0	hi: 100	def: 15	
9 - 3 - 2 -							AIR DO	N %	pw:no	lo: 0	hi: 100	def: 15	
9 - 3 - 2 -							OIL DO	N %	pw:no	lo: 0	hi: 100	def: 15	
9 - 3 - 2 -							AIR HFO	N %	pw:no	lo: 0	hi: 100	def: 15	
9 - 3 - 2 -							OIL HFO	N %	pw:no	lo: 0	hi: 100	def: 15	
9 - 3 - 2 -							SERVO POS.	N %	pw:cu	lo: 0	hi: 100	def: 30	
9 - 3 - 3					PURGE POSITION								
9 - 3 - 3 -							AIR POS.	N %	pw:su	lo: 50	hi: 100	def: 70	
9 - 3 - 3 -							OIL POS.	N %	pw:no	lo: 0	hi: 100	def: 15	
9 - 3 - 3 -							AIR SERVO	N %	pw:su	lo: 50	hi: 100	def: 70	
9 - 3 - 3 -							OIL SERVO	N %	pw:no	lo: 0	hi: 100	def: 15	
9 - 3 - 3 -							SERVO POS.	N %	pw:cu	lo: 0	hi: 100	def: 70	
9 - 3 - 4					IGNITION POSITION								
9 - 3 - 4 -							AIR POS.	N %	pw:no	lo: 0	hi: 100	def: 15	
9 - 3 - 4 -							OIL POS.	N %	pw:no	lo: 0	hi: 100	def: 15	
9 - 3 - 4 -							AIR DO	N %	pw:no	lo: 0	hi: 100	def: 15	
9 - 3 - 4 -							OIL DO	N %	pw:no	lo: 0	hi: 100	def: 15	
9 - 3 - 4 -							AIR HFO	N %	pw:no	lo: 0	hi: 100	def: 15	
9 - 3 - 4 -							OIL HFO	N %	pw:no	lo: 0	hi: 100	def: 15	
9 - 3 - 4 -							SERVO POS.	N %	pw:cu	lo: 0	hi: 100	def: 30	
9 - 3 - 5					SERVO POS								
9 - 3 - 5 -							POS NOZZL 1	N %	pw:cu	lo: 0	hi: 100	def: 30	
9 - 3 - 5 -							POS 2 OPENG	N %	pw:cu	lo: 0	hi: 100	def: 65	
9 - 3 - 5 -							POS 1 AND 2	N %	pw:cu	lo: 0	hi: 100	def: 75	
9 - 3 - 6					RISING								
9 - 3 - 6 -							WARM UP LIM	N BAR	pw:cu	lo: 0	hi: 27	def: 2	
9 - 3 - 6 -							RISING DIFF	N BAR	pw:cu	lo: 0	hi: 27	def: 1	
9 - 3 - 6 -							MOD.FR.DIFF	N BAR	pw:cu	lo: 0	hi: 27	def: 1	
9 - 3 - 7					STEAM PURGE								
9 - 3 - 7					POST PURGE								
9 - 3 - 7 -							AIR POS.	N %	pw:cu	lo: 0	hi: 100	def: 25	

MENU TREE FOR BOILER PLANT (LOCAL PANEL)					Version no/data: 6.08/071004		Burnertype: All		Platform: All				Settings: All	
LINE NO.	FRONT MENU	LOCK MENU	MAIN MENU	SUB MENU LEVEL 1	SUB MENU LEVEL 2	SUB MENU LEVEL 3	SUB MENU LEVEL 4	[VAL]	PASSW.	LOWEST	HIGHEST	DEFAULT	COMMISSIONING
9 - 3 - 7 -							OIL POS.	N %	pw:cu	lo: 0	hi: 100	def: 15	
9 - 3 - 7 -							AIR SERVO	N %	pw:cu	lo: 0	hi: 100	def: 25	
9 - 3 - 7 -							OIL SERVO	N %	pw:cu	lo: 0	hi: 100	def: 15	
9 - 3 - 8					STAND BY POSITION								
9 - 3 - 8 -							AIR POS.	N %	pw:cu	lo: 0	hi: 100	def: 0	
9 - 3 - 8 -							OIL POS.	N %	pw:cu	lo: 0	hi: 100	def: 15	
9 - 3 - 8 -							AIR SERVO	N %	pw:cu	lo: 0	hi: 100	def: 0	
9 - 3 - 8 -							OIL SERVO	N %	pw:cu	lo: 0	hi: 100	def: 15	
9 - 3 - 9					OIL - AIR RATIO								
9 - 3					OIL - AIR RATIO HFO								
9 - 3 - 9 -							0%OIL-AIR	N %	pw:cu	lo: 0	hi: 100	def: 0	
9 - 3 - 9 -							5%OIL-AIR	N %	pw:cu	lo: 0	hi: 100	def: 5	
9 - 3 - 9 -							10%OIL-AIR	N %	pw:cu	lo: 0	hi: 100	def: 10	
9 - 3 - 9 -							15%OIL-AIR	N %	pw:cu	lo: 0	hi: 100	def: 15	
9 - 3 - 9 -							20%OIL-AIR	N %	pw:cu	lo: 0	hi: 100	def: 20	
9 - 3 - 9 -							25%OIL-AIR	N %	pw:cu	lo: 0	hi: 100	def: 25	
9 - 3 - 9 -							30%OIL-AIR	N %	pw:cu	lo: 0	hi: 100	def: 30	
9 - 3 - 9 -							35%OIL-AIR	N %	pw:cu	lo: 0	hi: 100	def: 35	
9 - 3 - 9 -							40%OIL-AIR	N %	pw:cu	lo: 0	hi: 100	def: 40	
9 - 3 - 9 -							45%OIL-AIR	N %	pw:cu	lo: 0	hi: 100	def: 45	
9 - 3 - 9 -							50%OIL-AIR	N %	pw:cu	lo: 0	hi: 100	def: 50	
9 - 3 - 9 -							55%OIL-AIR	N %	pw:cu	lo: 0	hi: 100	def: 55	
9 - 3 - 9 -							60%OIL-AIR	N %	pw:cu	lo: 0	hi: 100	def: 60	
9 - 3 - 9 -							65%OIL-AIR	N %	pw:cu	lo: 0	hi: 100	def: 65	
9 - 3 - 9 -							70%OIL-AIR	N %	pw:cu	lo: 0	hi: 100	def: 70	
9 - 3 - 9 -							75%OIL-AIR	N %	pw:cu	lo: 0	hi: 100	def: 75	
9 - 3 - 9 -							80%OIL-AIR	N %	pw:cu	lo: 0	hi: 100	def: 80	
9 - 3 - 9 -							85%OIL-AIR	N %	pw:cu	lo: 0	hi: 100	def: 85	
9 - 3 - 9 -							90%OIL-AIR	N %	pw:cu	lo: 0	hi: 100	def: 90	
9 - 3 - 9 -							95%OIL-AIR	N %	pw:cu	lo: 0	hi: 100	def: 95	
9 - 3 - 9 -							100%OIL-AIR	N %	pw:cu	lo: 0	hi: 100	def: 100	
9 - 3							CORR.FACTOR	N %	pw:cu	lo: 50	hi: 150	def: 100	
9 - 3					OIL - AIR RATIO DO								
9 - 3 - 9 -							0%OIL-AIR	N %	pw:cu	lo: 0	hi: 100	def: 0	
9 - 3 - 9 -							10%OIL-AIR	N %	pw:cu	lo: 0	hi: 100	def: 10	
9 - 3 - 9 -							20%OIL-AIR	N %	pw:cu	lo: 0	hi: 100	def: 20	
9 - 3 - 9 -							30%OIL-AIR	N %	pw:cu	lo: 0	hi: 100	def: 30	
9 - 3 - 9 -							40%OIL-AIR	N %	pw:cu	lo: 0	hi: 100	def: 40	
9 - 3 - 9 -							50%OIL-AIR	N %	pw:cu	lo: 0	hi: 100	def: 50	
9 - 3 - 9 -							60%OIL-AIR	N %	pw:cu	lo: 0	hi: 100	def: 60	
9 - 3 - 9 -							70%OIL-AIR	N %	pw:cu	lo: 0	hi: 100	def: 70	
9 - 3 - 9 -							80%OIL-AIR	N %	pw:cu	lo: 0	hi: 100	def: 80	
9 - 3 - 9 -							90%OIL-AIR	N %	pw:cu	lo: 0	hi: 100	def: 90	
9 - 3 - 9 -							100%OIL-AIR	N %	pw:cu	lo: 0	hi: 100	def: 100	
9 - 3							CORR.FACTOR	N %	pw:cu	lo: 50	hi: 150	def: 100	
9 - 3 - 10					OIL - ATOMIZING								
9 - 3 - 10 -							0%OIL-ATZ	N BAR	pw:no	lo: 2	hi: 12	def: 2	
9 - 3 - 10 -							10%OIL-ATZ	N BAR	pw:no	lo: 2	hi: 12	def: 3	
9 - 3 - 10 -							20%OIL-ATZ	N BAR	pw:no	lo: 2	hi: 12	def: 3.5	
9 - 3 - 10 -							30%OIL-ATZ	N BAR	pw:no	lo: 2	hi: 12	def: 4	
9 - 3 - 10 -							40%OIL-ATZ	N BAR	pw:no	lo: 2	hi: 12	def: 4.5	
9 - 3 - 10 -							50%OIL-ATZ	N BAR	pw:no	lo: 2	hi: 12	def: 5	
9 - 3 - 10 -							60%OIL-ATZ	N BAR	pw:no	lo: 2	hi: 12	def: 5.5	
9 - 3 - 10 -							70%OIL-ATZ	N BAR	pw:no	lo: 2	hi: 12	def: 6	
9 - 3 - 10 -							80%OIL-ATZ	N BAR	pw:no	lo: 2	hi: 12	def: 6	
9 - 3 - 10 -							90%OIL-ATZ	N BAR	pw:no	lo: 2	hi: 12	def: 6	
9 - 3 - 10 -							100%OIL-ATZ	N BAR	pw:no	lo: 2	hi: 12	def: 6	
9 - 3 - 11					OIL OUT/IN								

MENU TREE FOR BOILER PLANT (LOCAL PANEL)	Version no/data: 6.08/071004	Burnertype: All	Platform: All	Settings: All

LINE NO.	FRONT MENU	LOCK MENU	MAIN MENU	SUB MENU LEVEL 1	SUB MENU LEVEL 2	SUB MENU LEVEL 3	SUB MENU LEVEL 4	[VAL]	PASSW.	LOWEST	HIGHEST	DEFAULT	COMMISSIONING
9 - 3 - 11 -							0%OIL OUT	N %	pw:cu	lo: 0	hi: 100	def: 0	
9 - 3 - 11 -							10%OIL OUT	N %	pw:cu	lo: 0	hi: 100	def: 2.2	
9 - 3 - 11 -							20%OIL OUT	N %	pw:cu	lo: 0	hi: 100	def: 4.5	
9 - 3 - 11 -							30%OIL OUT	N %	pw:cu	lo: 0	hi: 100	def: 6.6	
9 - 3 - 11 -							40%OIL OUT	N %	pw:cu	lo: 0	hi: 100	def: 9.9	
9 - 3 - 11 -							50%OIL OUT	N %	pw:cu	lo: 0	hi: 100	def: 14.3	
9 - 3 - 11 -							60%OIL OUT	N %	pw:cu	lo: 0	hi: 100	def: 21.1	
9 - 3 - 11 -							70%OIL OUT	N %	pw:cu	lo: 0	hi: 100	def: 29.8	
9 - 3 - 11 -							80%OIL OUT	N %	pw:cu	lo: 0	hi: 100	def: 46.9	
9 - 3 - 11 -							90%OIL OUT	N %	pw:cu	lo: 0	hi: 100	def: 67.9	
9 - 3 - 11 -							100%OIL OUT	N %	pw:cu	lo: 0	hi: 100	def: 100	
9 - 3 - 12					AIR OUT/IN								
9 - 3 - 12 -							0%AIR OUT	N %	pw:cu	lo: 0	hi: 100	def: 0	
9 - 3 - 12 -							10%AIR OUT	N %	pw:cu	lo: 0	hi: 100	def: 2.1	
9 - 3 - 12 -							20%AIR OUT	N %	pw:cu	lo: 0	hi: 100	def: 4.5	
9 - 3 - 12 -							30%AIR OUT	N %	pw:cu	lo: 0	hi: 100	def: 6.6	
9 - 3 - 12 -							40%AIR OUT	N %	pw:cu	lo: 0	hi: 100	def: 9.9	
9 - 3 - 12 -							50%AIR OUT	N %	pw:cu	lo: 0	hi: 100	def: 14.3	
9 - 3 - 12 -							60%AIR OUT	N %	pw:cu	lo: 0	hi: 100	def: 21.1	
9 - 3 - 12 -							70%AIR OUT	N %	pw:cu	lo: 0	hi: 100	def: 29.8	
9 - 3 - 12 -							80%AIR OUT	N %	pw:cu	lo: 0	hi: 100	def: 46.9	
9 - 3 - 12 -							90%AIR OUT	N %	pw:cu	lo: 0	hi: 100	def: 67.9	
9 - 3 - 12 -							100%AIR OUT	N %	pw:cu	lo: 0	hi: 100	def: 100	
9 - 3 - 2					MAX.FIRING								
9 - 3 - 2 -							AIR DO	N %	pw:no	lo: 0	hi: 100	def: 15	
9 - 3 - 2 -							OIL DO	N %	pw:no	lo: 0	hi: 100	def: 15	
9 - 3 - 2 -							AIR HFO	N %	pw:no	lo: 0	hi: 100	def: 15	
9 - 3 - 2 -							OIL HFO	N %	pw:no	lo: 0	hi: 100	def: 15	
9 - 3 - 13					MIN.FIRING	(only if SMALL GUN							
9 - 3 - 13 -							AIR POS.	N %	pw:no	lo: 0	hi: 100	def: 15	
9 - 3 - 13 -							OIL POS.	N %	pw:no	lo: 0	hi: 100	def: 15	
9 - 3 - 14					MAX.FIRING	(only if SMALL GUN							
9 - 3 - 14 -							MAX LOAD	N %	pw:no	lo: 0	hi: 100	def: 100	
9 - 3 - 15					PURGE POSITION	(only if SMALL GUN							
9 - 3 - 15 -							AIR POS.	N %	pw:su	lo: 20	hi: 100	def: 70	
9 - 3 - 15 -							OIL POS.	N %	pw:no	lo: 0	hi: 100	def: 15	
9 - 3 - 16					IGNITION POSITION	(only if SMALL GUN							
9 - 3 - 16 -							AIR POS.	N %	pw:no	lo: 0	hi: 100	def: 15	
9 - 3 - 16 -							OIL POS.	N %	pw:no	lo: 0	hi: 100	def: 15	
9 - 3 - 17					STM.PURGE	(only if SMALL GUN							
9 - 3 - 17 -							AIR POS.	N %	pw:cu	lo: 0	hi: 100	def: 25	
9 - 3 - 17 -							OIL POS.	N %	pw:cu	lo: 0	hi: 100	def: 15	
9 - 4				DIAGNOSES									
9 - 4 - 1					SOFTWARE VERSION				np				
9 - 4 - 1 -							[PANEL TYPE]	N	np				
9 - 4 - 1 -							[VERSION]	N	np				
9 - 4 - 1 -							[INFO 1]	N	np				
9 - 4 - 1 -							[INFO 2]	N	np				
9 - 4 - 2					DIGITAL INPUT				np				
9 - 4 - 2 -							EXTERN SHUTDOWN	N	np				
9 - 4 - 2 -							HI STM PRESS SWITC	N	np				
9 - 4 - 2 -							LANCE REDRAWN	N	np				
9 - 4 - 2 -							BURNER SWING OUT	N	np				
9 - 4 - 2 -							WATER LEVEL LOW	N	np				
9 - 4 - 2 -							FLAME SCANNER 1	N	np				
9 - 4 - 2 -							FLAME SCANNER 2	N	np				
9 - 4 - 2 -							START PER. FROM PA	N	np				
9 - 4 - 2 -							IGNITER INSERTED	N	np				

MENU TREE FOR BOILER PLANT (LOCAL PANEL)				Version no/data: 6.08/071004			Burnertype: All			Platform: All					Settings: All	
LINE NO.	FRONT MENU	LOCK MENU	MAIN MENU	SUB MENU LEVEL 1	SUB MENU LEVEL 2	SUB MENU LEVEL 3	SUB MENU LEVEL 4	[VAL]	PASSW.	LOWEST	HIGHEST	DEFAULT	COMMISSIONING			
9 - 4 - 2 -							AIR FAN CLOSED	N	np							
9 - 4 - 2							HFO DO POSITION	N	np							
9 - 4 - 2							OIL VLV. IN POSITION	N	np							
9 - 4 - 2 -							QUICK CLOSING VALV	N	np							
9 - 4 - 2							HI. OIL PRESS RETUR	N	np							
9 - 4 - 2 -							IGN. FLAME SURV.	N	np							
9 - 4 - 2							FIRE IN WINDBOX	N	np							
9 - 4 - 2 -							HIGH TEMP	N	np							
9 - 4 - 2 -							LOW COMB AIR PRES	N	np							
9 - 4 - 2 -							LOW OIL PRSS NOZZL	N	np							
9 - 4 - 2 -							HI.OIL TEMP SW IN PF	N	np							
9 - 4 - 2 -							LOW OIL TEMP NOZZL	N	np							
9 - 4 - 2 -							LOW ATM PRESS	N	np							
9 - 4 - 2 -							COLD WARM START	N	np							
9 - 4 - 2 -							INERT GAS	N	np							
9 - 4 - 2							EXTERN STOP	N	np							
9 - 4 - 2							SMALL GUN	N	np							
9 - 4 - 2							BURNER MOTOR 1 FB	N	np							
9 - 4 - 2							BURNER MOTOR 1 OL	N	np							
9 - 4 - 2							COMB AIR FAN 1 FB	N	np							
9 - 4 - 2							BOOSTER PUMP FB	N	np							
9 - 4 - 2							COMB AIR FAN 1 OL	N	np							
9 - 4 - 2							EXTERN STOP 2	N	np							
9 - 4 - 2							EXTERN SHUTDOWN	N	np							
9 - 4 - 2 -																
9 - 4 - 2							CIRC.PMP 1 LF	N	np							
9 - 4 - 2 -							HEAVY FUEL OPERAT	N	np							
9 - 4 - 2 -							FUEL PUMP1 FB	N	np							
9 - 4 - 2 -							FUEL PUMP2 FB	N	np							
9 - 4 - 2							F.W.PMP1 REM STOP	N	np							
9 - 4 - 2							F.W.PMP1 REM STAR	N	np							
9 - 4 - 2							F.W.PMP 1 FB	N	np							
9 - 4 - 2							F.W.PMP 2 FB	N	np							
9 - 4 - 2 -							COMB AIR FAN 1 FB	N	np							
9 - 4 - 2 -							HOTWELL LOW STOP	N	np							
9 - 4 - 2 -							COMB AIR FAN 1 OL	N	np							
9 - 4 - 2							F.W.PMP 1 STBY	N	np							
9 - 4 - 2 -							COMB AIR FAN 2 FB	N	np							
9 - 4 - 2 -							AUXILLARY PUMP FB	N	np							
9 - 4 - 2 -							COMB AIR FAN 2 OL	N	np							
9 - 4 - 2							CIRC.PMP 1 STBY	N	np							
9 - 4 - 2							F.W.PMP2 REM STOP	N	np							
9 - 4 - 2							F.W.PMP2 REM STAR	N	np							
9 - 4 - 2 -							CIRC.PMP 1 FB	N	np							
9 - 4 - 2							CIRC.PMP 2 FB	N	np							
9 - 4 - 2							SALINITY	N	np							
9 - 4 - 2							OIL CONTENT	N	np							
9 - 4 - 2							HI. STEAM XS2V	N	np							
9 - 4 - 2 -							HIGH GAS TEMP AT E	N	np							
9 - 4 - 2							F.O.PMP1 REM STOP	N	np							
9 - 4 - 2							F.O.PMP1 REM START	N	np							
9 - 4 - 2							F.O.PMP2 REM STOP	N	np							
9 - 4 - 2							F.O.PMP2 REM START	N	np							
9 - 4 - 2																
9 - 4 - 2 -							F.W.PMP 1 FB	N	np							
9 - 4 - 2 -							F.W.PMP 1 STBY	N	np							
9 - 4 - 2 -							F.W.PMP 2 FB	N	np							
9 - 4 - 2 -							F.W.PMP 2 STBY	N	np							

MENU TREE FOR BOILER PLANT (LOCAL PANEL)				Version no/data: 6.08/071004			Burnertype: All			Platform: All					Settings: All	
LINE NO.	FRONT MENU	LOCK MENU	MAIN MENU	SUB MENU LEVEL 1	SUB MENU LEVEL 2	SUB MENU LEVEL 3	SUB MENU LEVEL 4	[VAL]	PASSW.	LOWEST	HIGHEST	DEFAULT	COMMISSIONING
9 - 4 - 2							F.W.PMP 3 FB	N	np				
9 - 4 - 2							F.W.PMP 3 STBY	N	np				
9 - 4 - 2							F.W.PMP 4 FB	N	np				
9 - 4 - 2							F.W.PMP 4 STBY	N	np				
9 - 4 - 2							CIRC.PMP 1 FB	N	np				
9 - 4 - 2							CIRC.PMP 1 STBY	N	np				
9 - 4 - 2							CIRC.PMP 1 LF	N	np				
9 - 4 - 2							CIRC.PMP 2 FB	N	np				
9 - 4 - 2							CIRC.PMP 1 STOP	N	np				
9 - 4 - 2							CIRC.PMP 1 START	N	np				
9 - 4 - 2							CIRC.PMP 1 STOP	N	np				
9 - 4 - 2							CIRC.PMP 1 START	N	np				
9 - 4 - 2							F.W.PMP1 REM STOP	N	np				
9 - 4 - 2							F.W.PMP1 REM STAR	N	np				
9 - 4 - 2							F.W.PMP2 REM STOP	N	np				
9 - 4 - 2							F.W.PMP2 REM STAR	N	np				
9 - 4 - 2							F.W.PMP3 REM STOP	N	np				
9 - 4 - 2							F.W.PMP3 REM STAR	N	np				
9 - 4 - 2							F.W.PMP4 REM STOP	N	np				
9 - 4 - 2							F.W.PMP4 REMSTART	N	np				
9 - 4 - 2													
9 - 4 3					DIGITAL OUTPUT								
9 - 4 3							ATM STEAM PRS. UP	N	np				
9 - 4 3							SERVO MOTOR UP	N	np				
9 - 4 3							OIL SERVO MOTOR UI	N	np				
9 - 4 3							ATM STEAM PRS. DW	N	np				
9 - 4 3							SERVO MOTOR DOWI	N	np				
9 - 4 3							OIL SERVO MOTOR D'	N	np				
9 - 4 3							IGNITION	N	np				
9 - 4 3							BURNER MOTOR 1	N	np				
9 - 4 3							WATER LEVEL MAN A	N	np				
9 - 4 3							OIL	N	np				
9 - 4 3							NOZZLE1	N	np				
9 - 4 3							ATM STEAM	N	np				
9 - 4 3							SAFETY VALVE	N	np				
9 - 4 3							IGNITION PURGE VLV	N	np				
9 - 4 3							STEAM PURGE	N	np				
9 - 4 3							HEATING ELEMENT	N	np				
9 - 4 3							OUT SETP	N	np				
9 - 4 3							NOZZLE2	N	np				
9 - 4 3							FUEL OIL BOOSTER P	N	np				
9 - 4 3							AIR SERVO MOTOR U	N	np				
9 - 4 3							SOOTBLOWER	N	np				
9 - 4 3							AIR SERVO MOTOR D'	N	np				
9 - 4 3							W. LEVEL MAN INC.	N	np				
9 - 4 3							FUEL HEATER	N	np				
9 - 4 3							W. LEVEL MAN DEC.	N	np				
9 - 4 3							SMOKE DENSITY 1	N	np				
9 - 4 3							ALARM	N	np				
9 - 4 3							ALARM GR.1	N	np				
9 - 4 3							START REQ. TO PMS	N	np				
9 - 4 3							WARNING	N	np				
9 - 4 3							ALARM GR.2	N	np				
9 - 4 3							HIGH WATER LEVEL	N	np				
9 - 4 3							ALARM GR.3	N	np				
9 - 4 3							LOW WATER LEVEL	N	np				
9 - 4 3							ALARM GR.4	N	np				
9 - 4 3							BURNER IN STOP	N	np				

MENU TREE FOR BOILER PLANT (LOCAL PANEL)					Version no/data: 6.08/071004		Burnertype: All		Platform: All					Settings: All	
LINE NO.	FRONT MENU	LOCK MENU	MAIN MENU	SUB MENU LEVEL 1	SUB MENU LEVEL 2	SUB MENU LEVEL 3	SUB MENU LEVEL 4	[VAL]	PASSW.	LOWEST	HIGHEST	DEFAULT	COMMISSIONING		
9 - 4 3							FEED WATER REG 1	N	np						
9 - 4 3							FEED WATER REG 2	N	np						
9 - 4 3															
9 - 4 3							FUEL PUMP1	N	np						
9 - 4 3							FUEL PUMP2	N	np						
9 - 4 3							FUEL OIL PRESS UP	N	np						
9 - 4 3							FUEL OIL PRESS DW	N	np						
9 - 4 3							FEED WATER PUMP1	N	np						
9 - 4 3							FUEL OIL TEMP UP	N	np						
9 - 4 3							FEED WATER PUMP2	N	np						
9 - 4 3							FUEL OIL TEMP DW	N	np						
9 - 4 3							SMOKE DENSITY 1	N	np						
9 - 4 3							FEED WATER STBY	N	np						
9 - 4 3							SMOKE DENSITY 2	N	np						
9 - 4 3							CIRC PUMP STBY	N	np						
9 - 4 3							HEATING 1	N	np						
9 - 4 3							CIRC. PUMP1 START	N	np						
9 - 4 3							HEATING 2	N	np						
9 - 4 3							CIRC. PUMP2 START	N	np						
9 - 4 3							FUEL PMP STB ST	N	np						
9 - 4 3							OIL VLV RETURN LINE	N	np						
9 - 4 - 3 -							START COMB AIR FAN	N	np						
9 - 4 - 3 -							FUEL OIL TEMP UP	N	np						
9 - 4 - 3 -							FUEL OIL TEMP DW	N	np						
9 - 4 - 3 -							START COMB AIR FAN	N	np						
9 - 4 - 3 -							CHEMICAL STATION1	N	np						
9 - 4 - 3 -							CHEMICAL STATION2	N	np						
9 - 4 3							AUX START	N	np						
9 - 4 - 3 -															
9 - 4 - 3 -							FEED WATER PUMP1	N	np						
9 - 4 - 3 -							FEED WATER PUMP2	N	np						
9 - 4 - 3 -							FEED WATER PUMP3	N	np						
9 - 4 - 3 -							FEED WATER PUMP4	N	np						
9 - 4 - 3 -							CIRC. PUMP1 START	N	np						
9 - 4 - 3 -							CIRC. PUMP2 START	N	np						
9 - 4 - 3 -							FEED WATER STBY	N	np						
9 - 4 - 3 -							CIRC PUMP STBY	N	np						
9 - 4 - 3 -															
9 - 4 - 4 -					SUPERUSER				np						
9 - 4 - 4 -							[USED]	N	np						
9 - 4 - 5 -					SERIAL NUMBER				np						
9 - 4 - 5 -							SERIAL NO	N	pw:cu						
9 - 4 - 5 -							COMMISSIONED	N	np						
9 - 4 - 5 -							ERASE EEPROM	N	pw:cu						
9 - 4 - 6 -					NO OF SHT.DWN.				np						
9 - 4 - 6 -							NO OF SHT.DWN.	N	np						
9 - 4 3					DIGITAL OUTPUT										
9 - 4 3							ATM STEAM PRS. UP	N	np						
9 - 4 3							SERVO MOTOR UP	N	np						
9 - 4 3							OIL SERVO MOTOR UI	N	np						
9 - 4 3							ATM STEAM PRS. DW	N	np						
9 - 4 3							SERVO MOTOR DOWI	N	np						
9 - 4 3							OIL SERVO MOTOR D	N	np						
9 - 4 3							IGNITION	N	np						
9 - 4 3							BURNER MOTOR 1	N	np						
9 - 4 3							WATER LEVEL MAN A	N	np						
9 - 4 3							OIL	N	np						
9 - 4 3							NOZZLE1	N	np						

MENU TREE FOR BOILER PLANT (LOCAL PANEL)						Version no/data: 6.08/071004	Burnertype: All			Platform: All				Settings: All	
LINE NO.	FRONT MENU	LOCK MENU	MAIN MENU	SUB MENU LEVEL 1	SUB MENU LEVEL 2	SUB MENU LEVEL 3	SUB MENU LEVEL 4	[VAL]	PASSW.	LOWEST	HIGHEST	DEFAULT	COMMISSIONING
9 - 4 3							ATM STEAM	N	np				
9 - 4 3							SAFETY VALVE	N	np				
9 - 4 3							IGNITION PURGE VLV	N	np				
9 - 4 3							STEAM PURGE	N	np				
9 - 4 3							HEATING ELEMENT	N	np				
9 - 4 3							OUT SETP	N	np				
9 - 4 3							NOZZLE2	N	np				
9 - 4 3							FUEL OIL BOOSTER P	N	np				
9 - 4 3							AIR SERVO MOTOR U	N	np				
9 - 4 3							SOOTBLOWER	N	np				
9 - 4 3							AIR SERVO MOTOR D	N	np				
9 - 4 3							W. LEVEL MAN INC.	N	np				
9 - 4 3							FUEL HEATER	N	np				
9 - 4 3							W. LEVEL MAN DEC.	N	np				
9 - 4 3							SMOKE DENSITY 1	N	np				
9 - 4 3							ALARM	N	np				
9 - 4 3							ALARM GR.1	N	np				
9 - 4 3							START REQ. TO PMS	N	np				
9 - 4 3							WARNING	N	np				
9 - 4 3							ALARM GR.2	N	np				
9 - 4 3							HIGH WATER LEVEL	N	np				
9 - 4 3							ALARM GR.3	N	np				
9 - 4 3							LOW WATER LEVEL	N	np				
9 - 4 3							ALARM GR.4	N	np				
9 - 4 3							BURNER IN STOP	N	np				
9 - 4 3							FEED WATER REG 1	N	np				
9 - 4 3							FEED WATER REG 2	N	np				
9 - 4 3													
9 - 4 - 8					NEW PASSWORD								
9 - 4 - 8 -							NEW PASSWORD	N	pw:cu				
9 - 4 - 8 -							RESET PASSWORDS	N	pw:special				
9 - 4 - 9					CONTROLLERS				np				
9 - 4 - 9 -						AIR FLOW	[SET.P][VALUE]	N	np				
9 - 4 - 9 -						F.O. FL	[SET.P][VALUE]	N	np				
- - - - - -						[STATE][LOAD%]		N	np				
- - - - - -						[STATE][MODE][LOAD		N	np				
9 - 5				LOGGINGS									
9 - 5 - 1					INSPECT SHT.DWN.				np				
9 - 5 - 1 -							[SHT.DWN. NUM]	N	np				
9 - 5 - 1 -							[SHT.DWN. TEXT]	N	np				
9 - 5 - 3					OIL SUMMARIZER								
9 - 2 - 6 -													
9 - 2 - 6 -							OIL FLOW	N					
9 - 2 - 6 -							TOTAL	N HOUR	pw:su	lo: 0	hi: 30000	def: 0	
9 - 2 - 6 -							SERVICE	N HOUR	pw:su	lo: 0	hi: 30000	def: 0	
9 - 2 - 6 -							SRV.VAL(1000L)	N HOUR	pw:cu	lo: 0	hi: 22760	def: 0	
9 - 2 - 6 -							RESET	N	pw:cu				
9 - 6 -				CALIBRATE									
9 - 6 - 1					WATER LEVEL								
9 - 6 - 1 -							WATER LEVEL	N mm	np				
9 - 6 - 1 -							RANGE HIGH	N mm	pw:cu	lo: 0	hi: 1500	def: 260	
9 - 6 - 1 -							RANGE LOW	N mm	pw:cu	lo: -1000	hi: 0	def: -265	
9 - 6 - 1 -							RND.1/10MM	N	pw:cu	lo: 1	hi: 100	def: 10	
9 - 6 - 2					AIR FLOW								
9 - 6 - 2 -							AIR FLOW	N %	np				
9 - 6 - 2 -							RANGE HIGH	N %	pw:cu	lo: 0	hi: 999.9	def: 100	
9 - 6 - 2 -							RANGE LOW	N %	pw:cu	lo: -100	hi: 100	def: 0	
9 - 6 - 2					AIR SERVO								

MENU TREE FOR BOILER PLANT (LOCAL PANEL)	Version no/data: 6.08/071004	Burnertype: All	Platform: All	Settings: All

LINE NO.	FRONT MENU	LOCK MENU	MAIN MENU	SUB MENU LEVEL 1	SUB MENU LEVEL 2	SUB MENU LEVEL 3	SUB MENU LEVEL 4	[VAL]	PASSW.	LOWEST	HIGHEST	DEFAULT	COMMISSIONING
9 - 6 - 2 -							AIR SERVO	N %	np				
9 - 6 - 2 -							RANGE HIGH	N %	pw:cu	lo: 0	hi: 999.9	def: 100	
9 - 6 - 2 -							RANGE LOW	N %	pw:cu	lo: -100	hi: 100	def: 0	
9 - 6 - 3					OIL FLOW								
9 - 6 - 3 -							OIL FLOW	N %	np				
9 - 6 - 3 -							MAX FLOW	N L/H	pw:cu	lo: 0	hi: 10000	def: 0	
9 - 6 - 3 -							BEATS/(10L)	N	pw:cu	lo: 0	hi: 22000	def: 0	
9 - 6 - 3					OIL SERVO								
9 - 6 - 3 -							AIR SERVO	N %	np				
9 - 6 - 3 -							RANGE HIGH	N %	pw:cu	lo: 0	hi: 10000	def: 0	
9 - 6 - 3 -							RANGE LOW	N %	pw:cu	lo: 0	hi: 22000	def: 0	
9 - 6 - 4					BOILER PRES								
9 - 6 - 4 -							BOILER PRES	N BAR	np				
9 - 6 - 4 -							RANGE HIGH	N BAR	pw:cu	lo: -1	hi: 50	def: 25	
9 - 6 - 4 -							RANGE LOW	N BAR	pw:cu	lo: -1	hi: 50	def: 0	
9 - 6 - 5					ATM.STM.PRS								
9 - 6 - 5 -							ATM.STM.PRS	N BAR	np				
9 - 6 - 5 -							RANGE HIGH	N BAR	pw:cu	lo: -1	hi: 50	def: 25	
9 - 6 - 6 -							RANGE LOW	N BAR	pw:cu	lo: -1	hi: 50	def: 0	
9 - 6 - 6					FUEL O.PRES								
9 - 6 - 6 -							FUEL O.PRES	N BAR	np				
9 - 6 - 6 -							RANGE HIGH	N BAR	pw:cu	lo: -1	hi: 50	def:40	
9 - 6 - 6 -							RANGE LOW	N BAR	pw:cu	lo: -1	hi: 30	def: 0	
9 - 6 - 7					FUEL O.TEMP								
9 - 6 - 7 -							FUEL O.TEMP	N ºC	np				
9 - 6 - 7 -							RANGE HIGH	N ºC	pw:cu	lo: 0	hi: 500	def: 160	
9 - 6 - 7 -							RANGE LOW	N ºC	pw:cu	lo: -200	hi: 200	def: 0	
9 - 6 - 8					OXYGEN SENS								
9 - 6 - 8 -							OXYGEN SENS	N %	np				
9 - 6 - 8 -							RANGE HIGH	N %	pw:cu	lo: 0	hi: 100	def: 10	
9 - 6 - 8 -							RANGE LOW	N %	pw:cu	lo: 0	hi: 100	def: 0	
9 - 6 - 9					SMOKE DENS.								
9 - 6 - 9 -							SMOKE DENS.	N %					
9 - 6 - 9 -							RANGE HIGH	N %	pw:cu	lo: 0	hi: 100	def: 100	
9 - 6 - 9 -							RANGE LOW	N %	pw:cu	lo: 0	hi: 100	def: 0	
9 - 6 - 10					SALINITY								
9 - 6 - 10 -							SALINITY	N ppm	np				
9 - 6 - 10 -							RANGE HIGH	N ppm	pw:cu	lo: 0	hi: 50	def: 20	
9 - 6 - 10 -							RANGE LOW	N ppm	pw:cu	lo: 0	hi: 50	def: 0	
9 - 6 - 11					O.PR.NZ/EXT								
9 - 6 - 11 -							O.PR.NZ/EXT	N BAR or %	np				
9 - 6 - 11 -							RANGE HIGH	N BAR or %	pw:cu	lo: -10	hi: 110	def: 25	
9 - 6 - 11 -							RANGE LOW	N BAR or %	pw:cu	lo: -10	hi: 110	def: 0	
9 - 6 - 12					ST.PRES.COM								
9 - 6 - 12 -							ST.PRES.COM	N BAR	np				
9 - 6 - 12 -							RANGE HIGH	N BAR	pw:cu	lo: -1	hi: 50	def: 25	
9 - 6 - 12 -							RANGE LOW	N BAR	pw:cu	lo: -1	hi: 50	def: 0	
9 - 6 - 13					SERVO MOTOR								
9 - 6 - 13 -							SERVO MOTOR	N %	np				
9 - 6 - 13 -							RAW DATA	N	np				
9 - 6 - 13 -							RANGE HIGH	N	pw:cu	lo: 0	hi: 10000	def: 7500	
9 - 6 - 13 -							RANGE LOW	N	pw:cu	lo: 0	hi: 10000	def: 100	
9 - 6 - 14					STEAM FLOW								
9 - 6 - 14 -							STEAM FLOW	N %	np				
9 - 6 - 14 -							RANGE HIGH	N %	pw:cu	lo: 0	hi: 300	def: 200	
9 - 6 - 14 -							RANGE LOW	N %	pw:cu	lo: 0	hi: 300	def: 0	
9 - 6 - 15					TEMP.INLET								
9 - 6 - 15 -							TEMP.INLET	N ºC	pw:cu				

MENU TREE FOR BOILER PLANT (LOCAL PANEL)					Version no/data: 6.08/071004	Burnertype: All			Platform: All				Settings: All	
LINE NO.	FRONT MENU	LOCK MENU	MAIN MENU	SUB MENU LEVEL 1	SUB MENU LEVEL 2	SUB MENU LEVEL 3	SUB MENU LEVEL 4	[VAL]	PASSW.	LOWEST	HIGHEST	DEFAULT	COMMISSIONING
9 - 6 - 15							RANGE HIGH	N ºC	pw:cu	lo: 0	hi: 700	def: 600	
9 - 6 - 15							RANGE LOW	N ºC	pw:cu	lo: 0	hi: 700	def: 0	
9 - 6 - 16					TEMP. OUTLET								
9 - 6 - 16							TEMP.OUTLET	N ºC					
9 - 6 - 16							RANGE HIGH	N ºC	pw:cu	lo: 0	hi: 700	def: 600	
9 - 6 - 16							RANGE LOW	N ºC	pw:cu	lo: 0	hi: 700	def: 0	
9 - 6 - 17					DIFF.PRESS.								
9 - 6 - 17							DIFF.PRESS.	N mm					
9 - 6 - 17							RANGE HIGH	N mm	pw:cu	lo: 0	hi: 250	def: 250	
9 - 6 - 17							RANGE LOW	N mm	pw:cu	lo: 0	hi: 250	def: 0	
9 - 6 - 18					ME. LOAD								
9 - 6 - 18							ME.LOAD	N %					
9 - 6 - 18							RANGE HIGH	N %	pw:cu	lo: 0	hi: 100	def: 100	
9 - 6 - 18							RANGE LOW	N %	pw:cu	lo: 0	hi: 100	def: 0	
9 - 6 - 19					FW.PR/FL								
9 - 6 - 19							FW.PR/FL	N BAR	np				
9 - 6 - 19							OFFSET	N BAR	pw: cu	lo: -10	hi: 10	def: 0	
9 - 6 - 19							RANGE HIGH	N BAR	pw: cu	lo: -1	hi: 300	def: 40	
9 - 6 - 19							RANGE LOW	N BAR	pw: cu	lo: -1	hi: 300	def: 0	
9 - 6 - 3					OIL FLOW								
9 - 6 - 3							OIL FLOW	N %	np				
9 - 6 - 3							MAX FLOW	N L/H	pw:cu	lo: 0	hi: 10000	def: 0	
9 - 6 - 3							BEATS/(10L)	N	pw:cu	lo: 0	hi: 22000	def: 0	
9 - 6 - 1					WATER LEVEL XS2V								
9 - 6 - 1							WATER LEVEL	N mm	np				
9 - 6 - 1							RANGE HIGH	N mm	pw:cu	lo: 0	hi: 1500	def: 260	
9 - 6 - 1							RANGE LOW	N mm	pw:cu	lo: -1000	hi: 0	def: -265	
9 - 6 - 1							RND.1/10MM	N	pw:cu	lo: 1	hi: 100	def: 10	
9 - 6 - 4					BOILER PRES XS2V								
9 - 6 - 4							BOILER PRES	N BAR	np				
9 - 6 - 4							RANGE HIGH	N BAR	pw:cu	lo: -1	hi: 50	def: 25	
9 - 6 - 4							RANGE LOW	N BAR	pw:cu	lo: -1	hi: 50	def: 0	
9 - 7				CONFIG									
9 - 7 - 1					PANEL SYSTEM								
9 - 7 - 1							PANEL TYPE	N	pw:su			def: not def	
9 - 7 - 1							IO CFG	N	pw:su			def: not def	
9 - 7 - 1							BURNER TYPE	N	pw:su			def: not def	
9 - 7 - 1							BURNER FAMILY	N	pw:su			def: multi	
9 - 7 - 1							NODE NO.OFFSET	N	pw:su	lo: 0	hi: 125	def: 1	
9 - 7 - 1							PART NO OFFSET	N	pw:su	lo: 0	hi: 125	def: 1	
9 - 7 - 1							BAUD RATE	N	pw:su	lo: 600	hi: 38400	def: 38400	
9 - 7 - 2					BURNER SYSTEM								
9 - 7 - 2							MASTER-SLAVE	N	pw:cu			def: master	
9 - 7 - 2							OIL OK DIFF	N %	pw:cu	lo: 0.5	hi: 100	def: 5	
9 - 7 - 2							AIR OK DIFF	N %	pw:cu	lo: 0.5	hi: 100	def: 5	
9 - 7 - 2							MAN STEP	N %	pw:cu	lo: 0.5	hi: 2	def: 1	
9 - 7 - 2							AIR OIL DIF	N %	pw:cu	lo: 0	hi: 100	def: 10	
9 - 7 - 2							MAX OIL OUT	N %	pw:su	lo: 0	hi: 100	def: 40	
9 - 7 - 2						(only if SMALL GUN	MAX OIL S.GUN	N %	pw:su	lo: 0	hi: 100	def: 40	
9 - 7 - 2							REDUCED PRS	N BAR	pw:su	lo: 0	hi: 27	def: 4	
9 - 7 - 2							LOAD LIMIT	N %	pw:su	lo: 0	hi: 100	def: 60	
9 - 7 - 2							TAU W.LEVEL	N	pw:no	lo: 0	hi: 20	def: 0	
9 - 7 - 2							TAU AIR FLOW	N	pw:no	lo: 0	hi: 20	def: 0	
9 - 7 - 3							OIL SAMPLING	N	pw:su	lo: 0	hi: 10	def: 1	
9 - 7 - 3					BURNER OPTIONS								
9 - 7 - 3							0 PRESS UNIT	N BAR	pw:cu			def: bar	
9 - 7 - 3							1 OXYGEN	N	pw:su			def: no	
9 - 7 - 3							2 SMOKE MONITOR	N	pw:su			def: no	

MENU TREE FOR BOILER PLANT (LOCAL PANEL)				Version no/data: 6.08/071004		Burnertype: All			Platform: All				Settings: All	
LINE NO.	FRONT MENU	LOCK MENU	MAIN MENU	SUB MENU LEVEL 1	SUB MENU LEVEL 2	SUB MENU LEVEL 3	SUB MENU LEVEL 4	[VAL]	PASSW.	LOWEST	HIGHEST	DEFAULT	COMMISSIONING
9 - 7 - 3						3	STEAM DUMP	N	pw:su			def: no	
9 - 7 - 3						4	FW.PUMP CTRL	N	pw:su			def: no	
9 - 7 - 3						5	FW.REG.OUT.LIM	N	pw:su	lo: -1000	hi: 1500	def: 0	
9 - 7 - 3						6	WATER L. CONT	N	pw.su	mod	on/off	mod	
9 - 7 - 3						7	WATER L. CONT EGB	N	pw.su	mod	on/off	mod	
9 - 7 - 3						8	FW.OUTPUT.CFG	N	pw:su			def: off	
9 - 7 - 3						9	FW.REG.TYPE	N	pw:su			def: PID	
9 - 7 - 3						10	W.CIRC.PUMPS	N	pw:su	lo: 0	hi: 2	def: 0	
9 - 7 - 3						11	CHEM. PUMPS	N	pw:su	lo: 0	hi: 2	def: 0	
9 - 7 - 3						12	EXHAUST GAS	N	pw:su			def: no	
9 - 7 - 3						13	SALINITY	N	pw:su			def: off	
9 - 7 - 3						14	TEMP. UPTAKE	N	pw:su			def: off	
9 - 7 - 3						15	INERT GAS	N	pw:su			def: off	
9 - 7 - 3						16	KEY DISABLE	N	pw:su			def: off	
9 - 7 - 3						17	FLAME SURV. ON	N	pw:su			def: early	
9 - 7 - 3						18	WINDOWS	N	pw:su			def: 2000	
9 - 7 - 3						19	SMALL GUN	N	pw:su			def:no	
9 - 7 - 3						20	F.OIL T.CTRL	N	pw:su			def:on/off	
9 - 7 - 3						21	HOUR/START CNT	N	pw.su			def:on/off	
9 - 7 - 3						22	BOOSTER PUMP	N	pw:su			def:on/off	
9 - 7 - 3						23	SALINITY/OIL SHT	N	pw.su			def:on/off	
9 - 7 - 3						24	TEMP COMMON	N	pw.su			def:yes	
9 - 7 - 3						25	PRSS. COMMON	N	pw.su			def:yes	
9 - 7 - 3						26	OIL PUMPS	N	pw:su	lo: 1	hi: 2	def: 2	
9 - 7 - 3						27	SOOTBLOWER	N	pw:su			def:yes	
9 - 7 - 3						28	AUX PUMP	N	pw:su			def:no	
9 - 7 - 3						29	FLAME SCANNERS	N	pw:su	lo: 1	hi: 2	def:2	
9 - 7 - 3						30	WINDBOX TEMP	N	pw:su			def:no	
9 - 7 - 3						31	MODBUS EXT. PRIO	N	pw:su	lo: OFF	hi: HIGH	def:OFF	
9 - 7 - 3						32	BLOCK ALARMGRP	N	pw:su			def:yes	
9 - 7 - 4					ANALOG OPTIONS								
9 - 7 - 4						0	BOILER PRES	N	pw:su			def: yes	
9 - 7 - 4						1	OIL PRESS NZ	N	pw:su			def: no	
9 - 7 - 4						2	WATER LEVEL	N	pw:su			def: yes	
9 - 7 - 4						3	DIFF. PRES.	N	pw:su			def: yes	
9 - 7 - 4						4	ME LOAD	N	pw:su			def: yes	
9 - 7 - 4						5	F OIL TEMP	N	pw:su			def: yes	
9 - 7 - 4						6	OIL FLOW	N	pw:su			def: yes	
9 - 7 - 4						7	WATER EGB	N	pw:su			def: yes	
9 - 7 - 4						8	BOILER EGB	N	pw:su			def: yes	
9 - 7 - 4						9	TEMP.INLET	N	pw:su			def: yes	
9 - 7 - 4						10	TEMP.OUTLET	N	pw:su			def: yes	
9 - 7 - 5					EDIT TEXT				pw:su				
9 - 7 - 5							FREE TEXT #						
9 - 7 - 5							_						
9 - 7 - 5							ABCDEFGHIJKLMN						
9 - 7 - 5							OPQRSTUVWXYZ./						
9 - 7 - 6					LINK TEXT								
9 - 7 - 6							#01FREETEXT	NO	pw:su			def: NO 00	
9 - 7 - 6							#02FREETEXT	NO	pw:su			def: NO 00	
9 - 7 - 6							#03FREETEXT	NO	pw:su			def: NO 00	
9 - 7 - 6							#04FREETEXT	NO	pw:su			def: NO 00	
9 - 7 - 6							#05FREETEXT	NO	pw:su			def: NO 00	
9 - 7 - 6							#06FREETEXT	NO	pw:su			def: NO 00	
9 - 7 - 6							#07FREETEXT	NO	pw:su			def: NO 00	
9 - 7 - 6							#08FREETEXT	NO	pw:su			def: NO 00	
9 - 7 - 6							#09FREETEXT	NO	pw:su			def: NO 00	
9 - 7 - 6							#10FREETEXT	NO	pw:su			def: NO 00	

MENU TREE FOR BOILER PLANT (LOCAL PANEL)	Version no/data: 6.08/071004	Burnertype: All	Platform: All	Settings: All

LINE NO.	FRONT MENU	LOCK MENU	MAIN MENU	SUB MENU LEVEL 1	SUB MENU LEVEL 2	SUB MENU LEVEL 3	SUB MENU LEVEL 4	[VAL]	PASSW.	LOWEST	HIGHEST	DEFAULT	COMMISSIONING
9 - 7 - 6 -							CLEAR		pw:su				
9 - 8 - 0 -				LANGUAGE									
9 - 8 - 1							CONTRAST	N	pw:cu	lo: 20	hi: 80	def: 20	
9 - 8 - 2							LANGUAGE	N	pw:cu			def: GB	
10			MENU DEVELOPER										
10 - 1					EXAMINE MEMORY								
10 - 1 - 1							[ADR][CONTENT]	N	np				
10 - 2					EDIT MEMORY								
10 - 2 - 1							[ADR][CONTENT][VAL	N	np				
10 - 3					SCAN TIME								
10 - 3 - 1							MIN	N	np				
10 - 3 - 2							MAX	N	np				
10 - 3 - 3							VAL	N	np				
10 - 4					TASK DIAGNOSES								
10 - 4 - 1							[NUM][NAME]		np				
10 - 4 - 2							PTR:[VALUE]		np				
10 - 4 - 3							SEM:[VALUE]		np				
10 - 4 - 4							CNT:[VALUE]		np				
10 - 5					SHOW F.OIL TEMP.			N	np				

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BOILER CONTROL PANEL

ORDER NUMBER	: 051868-01 + 051868-02 + 051868-03 + 051868-04
	: 051868-05 + 051868-06 + 051868-07 + 051868-08
CUSTOMER	: JIANGNAN SHIPYARD
NEW BUILDING	: H2390+H2391+H2392+H2393+H2403+H2404+H2405+H2406
BOILER	: MISSION™ OS
OIL BURNER	: KBE 350
COMBUSTION OF	: DIESEL OIL, HEAVY FUEL OIL
POWER SUPPLY	: 3 x 440 VOLTS, 60 C/S
CONTROL VOLTAGE	: 1 x 230 VOLTS, 60 C/S
CLASSIFICATION	: GL + CCS

AALBORG INDUSTRIES

TITLE: CONTROL PANEL

ORIGINAL DRAWING NO.:

REV.	DESCRIPTION	DATE	NAME
E	AS BUILD - 051868-02	09 MAR 08	IMJ/188
C	UPDATE FOR PRODUCTION	22 NOV 07	IMJ/188
D	AS BUILD - 051868-01	29 JAN 08	LBD/172

DRAWN BY	DATE	CHECKED BY	CHECKED DATE
ESP/181	16 OCT 06	HOV/182	17 OCT 06

DRAWING NUMBER	REV.	SHEET
63X03:043507	E	01

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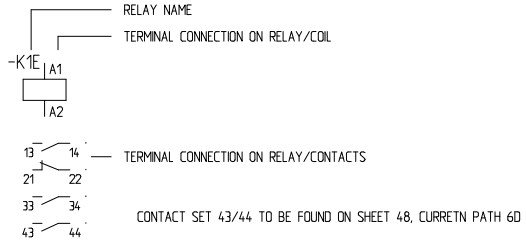
CONTENTS

SHEET NO.	NAME
1	COVER SHEET
2	LIST OF CONTENTS
3	POWER PANEL LAY OUT
4,5,6,7,8,9,10	WIRING DIAGRAM - POWER CIRCUIT
12,25	WIRING DIAGRAM - CONTROL CIRCUIT
14	WIRING DIAGRAMS - RS485 CONNECTION
30,35,40,51,60,62,64,80,81,84,85,90	WIRING DIAGRAMS - ANALOG IN/OUTPUT
20,43,44,49,50,66,68,70,71,72	WIRING DIAGRAMS - DIGITAL IN/OUTPUT
100,101,102,106,108,112,114,115,116,118,120,121,122,124,126,128	CONTROL PANELS

REVISIONS

SHEET NO.	INDEX	DATE	NAME
01,02,07,14,31,33,34,35,36,38,41,50,56,112,114,	A	06 JUL 07	IMJ/172
115,17,118,			
1,2,03,04,05,07,31,38,41,100,114,119	B	18 OCT 07	LBS/188
01,02,05,08,14,16,30,31,32,33,35,36,38,41,43,50,	C	22 NOV 07	IMJ/188
52,53,54,55,56,90,100,113,115,116,119,126			
1,2,5,8,13,14,15,38,40	D	29 JAN 08	LBD/172
1,2,3,30,32,37,52,54,90	E	09 MAR 08	IMJ/188

INTERPRETATION GUIDE:



MAXIMUM VIBRATION VALUES
100 GAL AT 10-30 Hz
(1 GAL = 0,01 m/sec^2)

SETPOINT FOR MOTOR PROTECTION
SHALL BE SET TO OPERATION CURRENT(In)
MAX. SETPOINT IS 110% OF In

UPDATE ON CONCEPT

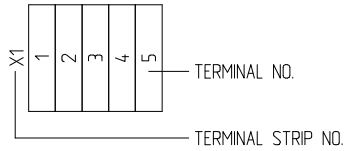
WIRING:

INTERNAL WIRING, SCREENED WIRING
INTERNAL WIRING
EXTERNAL WIRING

COLOUR CODE SIGNAL LAMPS:



TERMINAL STRIP



NOTE :

CONNECTIONS MARKED WITH * ARE PREWIRET BY AALBORG
WIRE COLOUR CODE: BLACK WITH NUMBERS

TERMINALS:

-X0 No.	TERMINALS FOR RS485 CONNECTION
-X1 No.	TERMINALS FOR ANALOG IN-/OUTPUT
-X2 No.	TERMINALS FOR DIGITAL IN-/OUTPUT
-X3 No.	SPARE
-X4 No.	SPARE
-X5 No.	TERMINALS IN POWER CIRCUIT
-X6 No.	TERMINALS FOR CONTROL VOLTAGE
-X7 No.	SPARE
-X8 No.	SPARE
-X9 No.	SPARE
-X10 No.	SPARE
-X11 No.	TERMINALS IN BURNER JUNCTION BOX
-X12 No.	TERMINALS IN HEATER JUNCTION BOX
-X13 No.	SPARE
-X14 No.	SPARE

AALBORG INDUSTRIES

TITLE: CONTROL PANEL

REV.	DESCRIPTION	DATE	NAME
E	AS BUILD - 051868-02	09 MAR 08	IMJ/188
C	UPDATE FOR PRODUCTION	22 NOV 07	IMJ/188
D	AS BUILD - 051868-01	29 JAN 08	LBD/172

ORIGINAL DRAWING NO.:

DRAWN BY	DATE	CHECKED BY	CHECKED DATE
ESP/181	16 OCT 06	HOV/182	17 OCT 06

DRAWING NUMBER	REV.	SHEET
63X03:043507	E	02

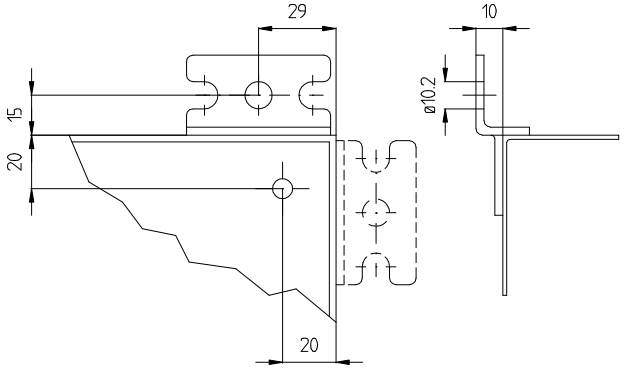
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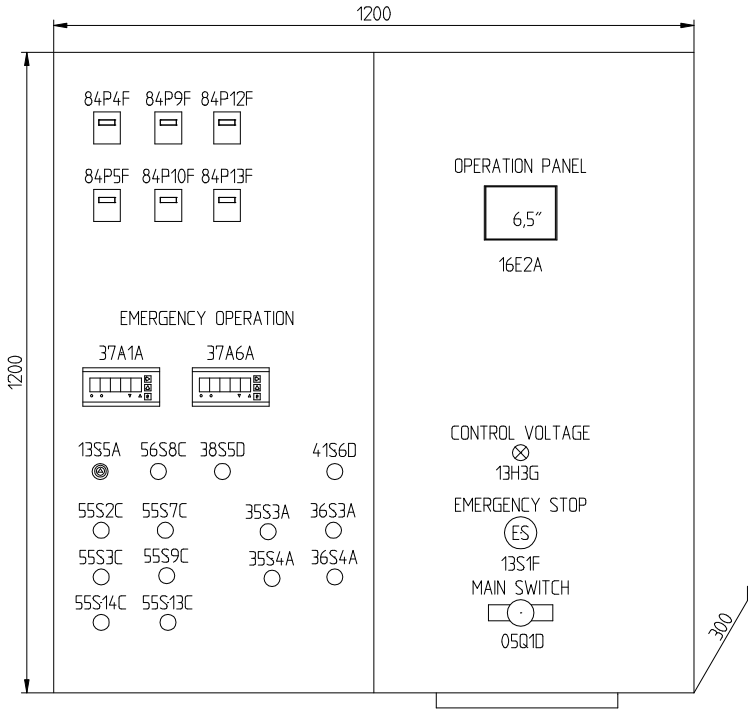
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PROTECTION CLASS: IP 44
PANEL TYPE: RITTAL
PANEL WEIGHT: 120 kg +/- 10%
AMBIENT TEMP. MAX 55°C

COLOUR: MUNSELL 7,5 BG 7/2

WALL BRACKET - 4 PIECES FOLLOW THE PANEL





AALBORG INDUSTRIES	TITLE: CONTROL PANEL			ORIGINAL DRAWING NO.:			
				DRAWN BY	DATE	CHECKED BY	CHECKED DATE
	E	AS BUILD - 051868-02: TEXT CHANGED	09 MAR 08	IMJ/188	ESP/181	16 OCT 06	HOV/182	17 OCT 06
	B	EMERGENCY OPERATION UPDATED	18 OCT 07	LBS/188	DRAWING NUMBER		REV.	SHEET
	REV.	DESCRIPTION	DATE	NAME	63X03:043507		E	03

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ALL CABLE GLANDS ARE
BRASS-NICKLE PLATED, IP68

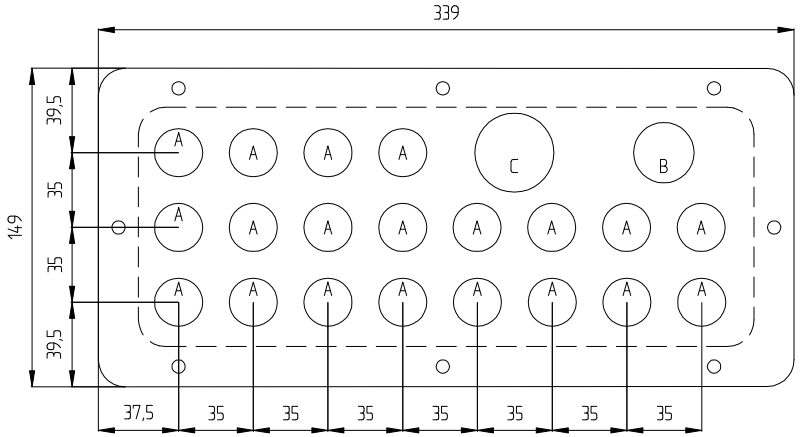
HOLE 22.5 mm FOR CABLE GLAND Pg 16 - 20 pcs.
CABLE ø 10-14

HOLE 28.3 mm FOR CABLE GLAND Pg 21 - 1 pcs.
CABLE ø 13-18

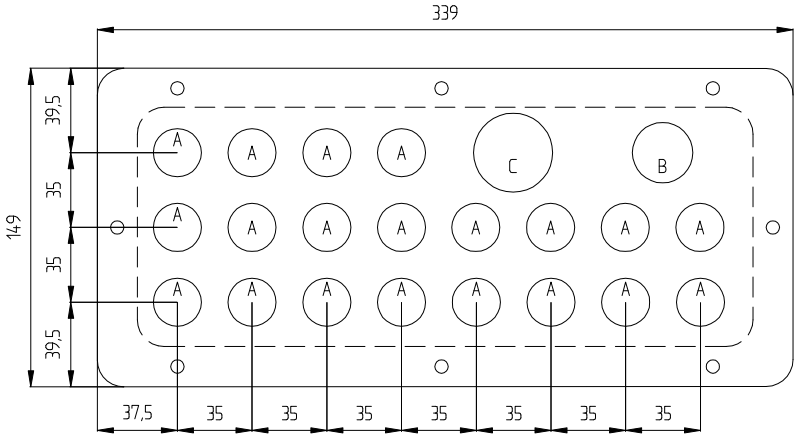
HOLE 37.0 mm FOR CABLE GLAND Pg 29 - 1 pcs.
CABLE ø 18-25

ALL MEASURES IN mm

BOTTOM VIEW



LEFT



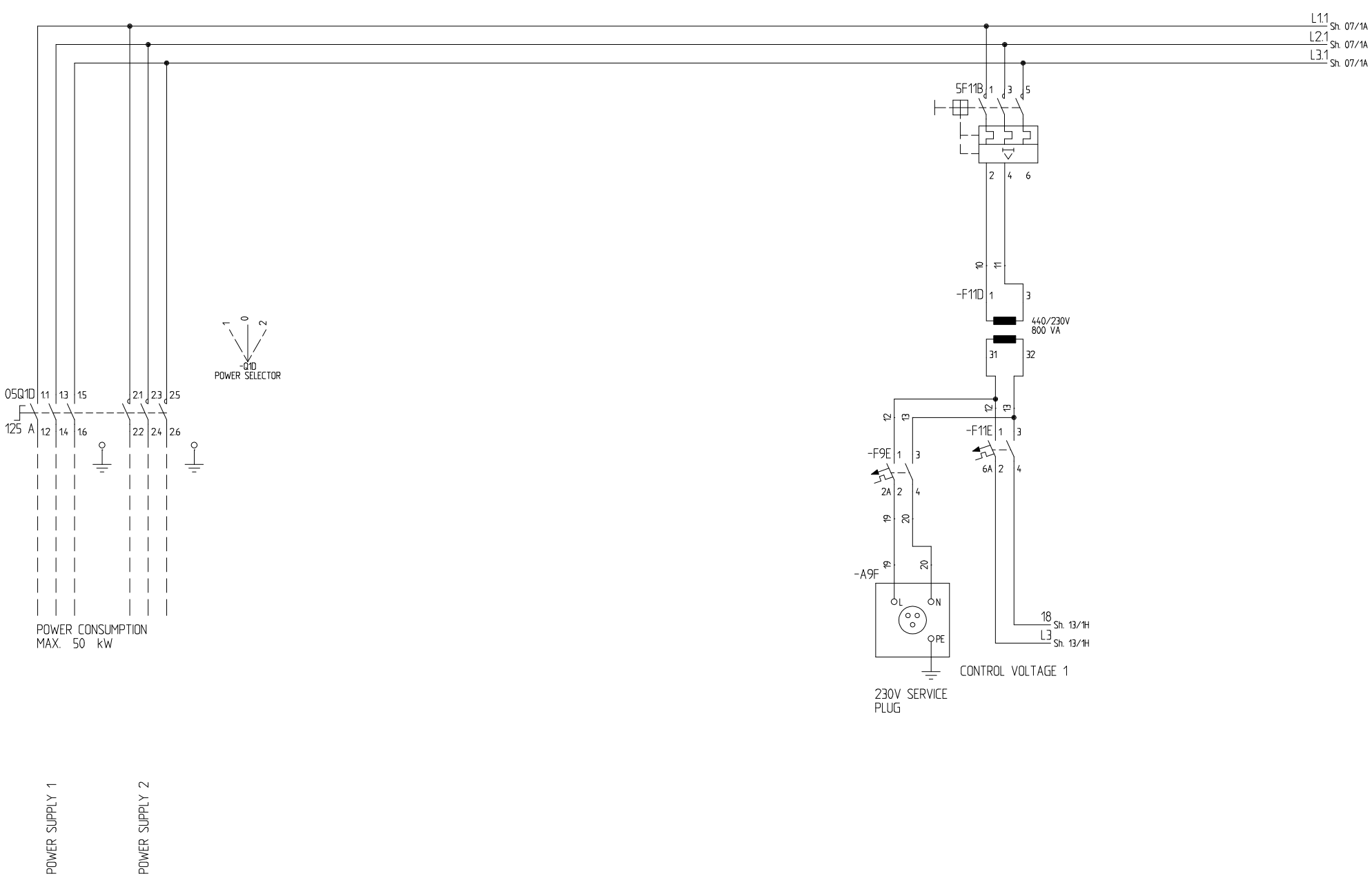
RIGHT

TITLE: CONTROL PANEL				ORIGINAL DRAWING NO.:	
				DRAWN BY / DATE	CHECKED BY / CHECKED DATE
				ESP/181 / 16 OCT 06	HOV/182 / 17 OCT 06
B	CABLE GLANDS UPDATED	18 OCT 07	LBS/188	DRAWING NUMBER	REV. / SHEET
REV.	DESCRIPTION	DATE	NAME	63X03:043507	B / 04

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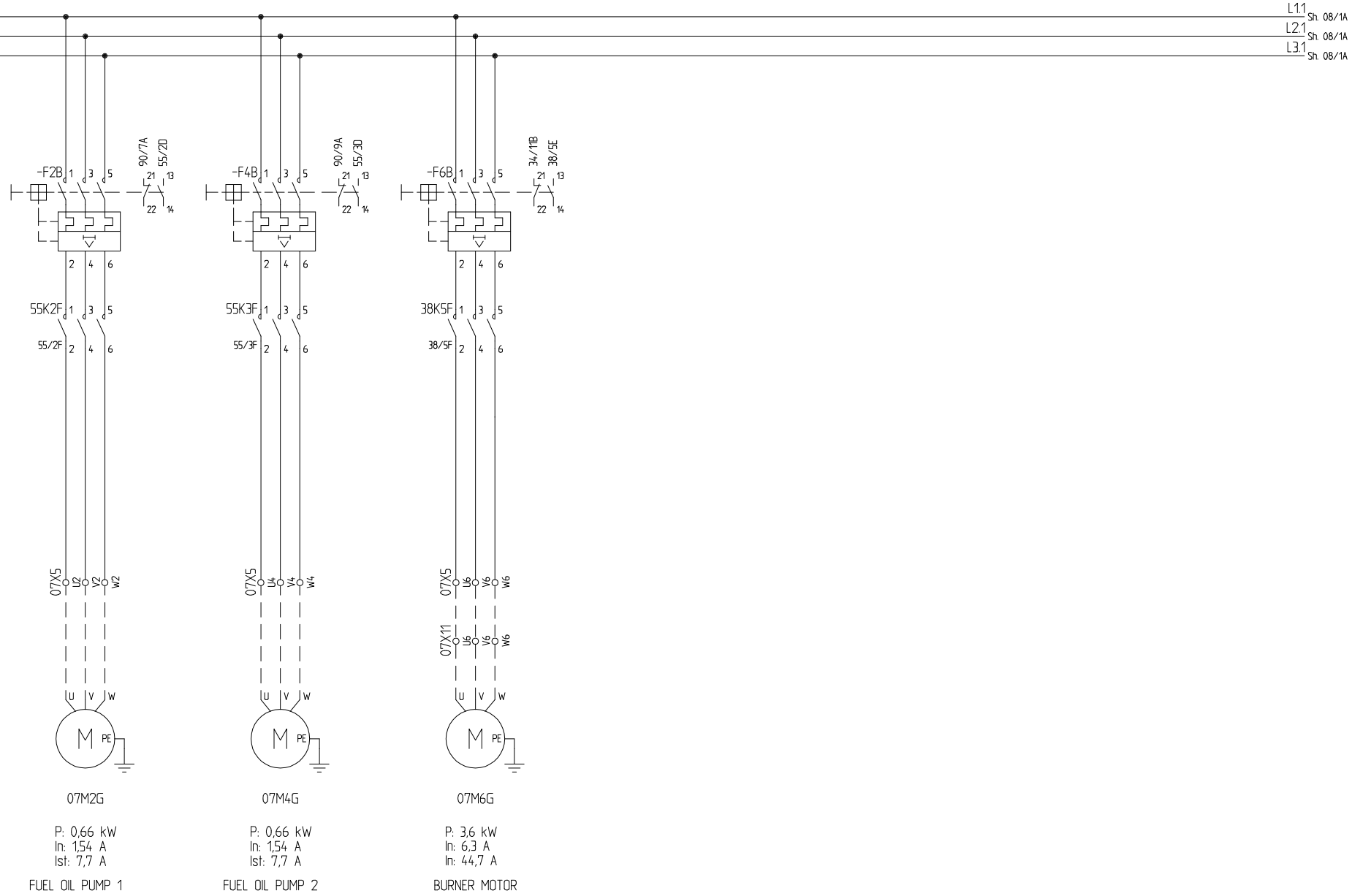


TITLE: CONTROL PANEL				ORIGINAL DRAWING NO.:			
				DRAWN BY	DATE	CHECKED BY	CHECKED DATE
B	SERVICE POWER PLUG UPDATED/MAIN BREAKER SIZE UPATED	18 OCT 07	LBS/188	ESP/181	16 OCT 06	HOV/182	17 OCT 06
D	AS BUILD - 051868-01	29 JAN 08	LBD/172	DRAWING NUMBER		REV.	SHEET
REV.	DESCRIPTION	DATE	NAME	63X03:043507		D	05

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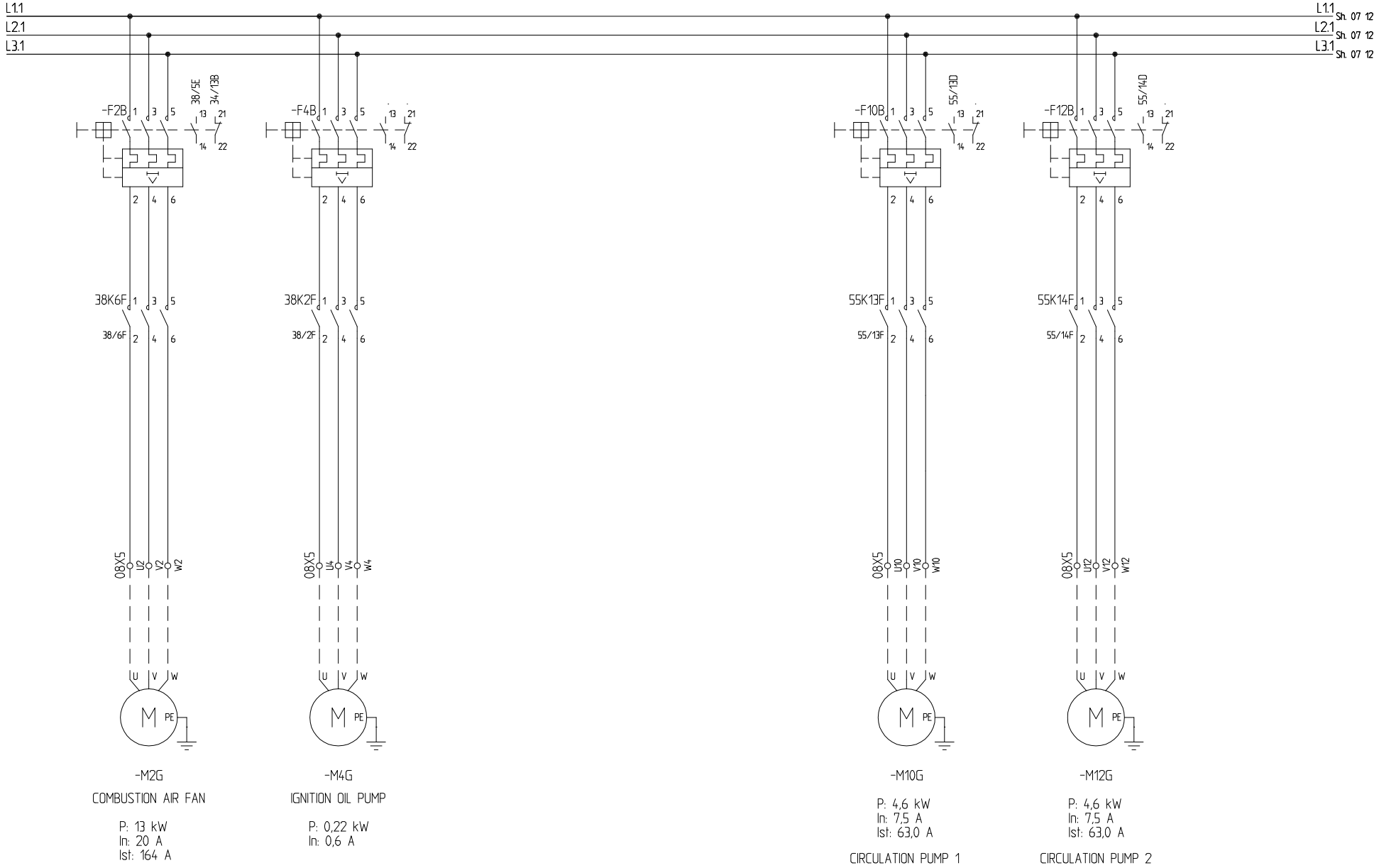
TITLE: CONTROL PANEL

ORIGINAL DRAWING NO.:

REV.	DESCRIPTION	DATE	NAME	DRAWN BY	DATE	CHECKED BY	CHECKED DATE
B	X11 TERMINALS ADDED FOR BURNER MOTOR	18 OCT 07	LBS/188	ESP/181	16 OCT 06	HOV/182	17 OCT 06
A	PREHEATER DELETE	06 JUL 07	IMJ/172	DRAWING NUMBER		REV.	SHEET
				63X03:043507		B	07

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TITLE: CONTROL PANEL

ORIGINAL DRAWING NO.:

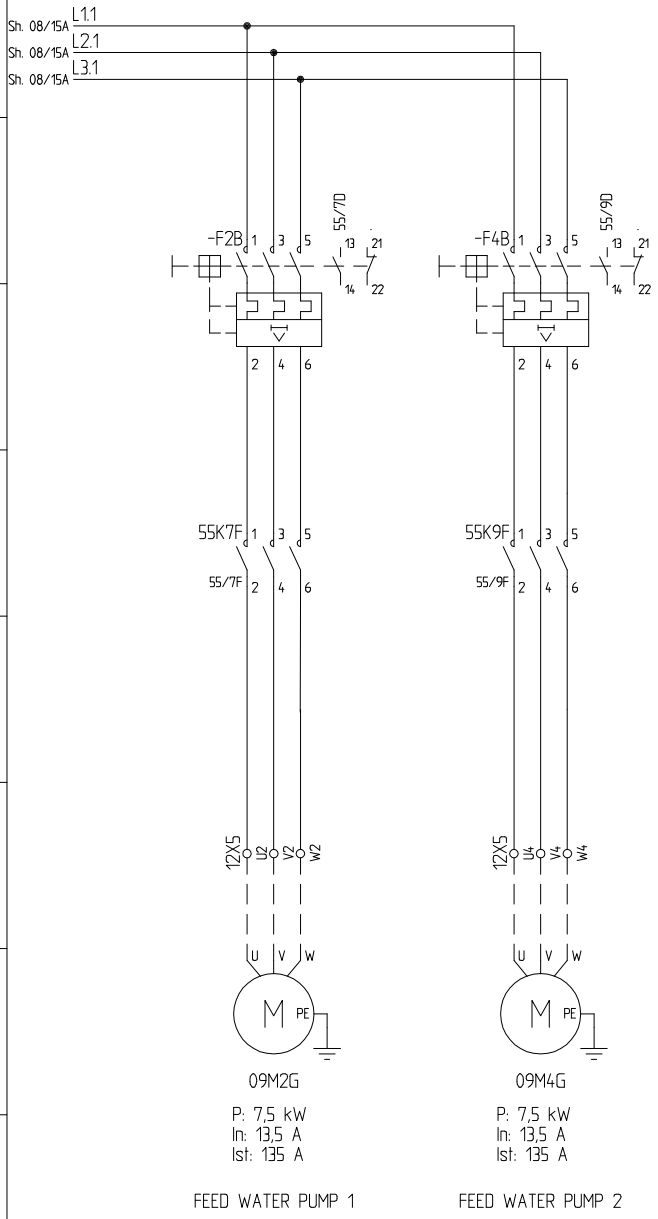
REV.	DESCRIPTION	DATE	NAME
D	AS BUILD - 051868-01	29 JAN 08	LBD/172
C	UPDATE FOR PRODUCTION: TERMINAL DESIGNATION EXCHANGE / -F10B + F12B	22 NOV 07	IMJ/188

DRAWN BY	DATE	CHECKED BY	CHECKED DATE
ESP/181	16 OCT 06	HOV/182	17 OCT 06

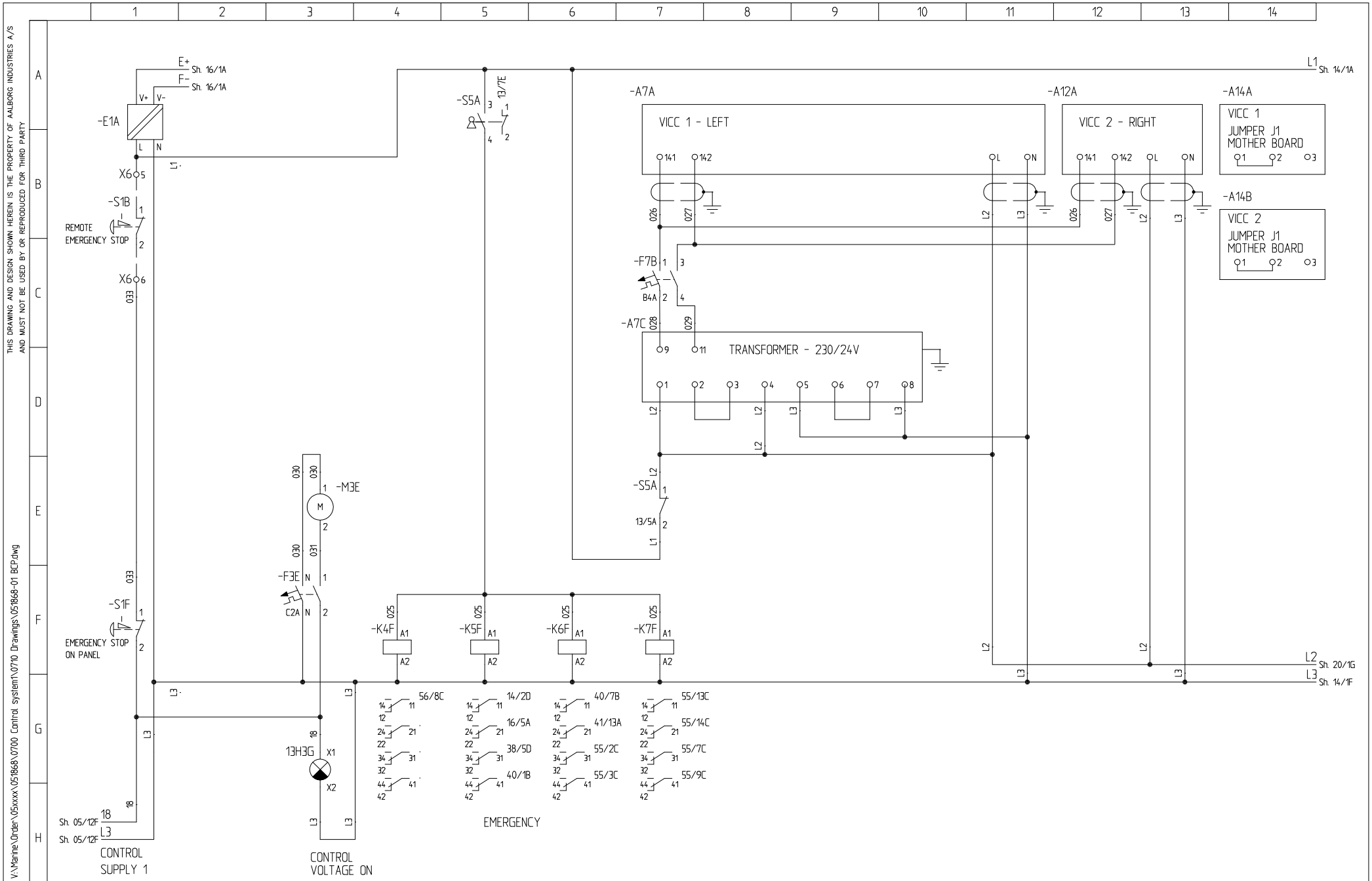
DRAWING NUMBER	REV.	SHEET
63X03:043507	D	08

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AALBORG INDUSTRIES	TITLE: CONTROL PANEL			ORIGINAL DRAWING NO.:			
				DRAWN BY	DATE	CHECKED BY	CHECKED DATE
				ESP/181	16 OCT 06	HOV/182	17 OCT 06
				DRAWING NUMBER		REV.	SHEET
	REV. DESCRIPTION	DATE	NAME	63X03:043507			12



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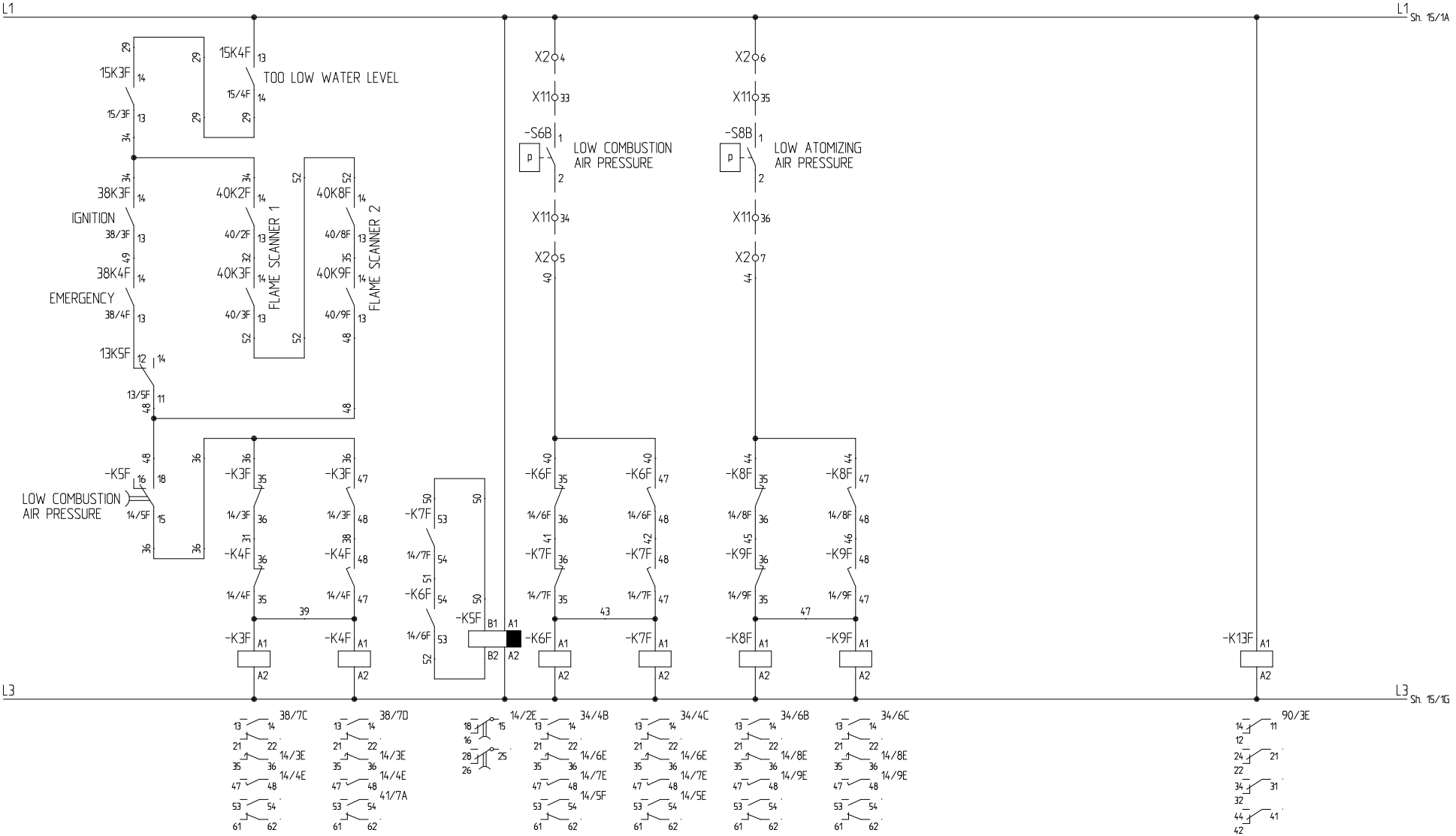
V:\Marine\Order\05xxxx\051868\0700 Control system\0700 Drawings\051868-01 BCP.dwg

AALBORG INDUSTRIES

TITLE: CONTROL PANEL				ORIGINAL DRAWING NO.:		
				DRAWN BY	DATE	CHECKED BY	CHECKED DATE
				ESP/181	16 OCT 06	HOV/182	17 OCT 06
D	AS BUILD - 051868-01 / RELAY ADDED	29 JAN 08	LBD/172	DRAWING NUMBER	REV.	SHEET
REV.	DESCRIPTION	DATE	NAME	63X03:043507	D	13

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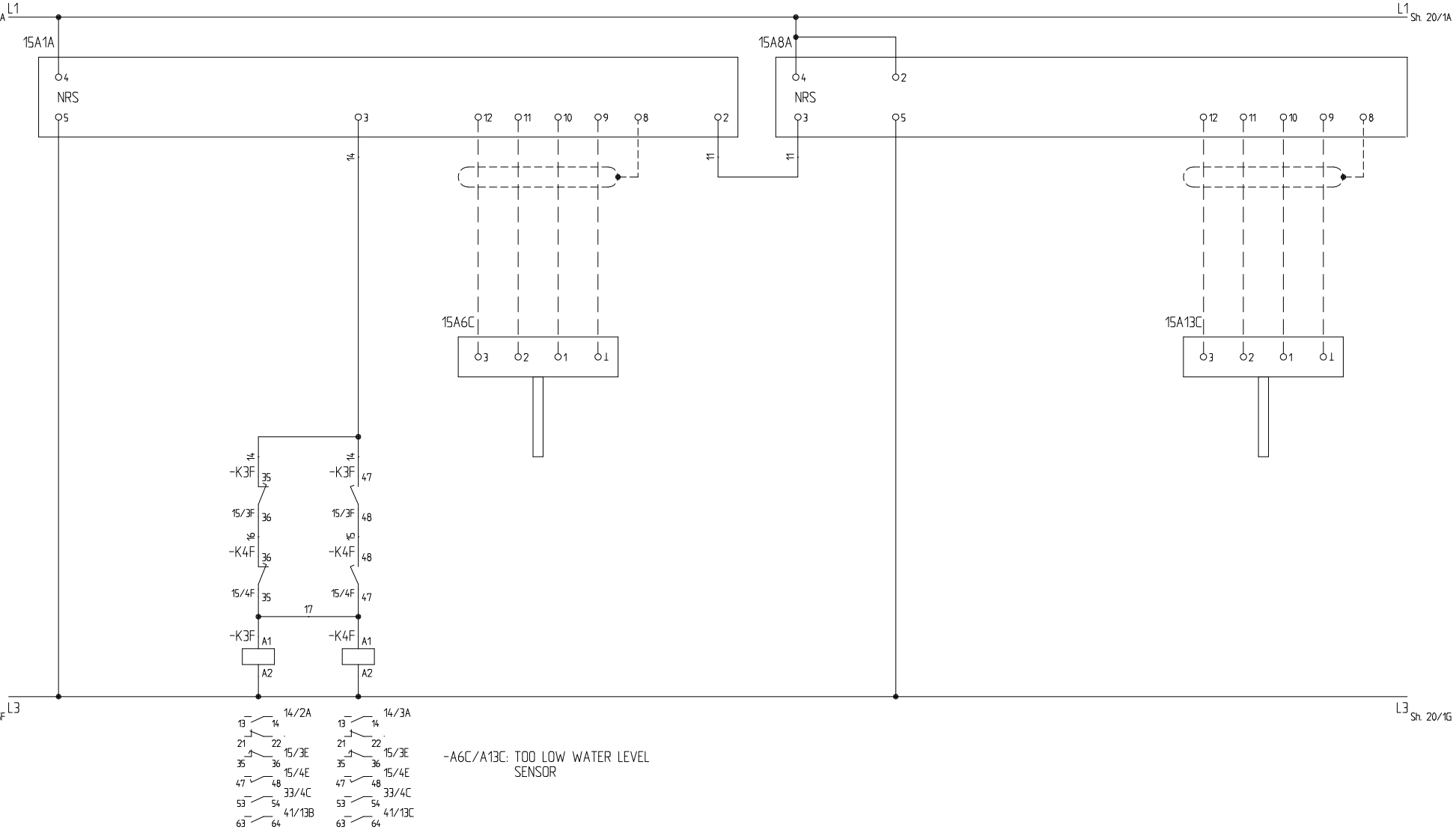


TITLE: CONTROL PANEL				ORIGINAL DRAWING NO.:	
A	TIMER -K5F ADDED.	06 JUL 07	IMJ/172	DRAWN BY / DATE	CHECKED BY / CHECKED DATE
C	UPDATE FOR PRODUCTION: TERMINAL DESIGNATION EXCHANGE / CORE NUMBER EXCHANGE / NEW CORE NUMBER ADDED	22 NOV 07	IMJ/188	ESP/181 — 16 OCT 06	HOV/182 — 17 OCT 06
D	AS BUILD - 051868-01 / RELAYS CHANGED	29 JAN 08	LBD/172	DRAWING NUMBER / REV. / SHEET	
REV.	DESCRIPTION	DATE	NAME	63X03:043507 — D — 14	

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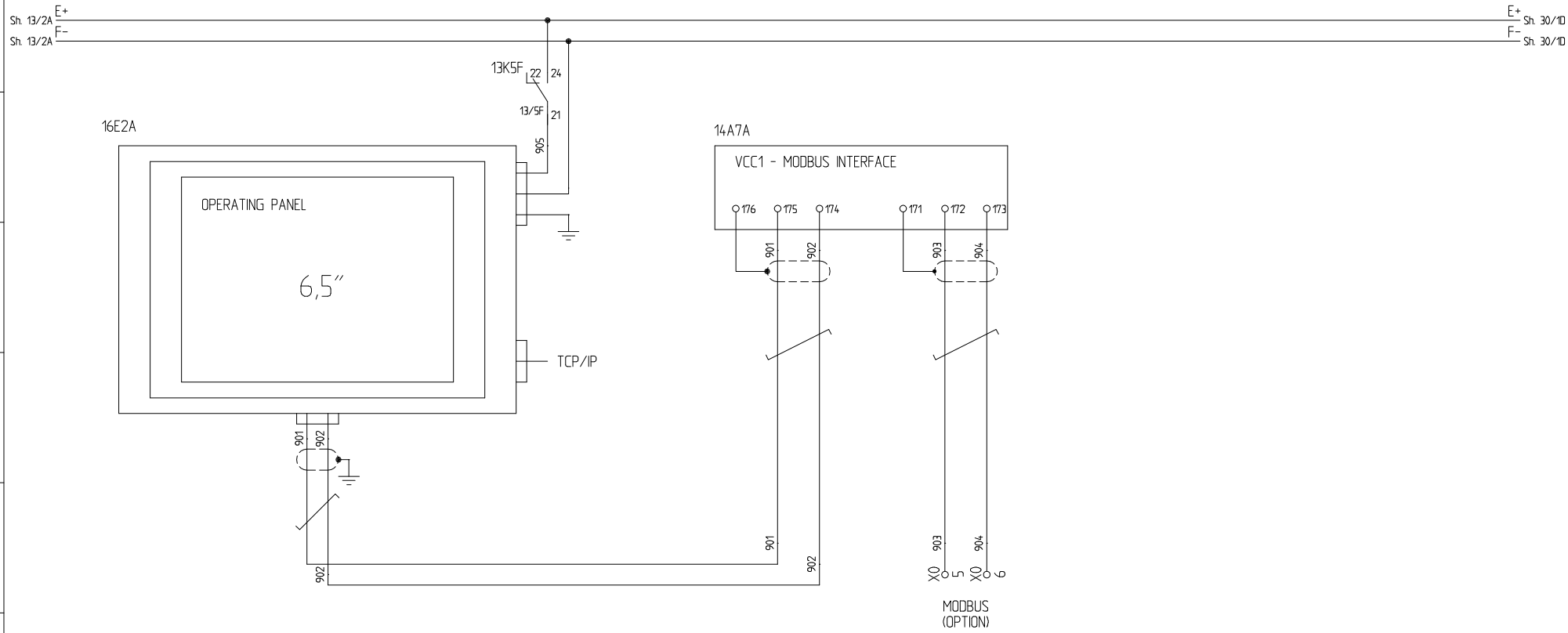


TITLE: CONTROL PANEL				ORIGINAL DRAWING NO.:		
				DRAWN BY / DATE	CHECKED BY / CHECKED DATE	
				ESP/181 16 OCT 06	HOV/182 17 OCT 06	
D	AS BUILD - 051868-01 / RELAYS CHANGED	29 JAN 08	LBD/172	DRAWING NUMBER	REV.	SHEET
REV.	DESCRIPTION	DATE	NAME	63X03:043507	D	15

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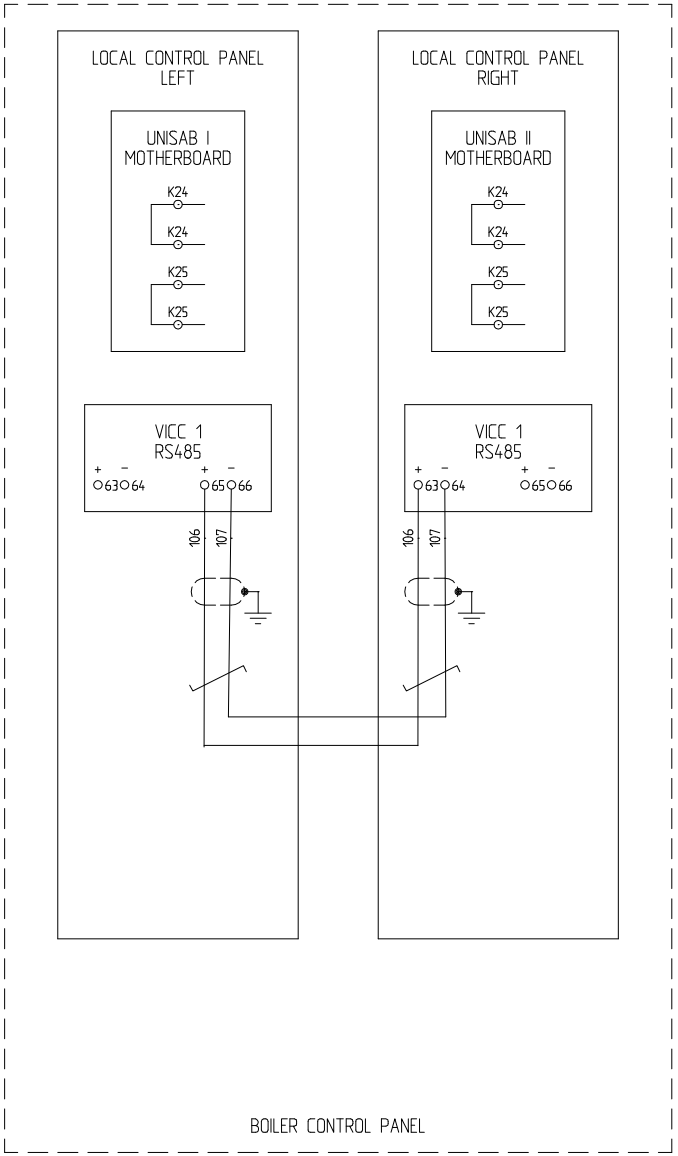


TITLE: CONTROL PANEL				ORIGINAL DRAWING NO.:			
				DRAWN BY	DATE	CHECKED BY	CHECKED DATE
				ESP/181	16 OCT 06	HOV/182	17 OCT 06
C	UPDATE FOR PRODUCTION: 13K5F ADDED	22 NOV 07	IMJ/188	DRAWING NUMBER		REV.	SHEET
REV.	DESCRIPTION	DATE	NAME	63X03:043507		C	16

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RS485 NETWORK CABLE
1x2xMIN 0.5 / MAX 1.5 WITH COMMON SCREEN. MAX CAPACITY 100 nF (TWISTED PAIR)
NOTE: EARTHING IS ONLY ALLOWED AT ONE END OF THE NETWORK

AALBORG INDUSTRIES

TITLE: CONTROL PANEL

REV.	DESCRIPTION	DATE	NAME

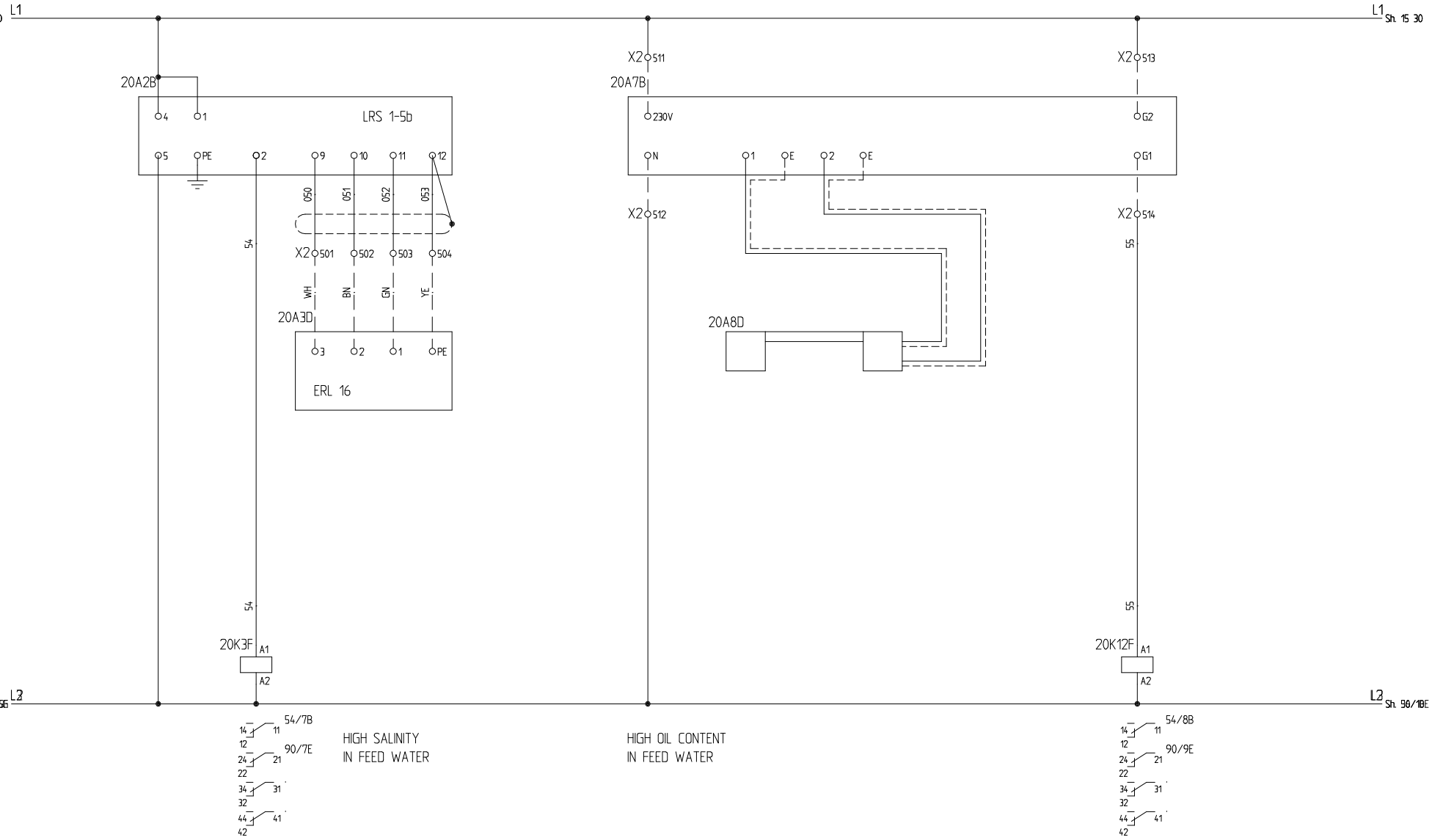
ORIGINAL DRAWING NO.:

DRAWN BY	DATE	CHECKED BY	CHECKED DATE
ESP/181	16 OCT 06	HOV/182	17 OCT 06

DRAWING NUMBER	REV.	SHEET
63X03:043507		17

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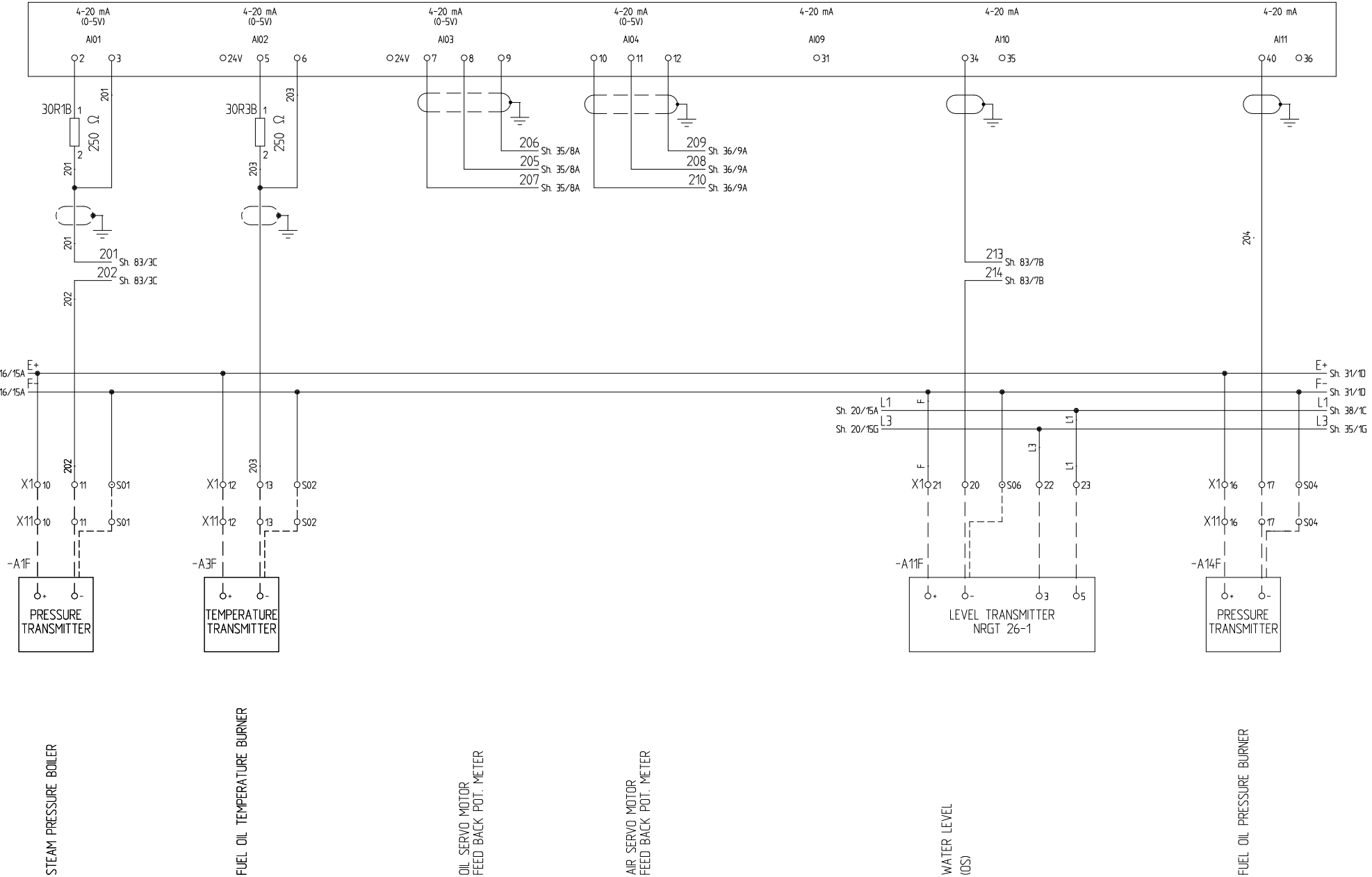


AALBORG INDUSTRIES	TITLE: CONTROL PANEL			ORIGINAL DRAWING NO.:			
				DRAWN BY	DATE	CHECKED BY	CHECKED DATE
				ESP/181	16 OCT 06	HOV/182	17 OCT 06
	REV. DESCRIPTION	DATE	NAME	DRAWING NUMBER		REV.	SHEET
				63X03:043507			20

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CONTROLLER 1 - LEFT



AALBORG INDUSTRIES	TITLE: CONTROL PANEL			ORIGINAL DRAWING NO.:			
				DRAWN BY	DATE	CHECKED BY	CHECKED DATE
	E	AS BUILD - 051868-02: SCREEN DELETED / SIGNAL FOR 201 + 202 UPDATED	09 MAR 08	IMJ/188	ESP/181	16 OCT 06	HOV/182	17 OCT 06
	C	UPDATE FOR PRODUCTION: SCREEN ADDED	22 NOV 07	IMJ/188	DRAWING NUMBER		REV.	SHEET
	REV.	DESCRIPTION	DATE	NAME	63X03:043507		E	30

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CONTROLLER 1 - LEFT

PT 100 INPUT

AI05 PT01: 13, 14, 15 SIG, 16 SIG
AI06 PT02: 17, 18, 19 SIG, 20 SIG
AI07 PT03: 22, 23 SIG, 24 SIG
AI08 PT04: 25, 26, 27 SIG, 28 SIG

086, 087, 088, 089
090, 091, 092, 093
096, 097, 098, 099

X1: 29, 30, 31, 32
X1: 25, 26, 27, 28
X1: 33, 34, 35, 36

TACHO INPUT

162, 161
320, 321

X1 320: 40, 41
X11: 40, 41

YELLOW
BLACK

31A12F
1, 5
TRANSMITTER

FUEL OIL FLOW METER

E+ Sh. 30/15D
F- Sh. 30/15D

E+ Sh. 32/1C
F- Sh. 32/1D

31A14A
JUMPER J1
PIGGYBACK
1, 2, 3

REV.	DESCRIPTION	DATE	NAME
C	UPDATE FOR PRODUCTION: CORE NUMBER EXCHANGE	22 NOV 07	IMJ/188
B	SENSOR FOR OIL TEMPERATUR (ELECTRICAL HEATER) - DELETED	18 OCT 07	LBS/188
A	TERMINAL NUMBER 42 DELETE	06 JUL 07	IMJ/172

TITLE: CONTROL PANEL

ORIGINAL DRAWING NO.:

DRAWN BY	DATE	CHECKED BY	CHECKED DATE
ESP/181	16 OCT 06	HOV/182	17 OCT 06

DRAWING NUMBER	REV.	SHEET
63X03:043507	C	31

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TITLE: CONTROL PANEL				ORIGINAL DRAWING NO.:			
				DRAWN BY	DATE	CHECKED BY	CHECKED DATE
E	AS BUILD - 051868-02: SCREEN DELETED	09 MAR 08	IMJ/188	ESP/181	16 OCT 06	HOV/182	17 OCT 06
C	UPDATE FOR PRODUCTION: NEW CORE NUMBER / SCREEN ADDED / TERMINAL BLOCK NUMBER CHANGE	22 NOV 07	IMJ/188	DRAWING NUMBER		REV.	SHEET
REV.	DESCRIPTION	DATE	NAME	63X03:043507		E	32

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CONTROLLER 1 - LEFT

DIGITAL INPUT

DI01 DI02 DI03 DI04 DI05 DI06 DI07 DI08 DI09 DI10

41 42 43 44 45 46 47 48 49 50 51 52 53 54 55 56 57 58 59 60 29 159

439 420 421 422 423 424 425 426 427 428 429 430 431 438

Sh. 32 34 — Sh. 32 34

15K3F 424 53 — 15/3F 54 — 416 — 15K4F 54 — 15/4F 53 — 425

40K2F 426 53 — 40/2F 54 — 417 — 40K3F 54 — 40/3F 53 — 427

40K8F 428 53 — 40/8F 54 — 418 — 40K9F 54 — 40/9F 53 — 429

X2 10 11 — X2 12 13 — X2 14 15 — X2 16 17

X11 3 4 — X11 31 32

33S2F 1 2 P

EXTERNAL SHUT DOWN

HIGH STEAM PRESSURE

BURNER SWING OUT

TOO LOW WATER LEVEL

FLAME SCANNER 1

FLAME SCANNER 2

START PERMISSION FROM PMS

AALBORG INDUSTRIES

TITLE: CONTROL PANEL

ORIGINAL DRAWING NO.:

REV.	DESCRIPTION	DATE	NAME
A	-K8F/-K9F ADDED	06 JUL 07	IMJ/172
C	UPDATE FOR PRODUCTION: NEW CORE NUMBER ADDED / CORE NUMBER CHANGE	22 NOV 07	IMJ/188

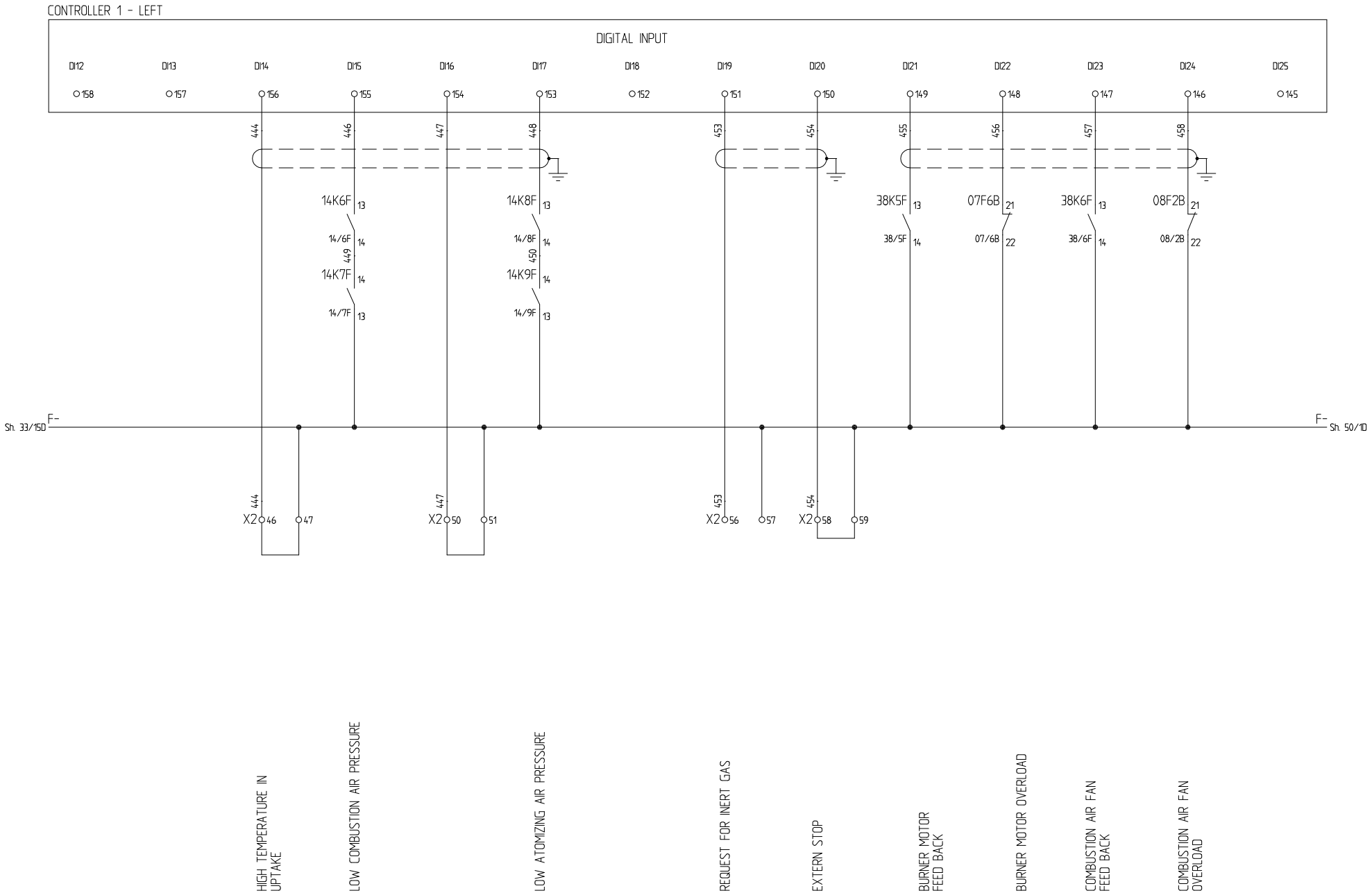
DRAWN BY	DATE	CHECKED BY	CHECKED DATE
ESP/181	16 OCT 06	HOV/182	17 OCT 06

DRAWING NUMBER	REV.	SHEET
63X03:043507	C	33

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CONTROLLER 1 - LEFT

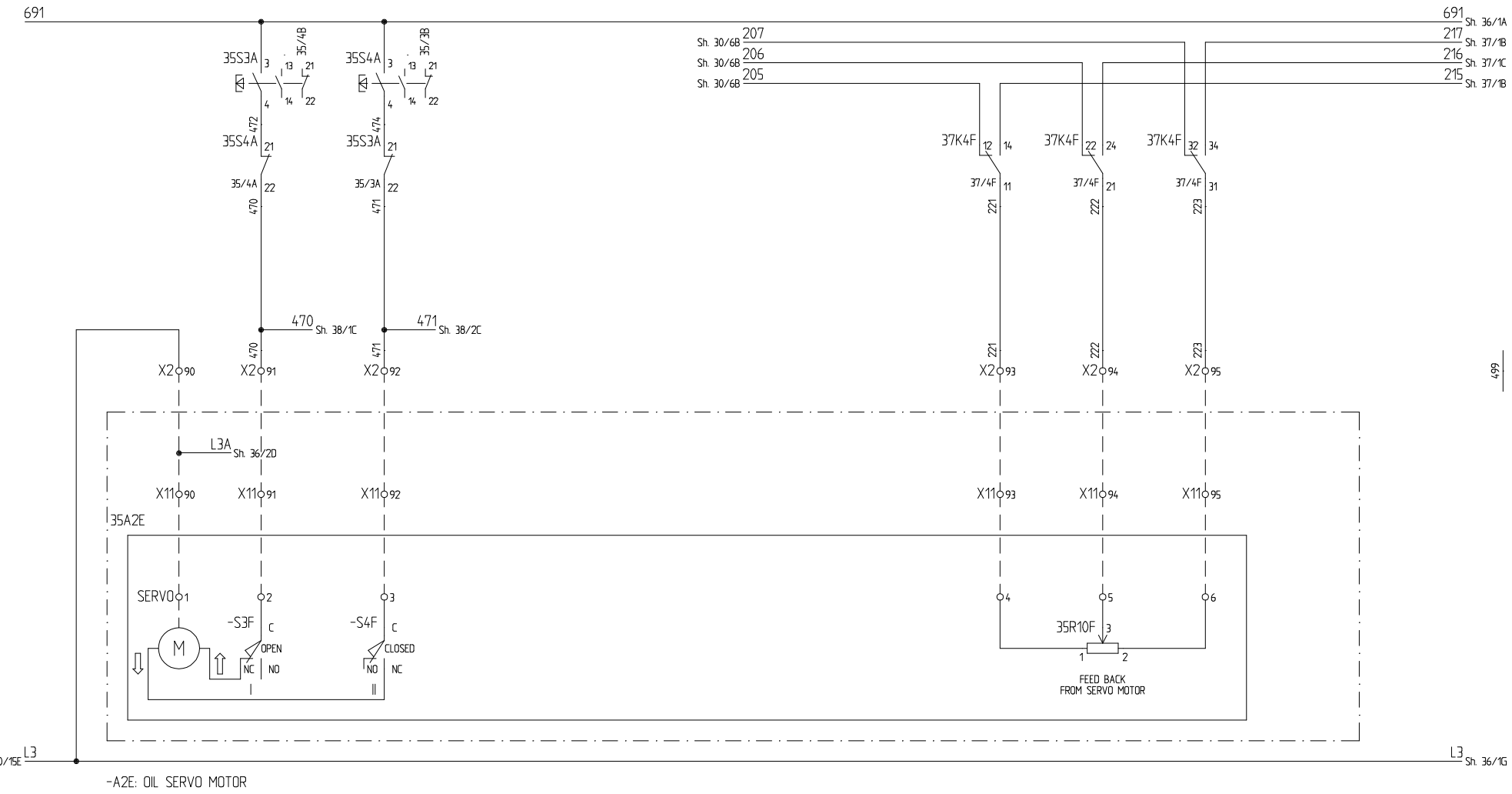


TITLE: CONTROL PANEL			ORIGINAL DRAWING NO.:
A	HIGH OIL TEMPERATURE PREHEATER DELETE	06 JUL 07	IMJ/172
REV.	DESCRIPTION	DATE	NAME

DRAWN BY	DATE	CHECKED BY	CHECKED DATE
ESP/181	16 OCT 06	HOV/182	17 OCT 06
DRAWING NUMBER		REV.	SHEET
63X03:043507		A	34

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-A2E: OIL SERVO MOTOR

REV.	DESCRIPTION	DATE	NAME
A	SERVO MOTOR CHANGED	06 JUL 07	IMJ/172
C	UPDATE FOR PRODUCTION: NEW CORE NUMBER / SCREEN ADDED	22 NOV 07	IMJ/188

TITLE: CONTROL PANEL

ORIGINAL DRAWING NO.:

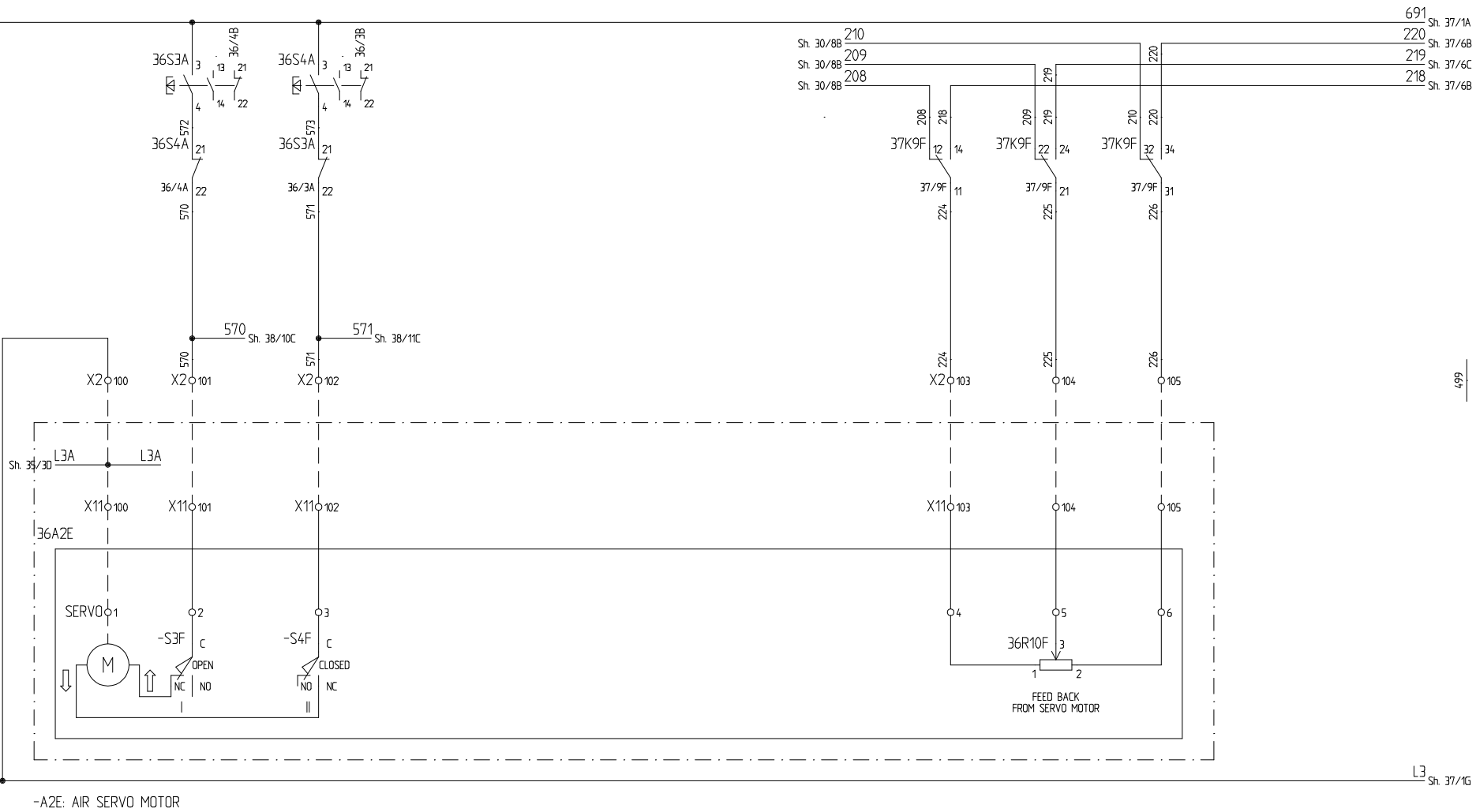
DRAWN BY	DATE	CHECKED BY	CHECKED DATE
ESP/181	16 OCT 06	HOV/182	17 OCT 06

DRAWING NUMBER	REV.	SHEET
63X03:043507	C	35

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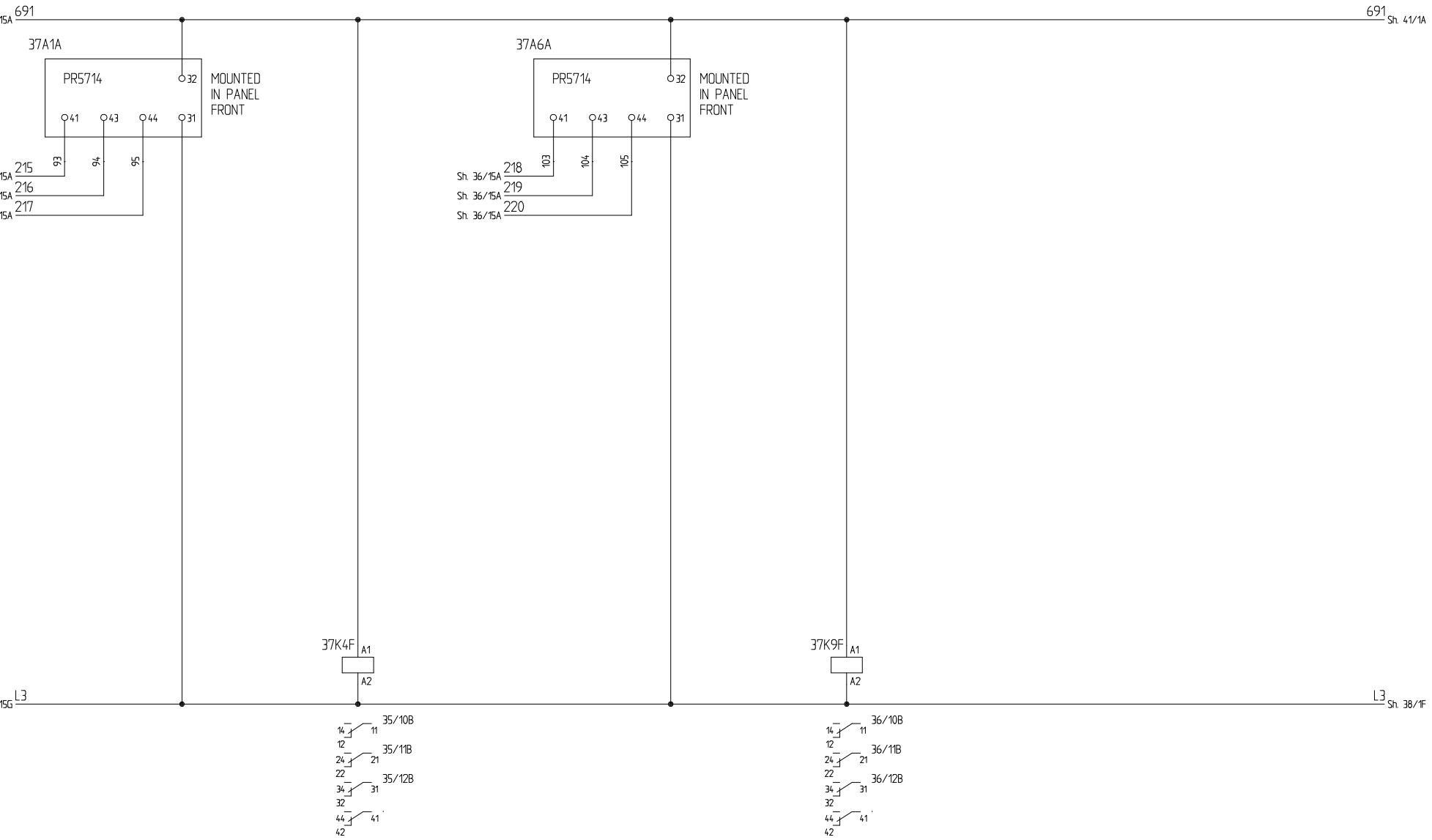
-A2E: AIR SERVO MOTOR

TITLE: CONTROL PANEL				ORIGINAL DRAWING NO.:			
A	SERVO MOTOR CHANGED	06 JUL 07	IMJ/172	DRAWN BY	DATE	CHECKED BY	CHECKED DATE
C	UPDATE FOR PRODUCTION: NEW CORE NUMBER / SCREEN ADDED	22 NOV 07	IMJ/188	ESP/181	16 OCT 06	HOV/182	17 OCT 06
				DRAWING NUMBER		REV.	SHEET
REV.	DESCRIPTION	DATE	NAME	63X03:043507		C	36

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AALBORG INDUSTRIES	TITLE: CONTROL PANEL			ORIGINAL DRAWING NO.:	
				DRAWN BY / DATE: ESP/181 16 OCT 06	CHECKED BY / CHECKED DATE: HOV/182 17 OCT 06
	E AS BUILD - 051868-02: WIRE NO. EXCHANGE / CORE NO. ADDED	09 MAR 08	IMJ/188	DRAWING NUMBER: 63X03:043507	REV.: E / SHEET: 37
	REV. DESCRIPTION	DATE	NAME		

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CONTROLLER 1 - LEFT

DIG. OUTPUT D001 … DIG. OUTPUT D011

67 71 75 81 85 87 89 91 95 99 101 137 139

380

L1 Sh. 30/15D … L1 Sh. 39/1C

470 Sh. 35/3C — OIL SERVO MOTOR BURNER LOAD UP

471 Sh. 35/5C — OIL SERVO MOTOR BURNER LOAD DOWN

532 Sh. 41/1F

-S5D 3 4 — 13K5F 31 32 34 — 13/5F

14K3F 13 — 14/3F 14 — 520 — 14K4F 14 — 14/4F 13 — 473 Sh. 41/8F

535 Sh. 40/1A — IGNITION PURGE VALVE

570 Sh. 36/3C — AIR SERVO MOTOR LOAD UP

571 Sh. 36/5C — AIR SERVO MOTOR LOAD DOWN

-K3F 35 — 38/3F 36 — 382 — -K4F 36 — 38/4F 35

-K3F 47 — 38/3F 48 — 384 — -K4F 48 — 38/4F 47

07F6B 13 — 07/6B 14 — 574 — 08F2B 14 — 08/2B 13 — 575

-K2F A1 A2 — 383

-K3F A1 A2 — 383

-K4F A1 A2 — 383

-K5F A1 A2

-K6F A1 A2

-K7F A1 A2 — 473

L3 Sh. 37/15G … L3 Sh. 39/1G

08/4C 08/4C 08/4C

14/2B 41/7E 38/3E 38/4E

IGNITION

14/2C 38/3E 38/4E

07/6C 07/6C 07/6C 34/10B 90/1E

BURNER START/STOP

08/2C 08/2C 08/2C 34/12B

COMBUSTION AIR FAN START/STOP

OIL VALVES OPEN

TITLE: CONTROL PANEL				ORIGINAL DRAWING NO.:	
C	UPDATE FOR PRODUCTION: NEW CORE NUMBER ADDED / SIGNAL 341 DELETED	22 NOV 07	IMJ/188	DRAWN BY: ESP/181	DATE: 16 OCT 06
B	OVERLOAD SIGNALS FOR BM/CF - ADDED/SIGNAL FOR D010 - DELETED	18 OCT 07	LBS/188	CHECKED BY: HOV/182	CHECKED DATE: 17 OCT 06
D	AS BUILD - 051868-01 / RELAY ADDED	29 JAN 08	LBD/172	DRAWING NUMBER: 63X03:043507	REV.: D
REV.	DESCRIPTION	DATE	NAME		SHEET: 38

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CONTROLLER 1 - LEFT

DIG. OUTPUT D012 — 107 109
DIG. OUTPUT D013 — 110 112
DIG. OUTPUT D014 — 113 115
DIG. OUTPUT D015 — 116 117
DIG. OUTPUT D016 — 118 125
DIG. OUTPUT D017 — 120 121
DIG. OUTPUT D018 — 122 123

L1 — Sh. 38/15C — Sh. 40/1A
L3 — Sh. 38/15F — Sh. 40/1F

390 391 392 393 394 395 396 397 398 399

590

619

X2 110 111
X2 112 113
X2 114 115
X2 116 117
X2 118 119

ALARM GROUP 1
START REQUEST TO PMS
ALARM GROUP 2
ALARM GROUP 3
ALARM GROUP 4

AALBORG INDUSTRIES

TITLE: CONTROL PANEL

REV.	DESCRIPTION	DATE	NAME

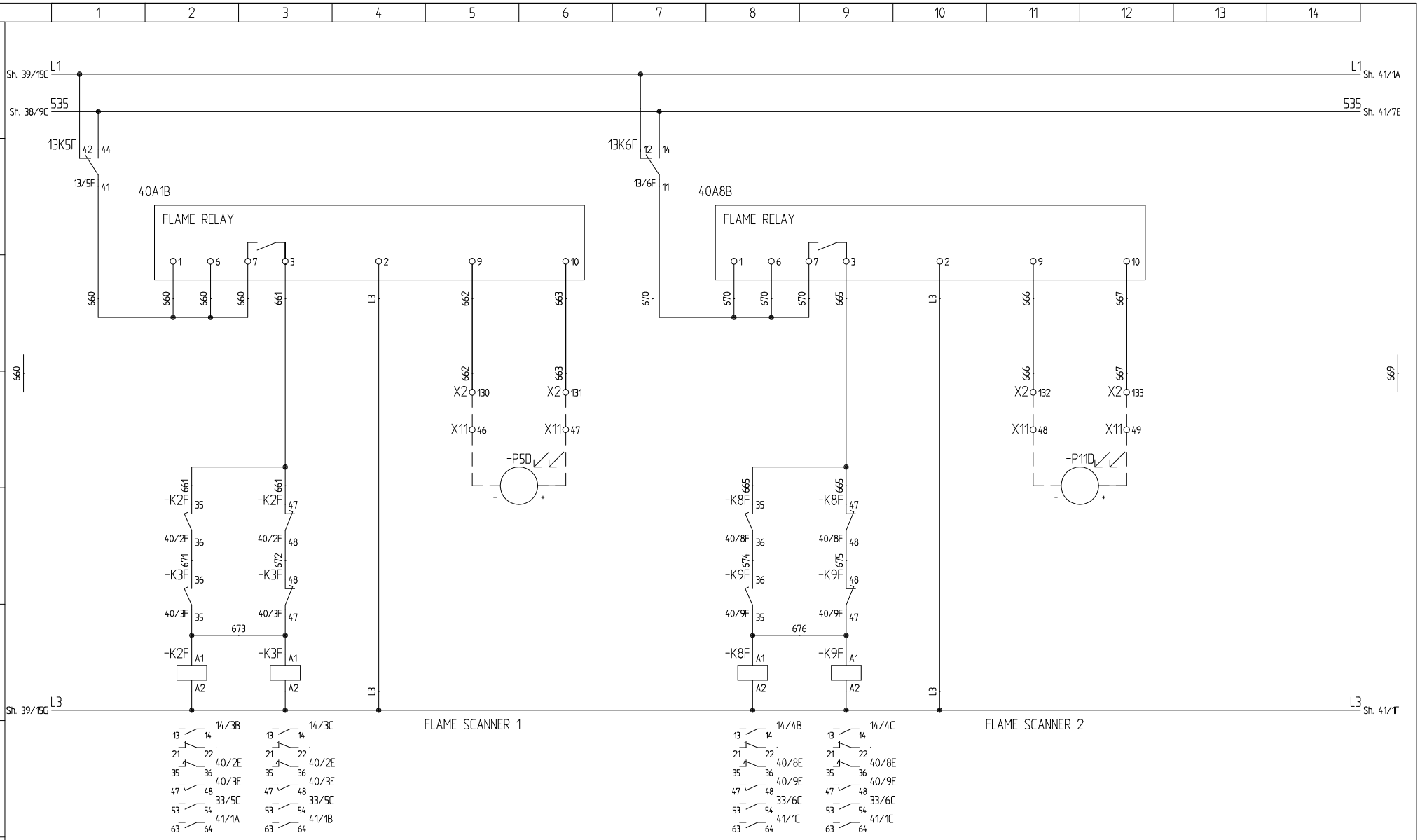
ORIGINAL DRAWING NO.:

DRAWN BY	DATE	CHECKED BY	CHECKED DATE
ESP/181	16 OCT 06	HOV/182	17 OCT 06

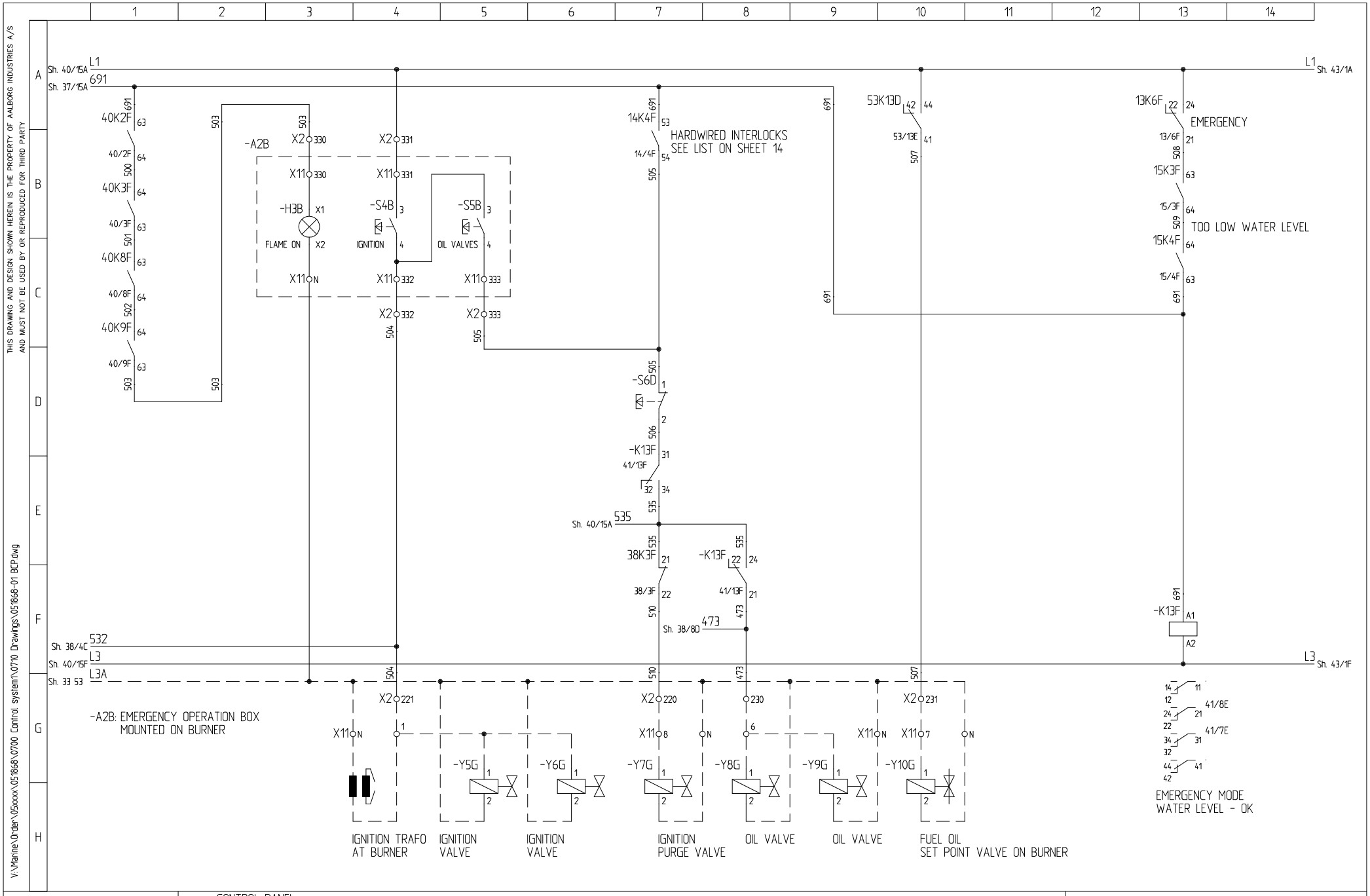
DRAWING NUMBER	REV.	SHEET
63X03:043507		39

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AALBORG INDUSTRIES	TITLE: CONTROL PANEL			ORIGINAL DRAWING NO.:			
				DRAWN BY	DATE	CHECKED BY	CHECKED DATE
				ESP/181	16 OCT 06	HOV/182	17 OCT 06
	D	AS BUILD - 051868-01 / RELAY ADDED	29 JAN 08	LBD/172	DRAWING NUMBER	REV.	SHEET
	REV.	DESCRIPTION	DATE	NAME	63X03:043507	D	40

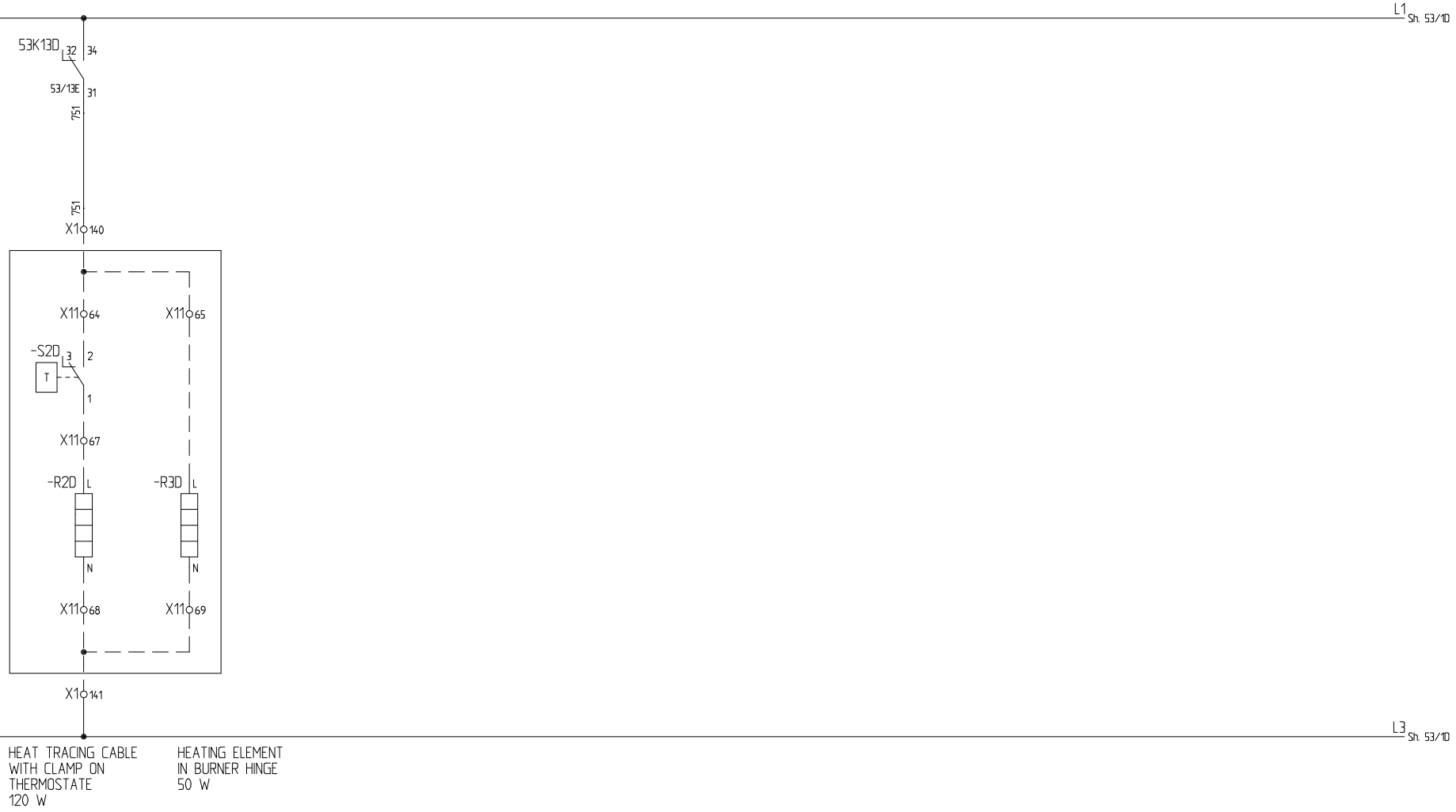


TITLE: CONTROL PANEL				ORIGINAL DRAWING NO.:	
C	UPDATE FOR PRODUCTION: CORE NUMBER DELETED/ TERMINAL DISIGNATION EXCHANGE - 40K2F + 40K3F + 40K8F + 40K9F + 13K6F	22 NOV 07	IMJ/188	DRAWN BY: ESP/181	DATE: 16 OCT 06
B	NEW DESIGN FOR BURNER CONNECTIONS	18 OCT 07	LBS/188	CHECKED BY: HOV/182	CHECKED DATE: 17 OCT 06
A	INSERT -KF8/-K3F/-K2F	06 JUL 07	IMJ/172	DRAWING NUMBER: 63X03:043507	REV.: C
REV.	DESCRIPTION	DATE	NAME		SHEET: 41

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TITLE: CONTROL PANEL

REV.	DESCRIPTION	DATE	NAME
C	UPDATE FOR PRODUCTION: 53K13D CHANGE TYPE / DESIGNATION	22 NOV 07	IMJ/188

ORIGINAL DRAWING NO.:

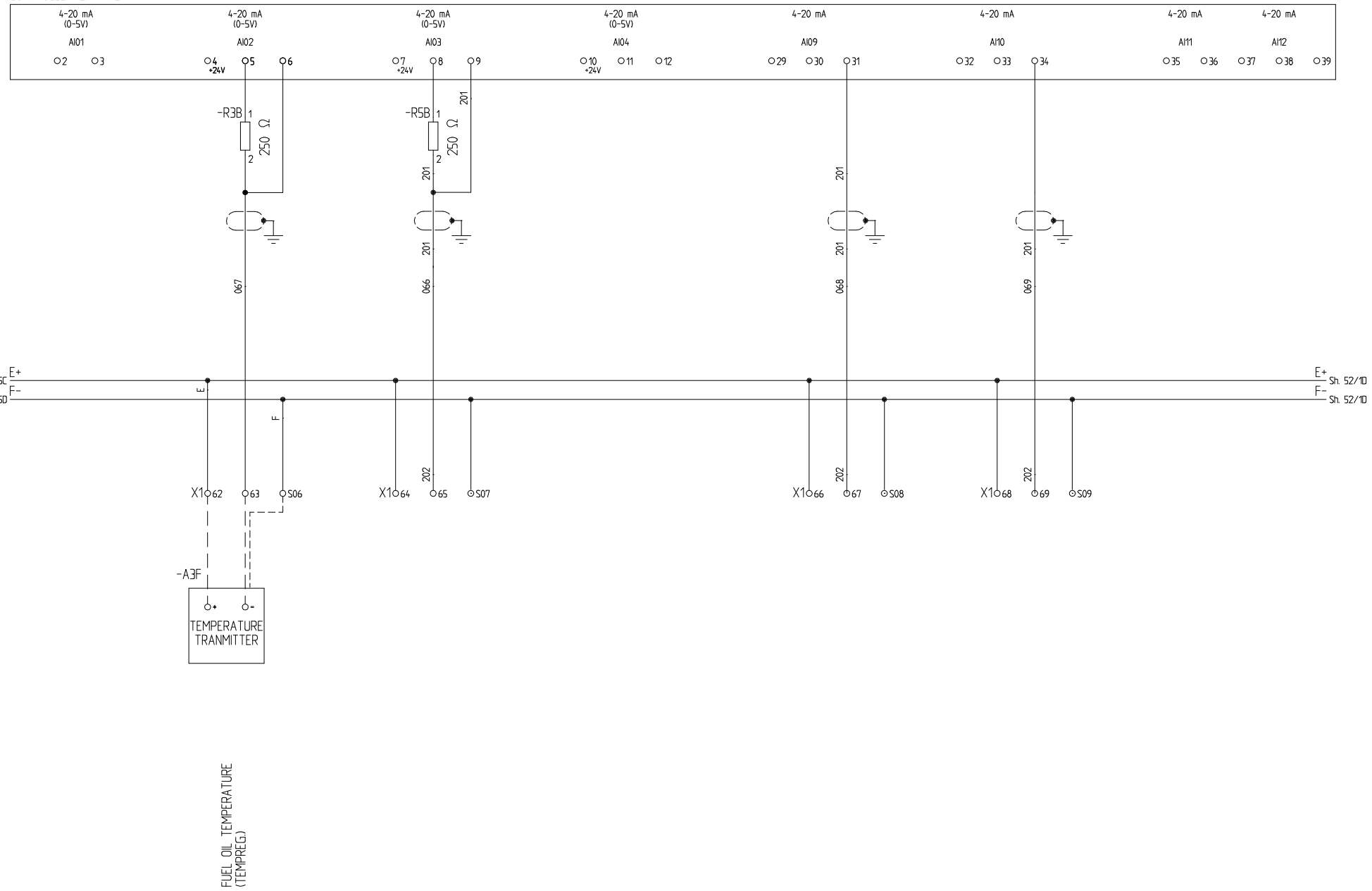
DRAWN BY	DATE	CHECKED BY	CHECKED DATE
ESP/181	16 OCT 06	HOV/182	17 OCT 06

DRAWING NUMBER	REV.	SHEET
63X03:043507	C	43

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CONTROLLER 2 - RIGHT



TITLE: CONTROL PANEL				ORIGINAL DRAWING NO.:			
A	FUEL OIL TEMPERATURE ADDED.	06 JUL 07	IMJ/172	DRAWN BY	DATE	CHECKED BY	CHECKED DATE
C	UPDATE FOR PRODUCTION: NEW CORE NUMBER ADDED	22 NOV 07	IMJ/188	ESP/181	16 OCT 06	HOV/182	17 OCT 06
				DRAWING NUMBER		REV.	SHEET
REV.	DESCRIPTION	DATE	NAME	63X03:043507		C	50

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CONTROLLER 2 - RIGHT

50A14A

PT 100 INPUT

AI05 PT01				AI06 PT02				AI07 PT03				AI08 PT04			
13	14	15 SIG	16 SIG	17	18	19 SIG	20 SIG	21	22	23 SIG	24 SIG	25	26	27 SIG	28 SIG

TACHO INPUT

162 161

JUMPER J1
PIGGYBACK

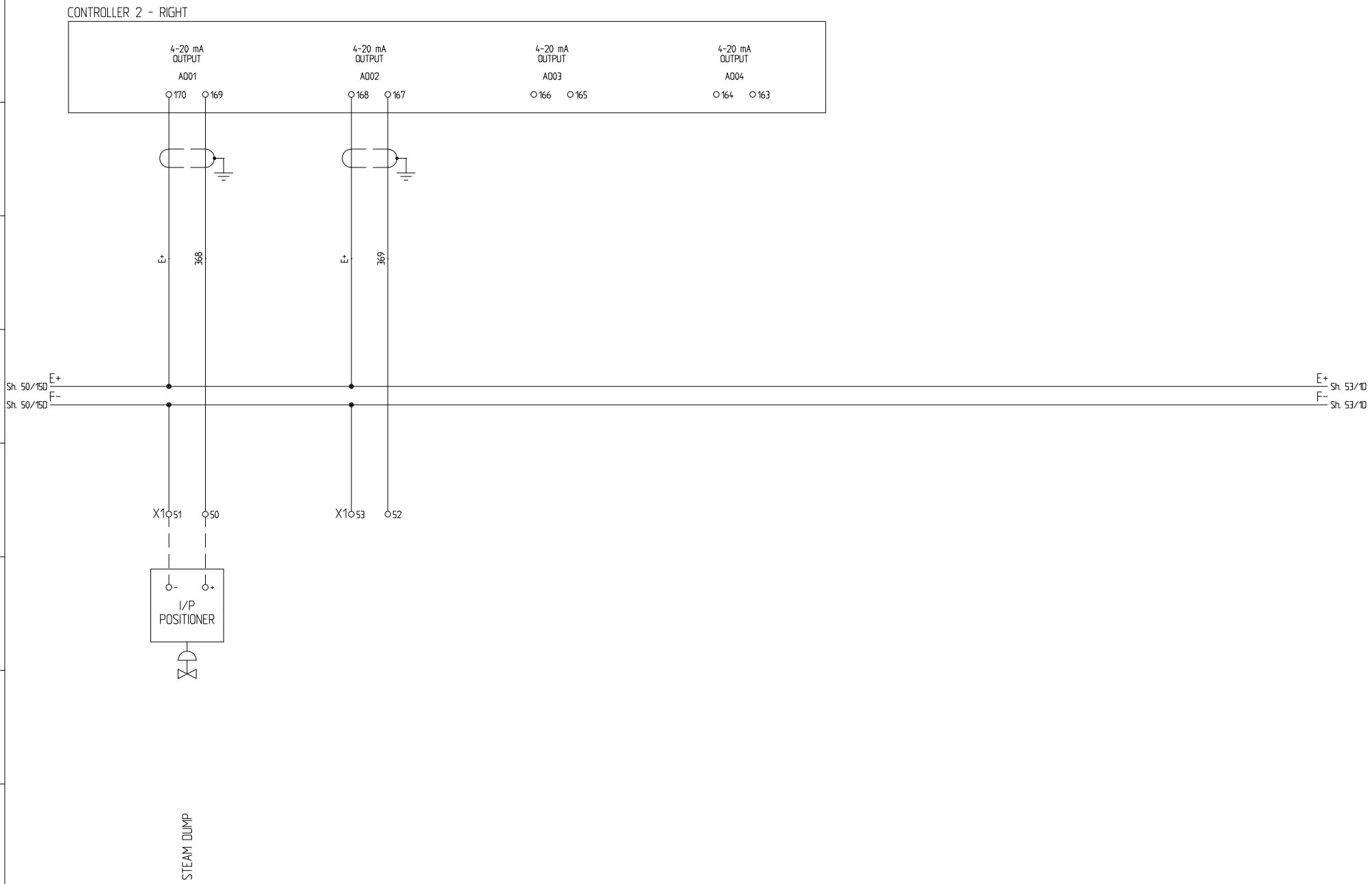
1 2 3

AALBORG INDUSTRIES

TITLE: CONTROL PANEL				ORIGINAL DRAWING NO.:			
				DRAWN BY	DATE	CHECKED BY	CHECKED DATE
				ESP/181	16 OCT 06	HOV/182	17 OCT 06
				DRAWING NUMBER		REV.	SHEET
REV.	DESCRIPTION	DATE	NAME	63X03:043507			51

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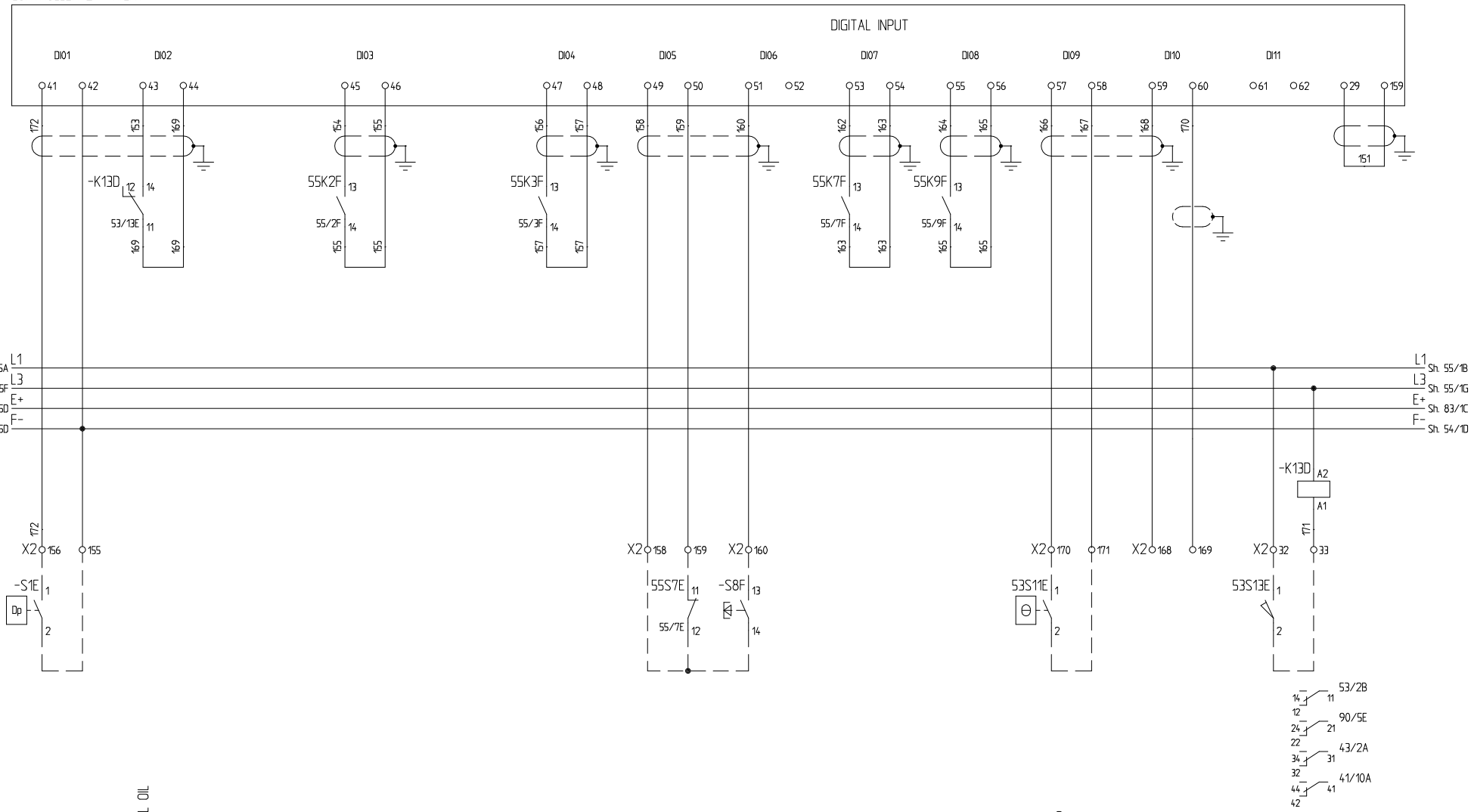
TITLE: CONTROL PANEL				ORIGINAL DRAWING NO.:			
				DRAWN BY	DATE	CHECKED BY	CHECKED DATE
E	AS BUILD - 051868-02: SCREEN DELETED	09 MAR 08	IMJ/188	ESP/181	16 OCT 06	HOV/182	17 OCT 06
C	UPDATE FOR PRODUCTION: SCREEN ADDED	22 NOV 07	IMJ/188	DRAWING NUMBER		REV.	SHEET
REV.	DESCRIPTION	DATE	NAME	63X03:043507		E	52

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CONTROLLER 2 - RIGHT



REV.	DESCRIPTION	DATE	NAME
C	UPDATE FOR PRODUCTION: NEW CORE NUMBER / SIGNAL L1 + L3 ADDED	22 NOV 07	IMJ/188

AALBORG INDUSTRIES

TITLE: CONTROL PANEL

ORIGINAL DRAWING NO.:

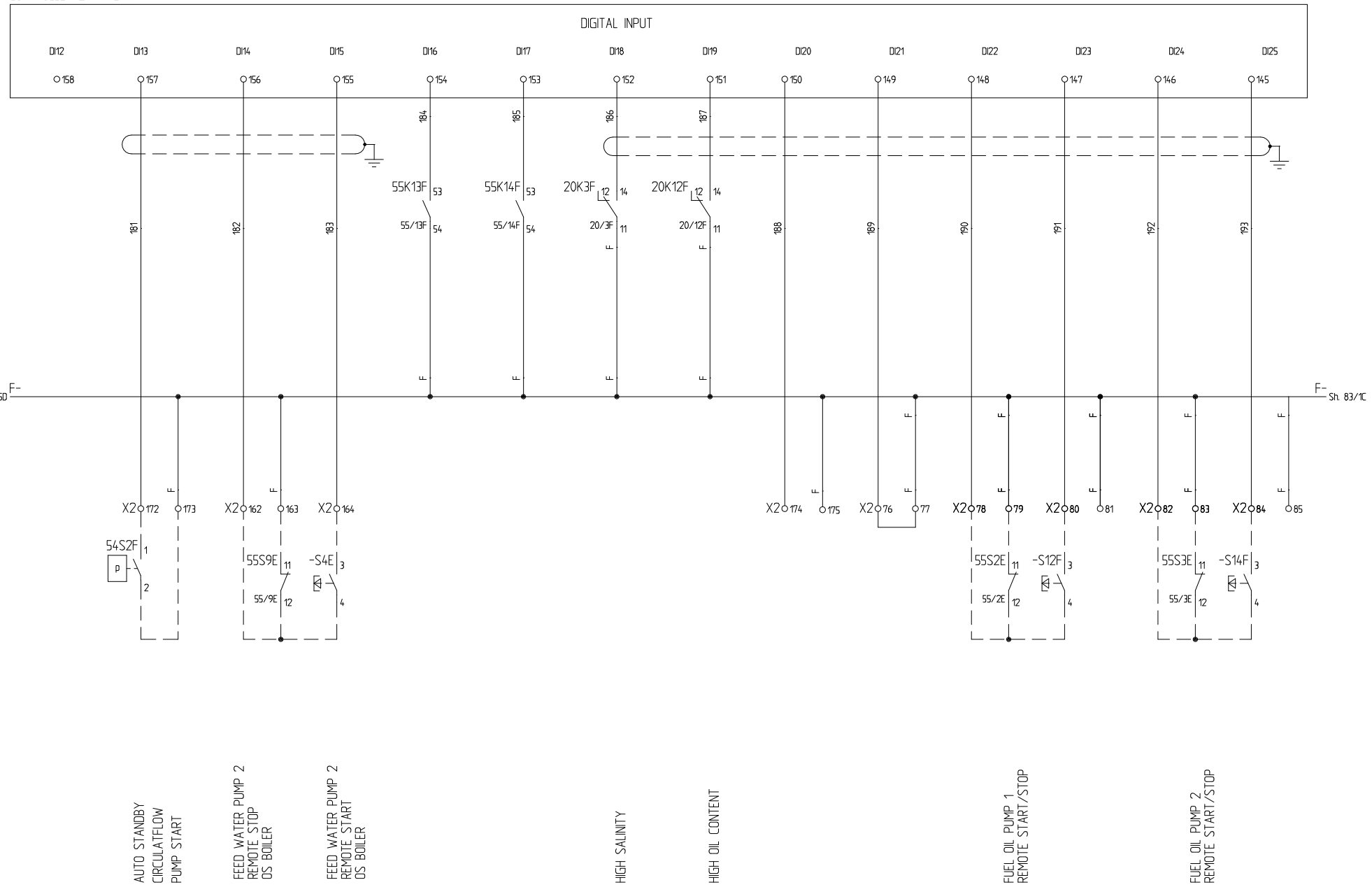
DRAWN BY	DATE	CHECKED BY	CHECKED DATE
ESP/181	16 OCT 06	HOV/182	17 OCT 06

DRAWING NUMBER	REV.	SHEET
63X03:043507	C	53

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CONTROLLER 2 - RIGHT



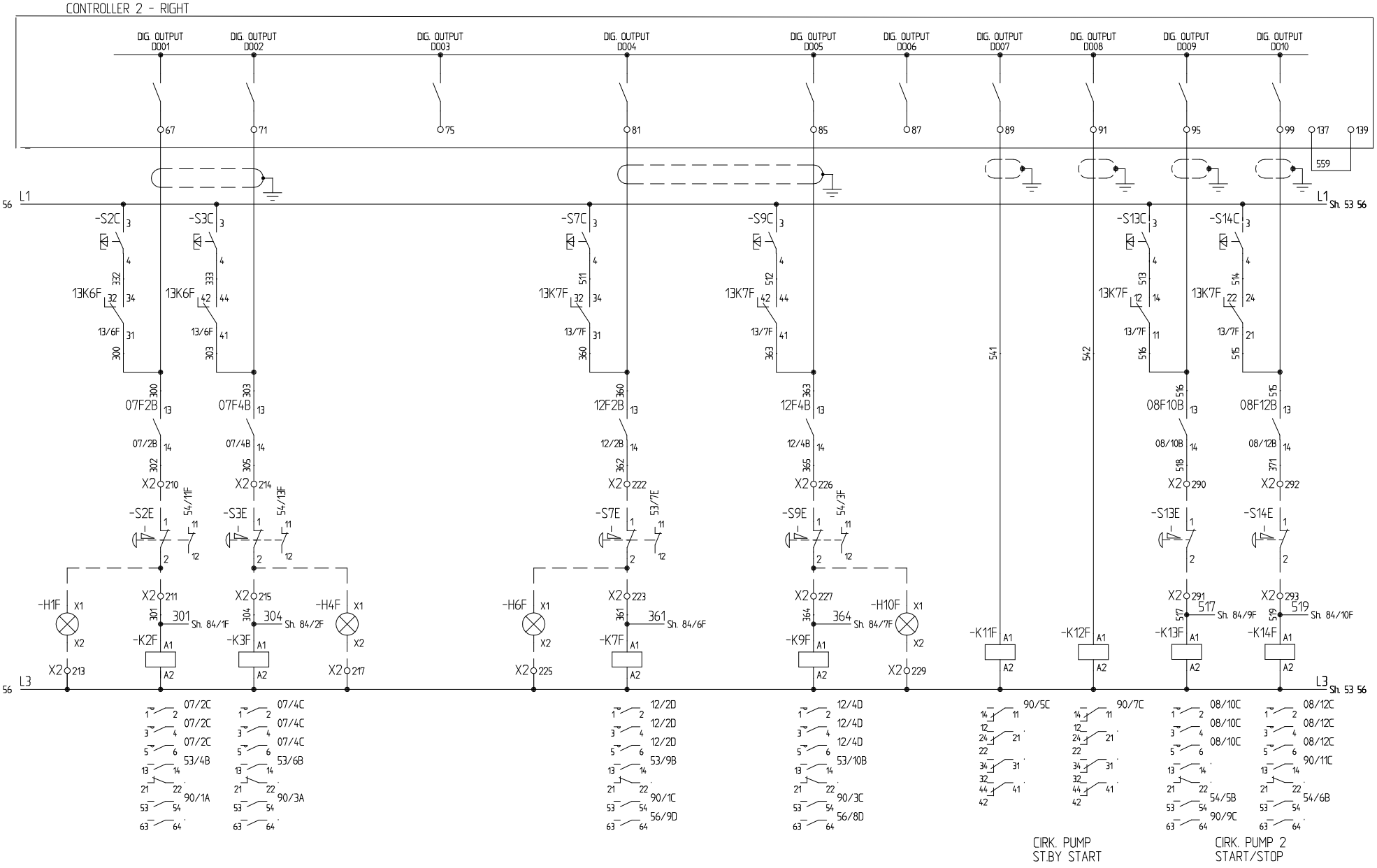
TITLE: CONTROL PANEL				ORIGINAL DRAWING NO.:			
				DRAWN BY	DATE	CHECKED BY	CHECKED DATE
E	AS BUILD - 051868-02: 55K13 + 55K14 ADDED	09 MAR 08	IMJ/188	ESP/181	16 OCT 06	HOV/182	17 OCT 06
C	UPDATE FOR PRODUCTION: SIGNAL F- TO SHEET 83	22 NOV 07	IMJ/188	DRAWING NUMBER		REV.	SHEET
REV.	DESCRIPTION	DATE	NAME	63X03:043507		E	54

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CONTROLLER 2 - RIGHT



TITLE: CONTROL PANEL				ORIGINAL DRAWING NO.:			
				DRAWN BY	DATE	CHECKED BY	CHECKED DATE
				ESP/181	16 OCT 06	HOV/182	17 OCT 06
C	UPDATE FOR PRODUCTION: 12F10B + 12F12B EXCHANGE TO - 08F10B + 08F12B / CORE NUMBER CHANGE	22 NOV 07	IMJ/188	DRAWING NUMBER		REV.	SHEET
REV.	DESCRIPTION	DATE	NAME	63X03:043507		C	55

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CONTROLLER 2 - RIGHT

DIG. OUTPUT D011 — 101
DIG. OUTPUT D012 — 107 — 109
DIG. OUTPUT D013 — 110 — 112
DIG. OUTPUT D014 — 113 — 115
DIG. OUTPUT D015 — 116 — 117
DIG. OUTPUT D016 — 118 — 125
DIG. OUTPUT D017 — 120 — 121
DIG. OUTPUT D018 — 122 — 123 — 137 — 139

L2 Sh. 20/15G
L1 Sh. 55/15B
L1 Sh. 83/1A
L3 Sh. 55/15G
L3 Sh. 83/1G

TEMPERATURE DOWN = CLOSED VALVE
TEMPERATURE UP = OPEN VALVE

345 — X2 494
346 — X2 496
3
2
M
-M4F
1
X2 495

-S8C 3 — 4
348
13K4F 12 — 14
13/4F 11
347
347 — 55K9F 63 — 55/9F 64 — 349
347 — 55K7F 63 — 55/7F 64 — 349
349
X2 400
-M9F 1
M
2
X2 401

-K1F A1 — A2

90/5A
14 — 11
12
24 — 21
22
34 — 31
32
44 — 41
42

FUEL OIL PUMP
AUTO ST.BY START

SERVO MOTOR
FUEL OIL TEMPERATURE
UP/DOWN

CHEMICAL DOSING PUMP (OS)
In = 0,1 A

TITLE: CONTROL PANEL				ORIGINAL DRAWING NO.:	
A	SERVO MOTOR ADDED	06 JUL 07	IMJ/172	DRAWN BY: ESP/181	DATE: 16 OCT 06
C	UPDATE FOR PRODUCTION: NEW CORE NUMBER ADDED	22 NOV 07	IMJ/188	CHECKED BY: HOV/182	CHECKED DATE: 17 OCT 06
				DRAWING NUMBER: 63X03:043507	REV.: C — SHEET: 56
REV.	DESCRIPTION	DATE	NAME		

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1	2	3	4	5	6	7	8	9	10	11	12	13	14

A

Sh. 56/15B L1 — L1 Sh. 83/1A

B

C

D

E

F

Sh. 56/15G L3 — L3 Sh. 83/1G

G

H

AALBORG INDUSTRIES

TITLE: CONTROL PANEL

ORIGINAL DRAWING NO.:

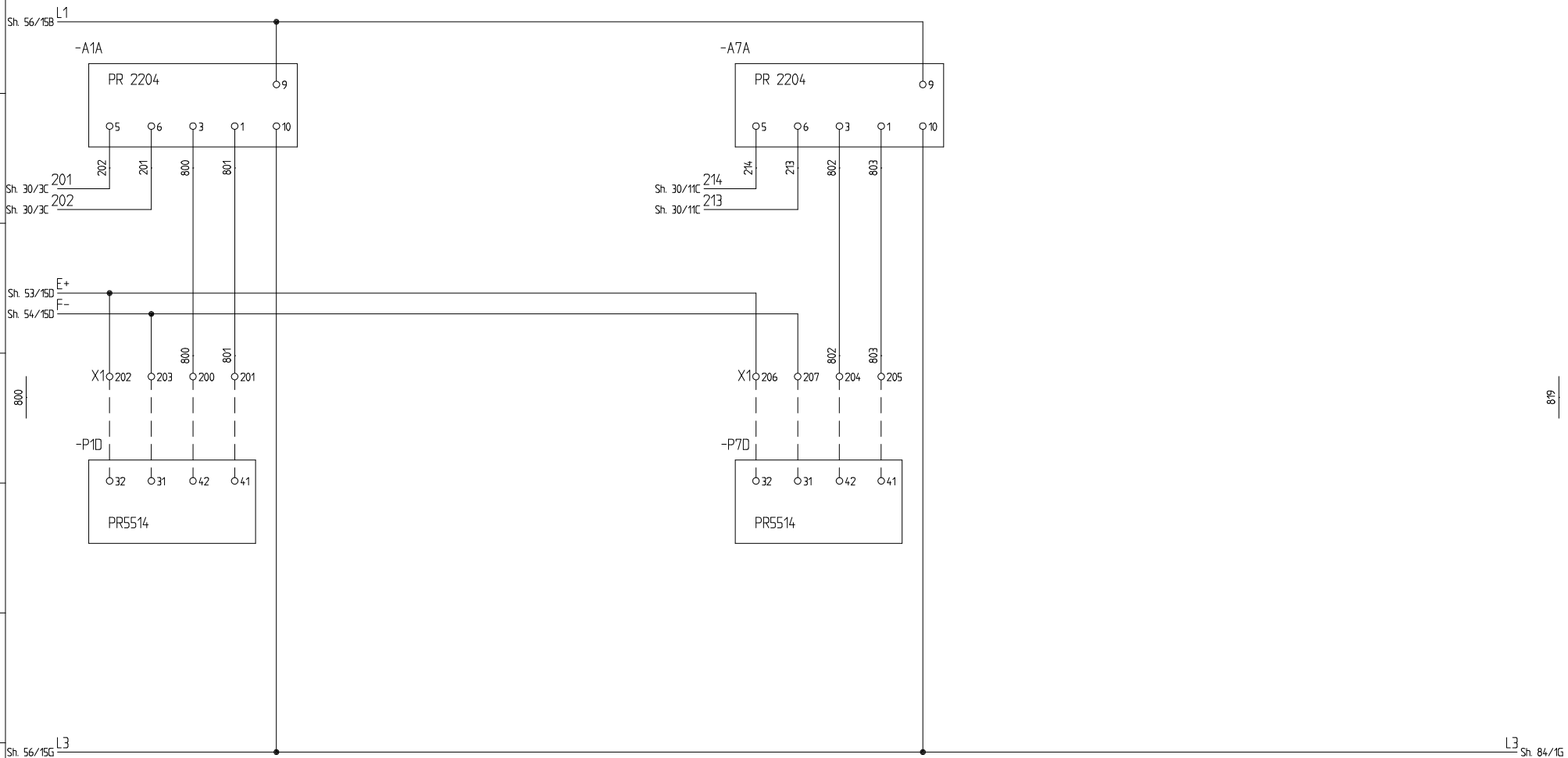
REV.	DESCRIPTION	DATE	NAME

DRAWN BY	DATE	CHECKED BY	CHECKED DATE
Init1/3520	yy.mm.dd1	Init2/3520	yy.mm.dd2

DRAWING NUMBER	REV.	SHEET
63X03:043507		81

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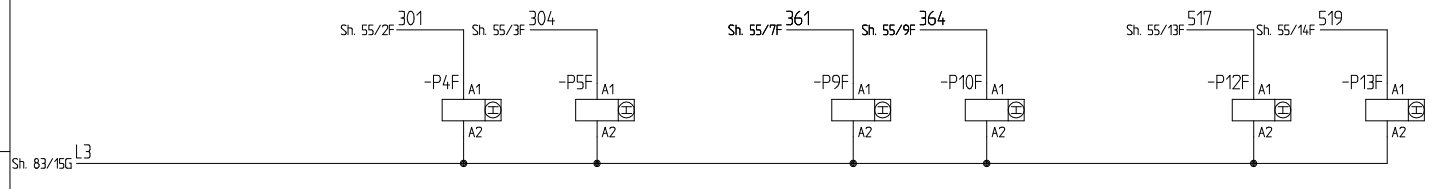


AALBORG INDUSTRIES

TITLE: CONTROL PANEL				ORIGINAL DRAWING NO.:			
				DRAWN BY	DATE	CHECKED BY	CHECKED DATE
				ESP/181	16 OCT 06	HOV/182	17 OCT 06
				DRAWING NUMBER		REV.	SHEET
REV.	DESCRIPTION	DATE	NAME	63X03:043507			83

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HOUR COUNTER FUEL OIL PUMP 1

HOUR COUNTER FUEL OIL PUMP 2

HOUR COUNTER FEED WATER PUMP 1 (OS)

HOUR COUNTER FEED WATER PUMP 2 (OS)

HOUR COUNTER CIRCULATION PUMP 1

HOUR COUNTER CIRCULATION PUMP 2

AALBORG INDUSTRIES

TITLE: CONTROL PANEL

REV.	DESCRIPTION	DATE	NAME

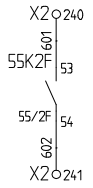
ORIGINAL DRAWING NO.:

DRAWN BY	DATE	CHECKED BY	CHECKED DATE
ESP/181	16 OCT 06	HOV/182	17 OCT 06

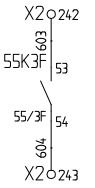
DRAWING NUMBER	REV.	SHEET
63X03:043507		84

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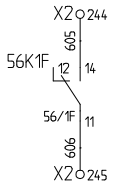
V:\Marine\Order\05xxxx\051868\0700 Control system\0700 Drawings\051868-01 BCP.dwg



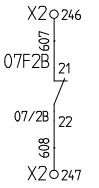
FUEL OIL PUMP 1
RUNNING
POT. FREE SIGNAL



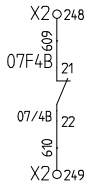
FUEL OIL PUMP 2
RUNNING
POT. FREE SIGNAL



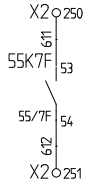
AUTO STAND BY
FUEL OIL PUMPS
POT. FREE SIGNAL



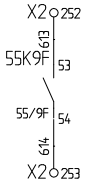
FUEL OIL PUMP 1
OVERLOAD
POT. FREE SIGNAL



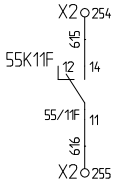
FUEL OIL PUMP 2
OVERLOAD
POT. FREE SIGNAL



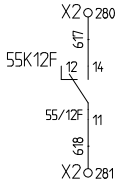
FEED WATER PUMP 1
RUNNING
POT. FREE SIGNAL



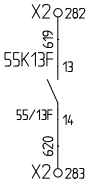
FEED WATER PUMP 2
RUNNING
POT. FREE SIGNAL



AUTO STAND BY
FEED WATER PUMPS
POT. FREE SIGNAL



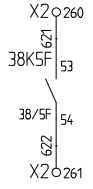
AUTO STAND BY
CIRCULATION PUMP
POT. FREE SIGNAL



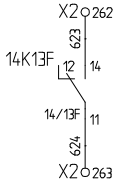
CIRCULATION PUMP 1
RUNNING
POT. FREE SIGNAL



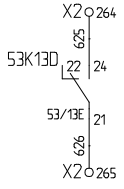
CIRCULATION PUMP 2
RUNNING
POT. FREE SIGNAL



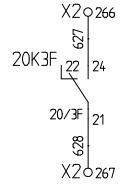
BURNER MOTOR ON
POT. FREE SIGNAL



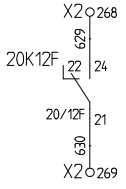
BOILER
POWER FAILURE
POT. FREE SIGNAL



HEAVY FUEL OIL /
DIESEL OIL POS.
POT. FREE SIGNAL



HIGH SALINITY
IN FEED WATER



HIGH OIL CONTENT
IN CONDENSATE

AALBORG INDUSTRIES

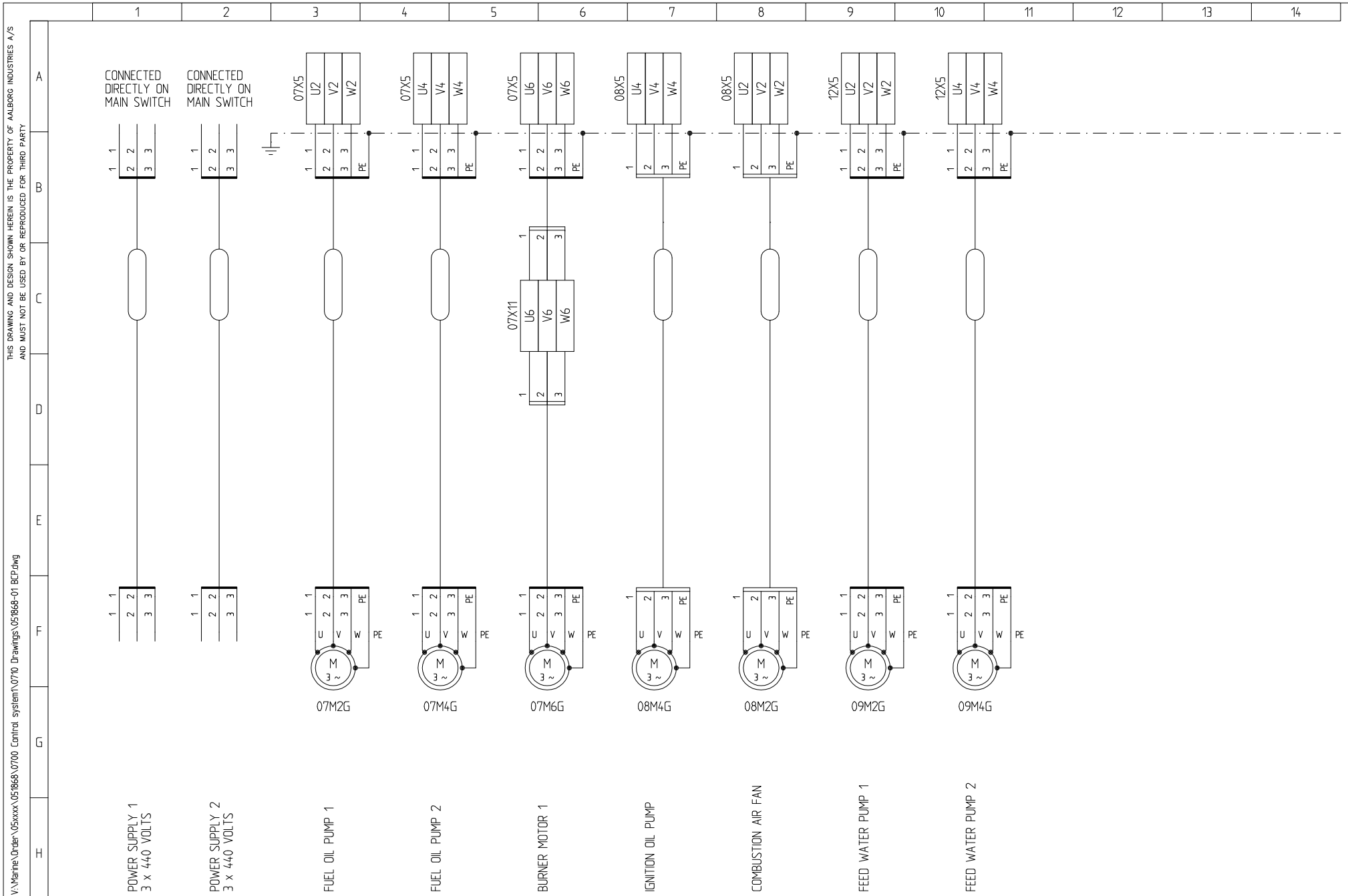
TITLE: CONTROL PANEL

ORIGINAL DRAWING NO.:

REV.	DESCRIPTION	DATE	NAME
E	AS BUILD - 051868-02: TERMINAL DESIGNATION CHANGED	09 MAR 08	IMJ/188
C	UPDATE FOR PRODUCTION: CORE NUMBER CHANGE	22 NOV 07	IMJ/188

DRAWN BY	DATE	CHECKED BY	CHECKED DATE
ESP/181	16 OCT 06	HOV/182	17 OCT 06

DRAWING NUMBER	REV.	SHEET
63X03:043507	E	90



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AALBORG INDUSTRIES

TITLE: CONTROL PANEL

ORIGINAL DRAWING NO.:

REV.	DESCRIPTION	DATE	NAME
C	UPDATE FOR PRODUCTION: 12X5: U10 - U12, V10 - V12, W10 - W12 / 058X DELETED	22 NOV 07	IMJ/188
B	X11 TERMINALS ADDED BURNER MOTOR	18 OCT 07	LBS/188

DRAWN BY	DATE	CHECKED BY	CHECKED DATE
ESP/181	16 OCT 06	HOV/182	17 OCT 06

DRAWING NUMBER	REV.	SHEET
63X03:043507	C	100

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NOTE :

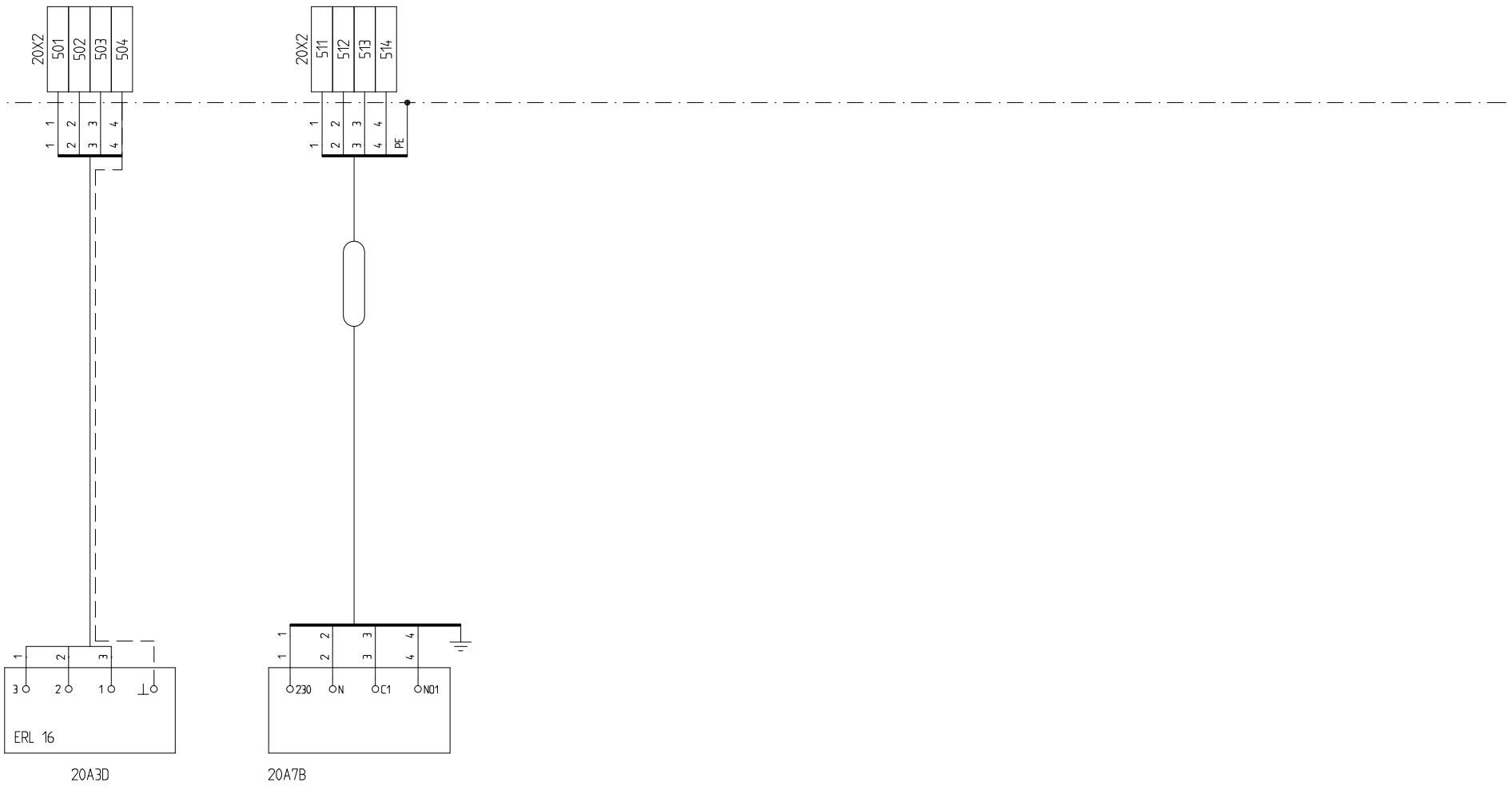
CONNECTIONS MARKED WITH * ARE PREWIRET BY AALBORG
SOLID STATE RELAYS ARE MOUNTED ON THE BURNER

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TITLE: CONTROL PANEL				ORIGINAL DRAWING NO.:			
				DRAWN BY	DATE	CHECKED BY	CHECKED DATE
				ESP/181	16 OCT 06	HOV/182	17 OCT 06
				DRAWING NUMBER		REV.	SHEET
REV.	DESCRIPTION	DATE	NAME	63X03:043507			101

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TITLE: CONTROL PANEL

REV.	DESCRIPTION	DATE	NAME

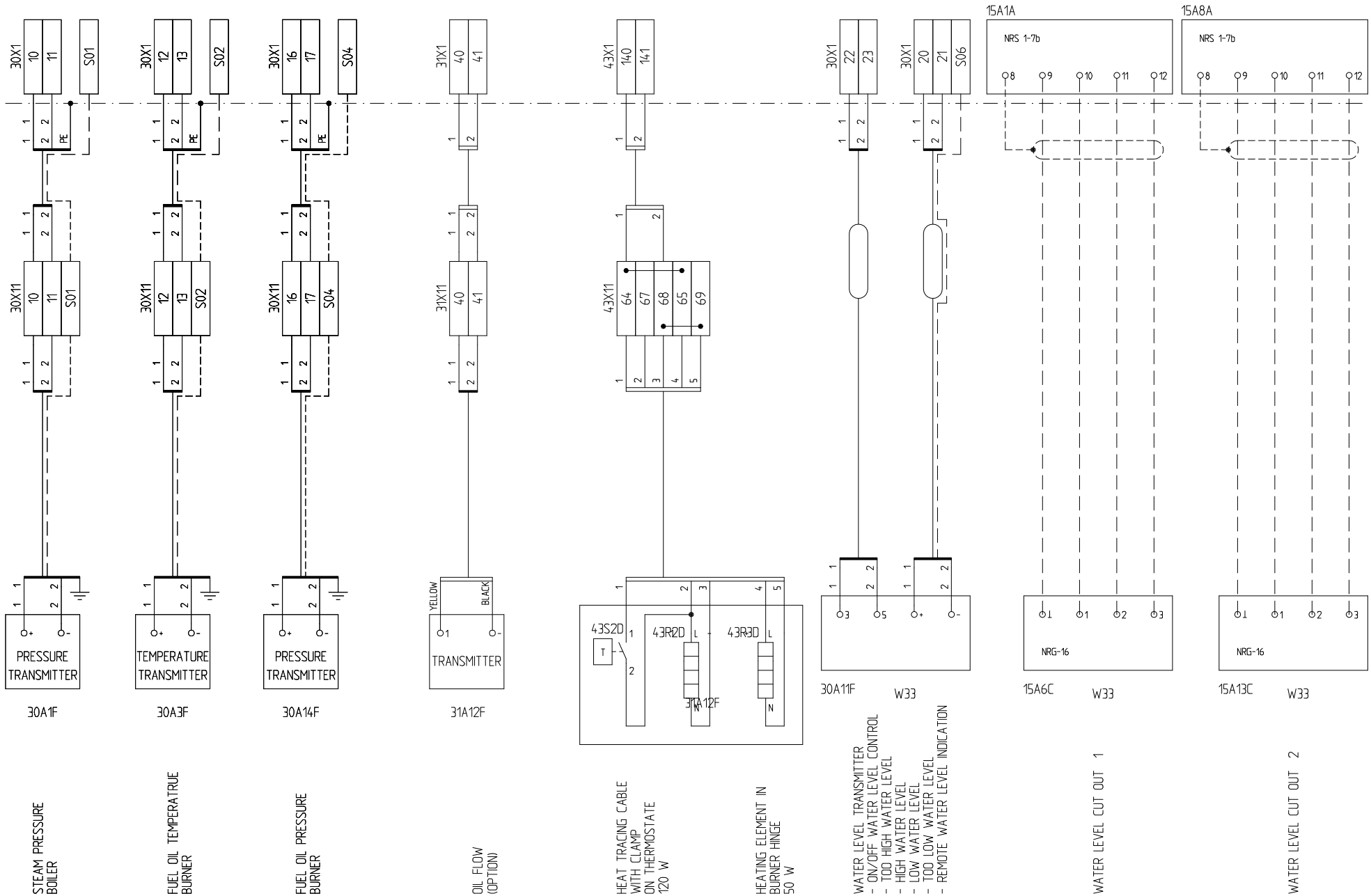
ORIGINAL DRAWING NO.:

DRAWN BY	DATE	CHECKED BY	CHECKED DATE
ESP/181	16 OCT 06	HOV/182	17 OCT 06

DRAWING NUMBER	REV.	SHEET
63X03:043507		108

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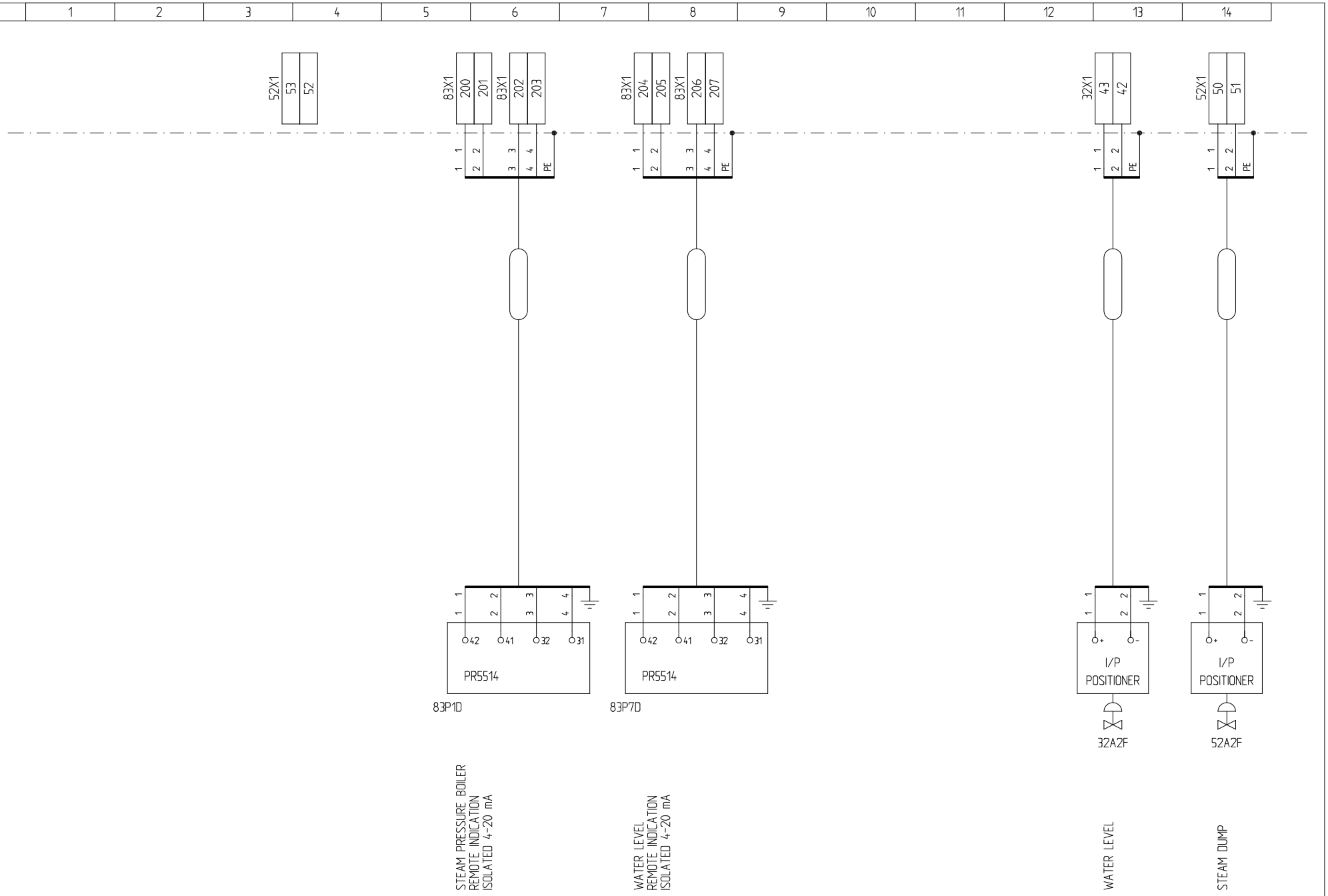


TITLE: CONTROL PANEL				ORIGINAL DRAWING NO.:	
A	TERMINAL NUMBER 42 DELETE	06 JUL 07	IMJ/172	DRAWN BY / DATE	CHECKED BY / CHECKED DATE
				ESP/181 16 OCT 06	HOV/182 17 OCT 06
				DRAWING NUMBER	REV. / SHEET
REV.	DESCRIPTION	DATE	NAME	63X03:043507	A / 112

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TITLE: CONTROL PANEL			ORIGINAL DRAWING NO.:
			DRAWN BY: ESP/181 · DATE: 16 OCT 06 · CHECKED BY: HOV/182 · CHECKED DATE: 17 OCT 06
C	UPDATE FOR PRODUCTION: 32X1: 40 + 41, CHANGED 43 + 42	22 NOV 07	IMJ/188
REV.	DESCRIPTION	DATE	NAME

DRAWING NUMBER: 63X03:043507 · REV.: C · SHEET: 113

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TITLE: CONTROL PANEL

ORIGINAL DRAWING NO.:

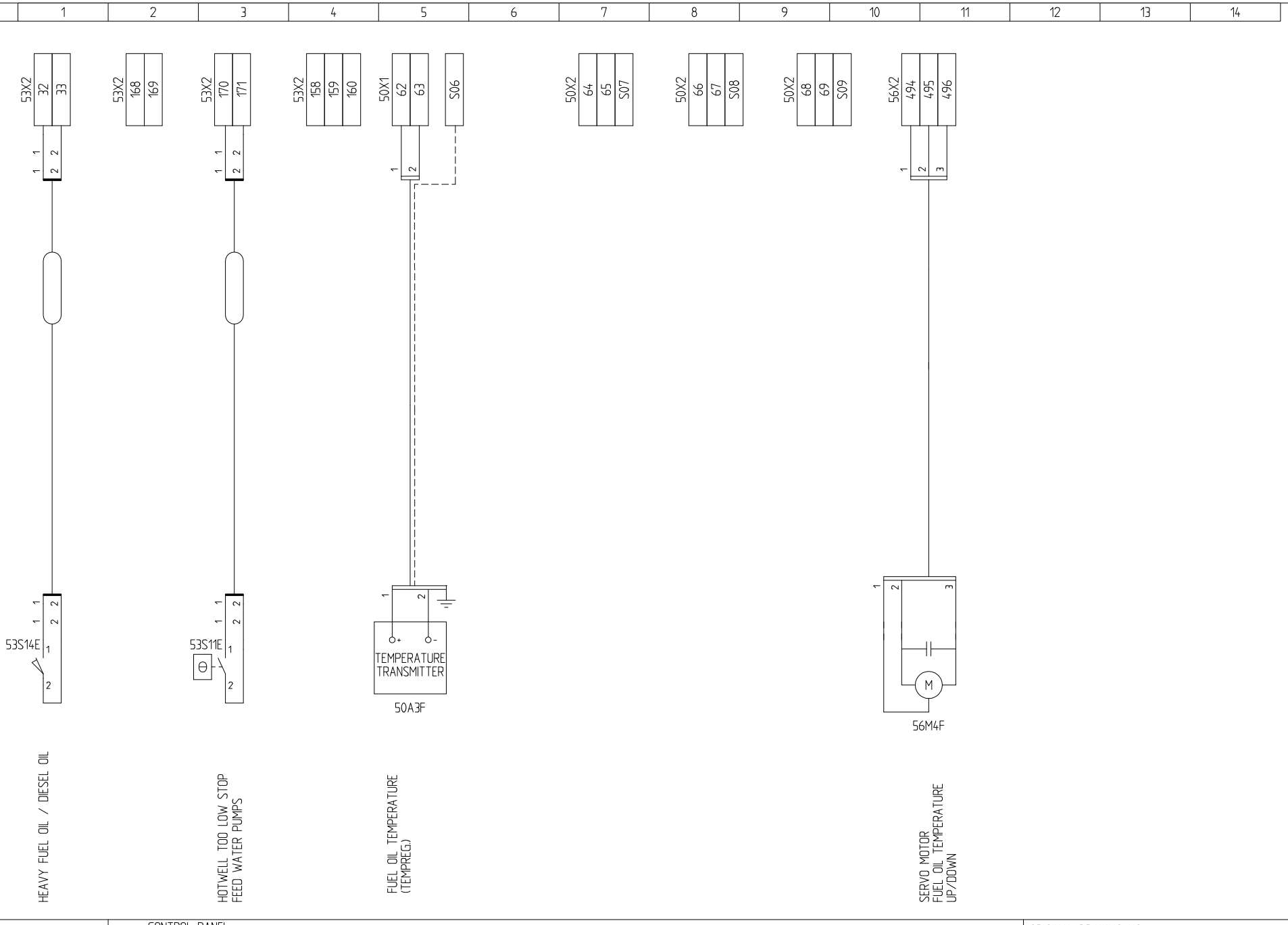
REV.	DESCRIPTION	DATE	NAME
B	SENSOR FOR PREHEATER (ELECTRICAL) DELETED	18 OCT 07	LBS/188
A	HIGH OIL TEMPERATURE PREHEATER DELETE	06 JUL 07	IMJ/172

DRAWN BY	DATE	CHECKED BY	CHECKED DATE
ESP/181	16 OCT 06	HOV/182	17 OCT 06

DRAWING NUMBER	REV.	SHEET
63X03:043507	B	114

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TITLE: CONTROL PANEL

ORIGINAL DRAWING NO.:

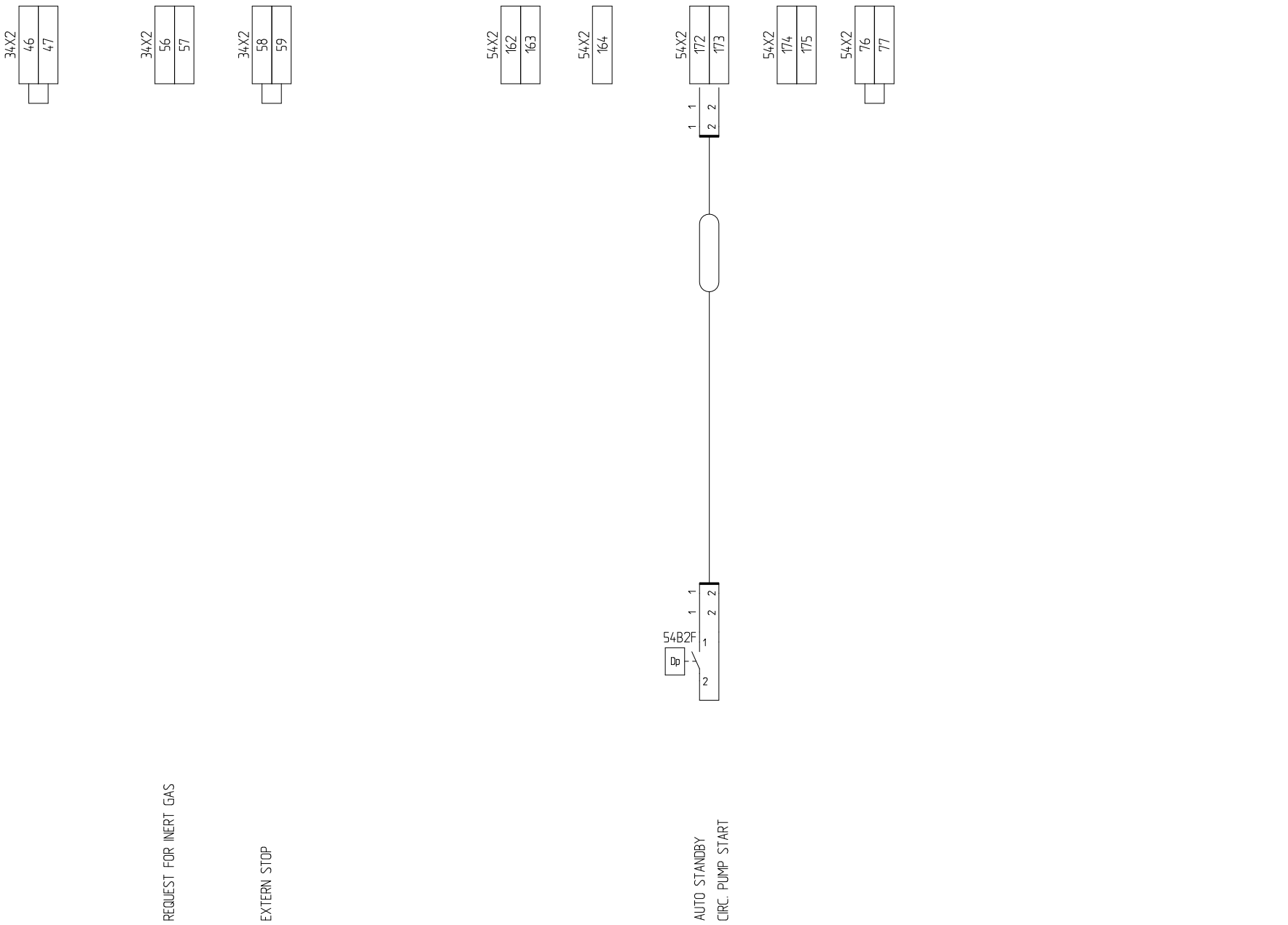
REV.	DESCRIPTION	DATE	NAME
A	FUEL OIL TEMPERATURE ADDED.	06 JUL 07	IMJ/172
C	UPDATE FOR PRODUCTION: 53X2: 158 - 160 DELETED / 34S2F EXCHANGE TO 53S11F	22 NOV 07	IMJ/188

DRAWN BY	DATE	CHECKED BY	CHECKED DATE
ESP/181	16 OCT 06	HOV/182	17 OCT 06

DRAWING NUMBER	REV.	SHEET
63X03:043507	C	115

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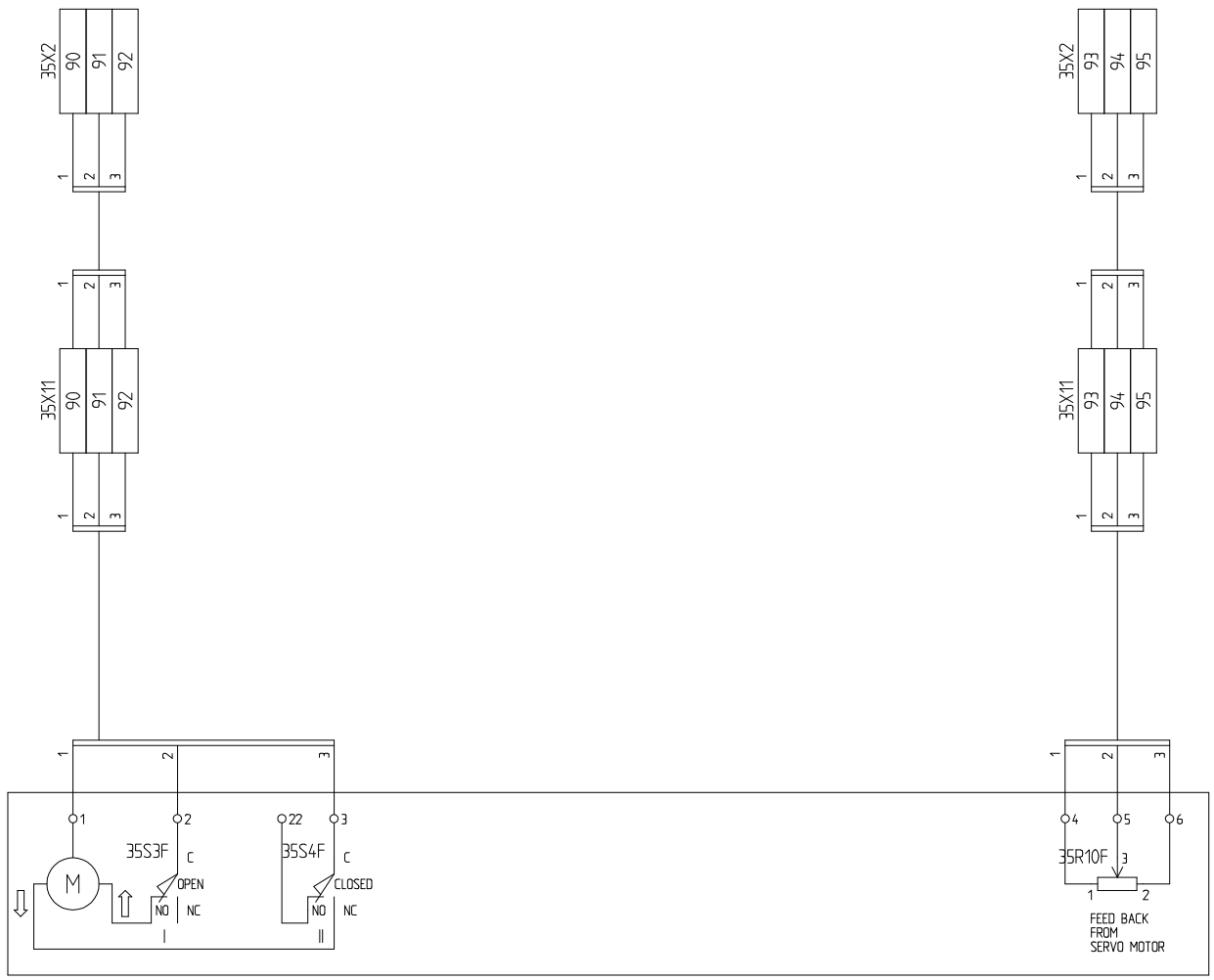


TITLE: CONTROL PANEL				ORIGINAL DRAWING NO.:			
				DRAWN BY	DATE	CHECKED BY	CHECKED DATE
				ESP/181	16 OCT 06	HOV/182	17 OCT 06
C	UPDATE FOR PRODUCTION: 54X2: 165 DELETED	22 NOV 07	IMJ/188	DRAWING NUMBER		REV.	SHEET
REV.	DESCRIPTION	DATE	NAME	63X03:043507		C	116

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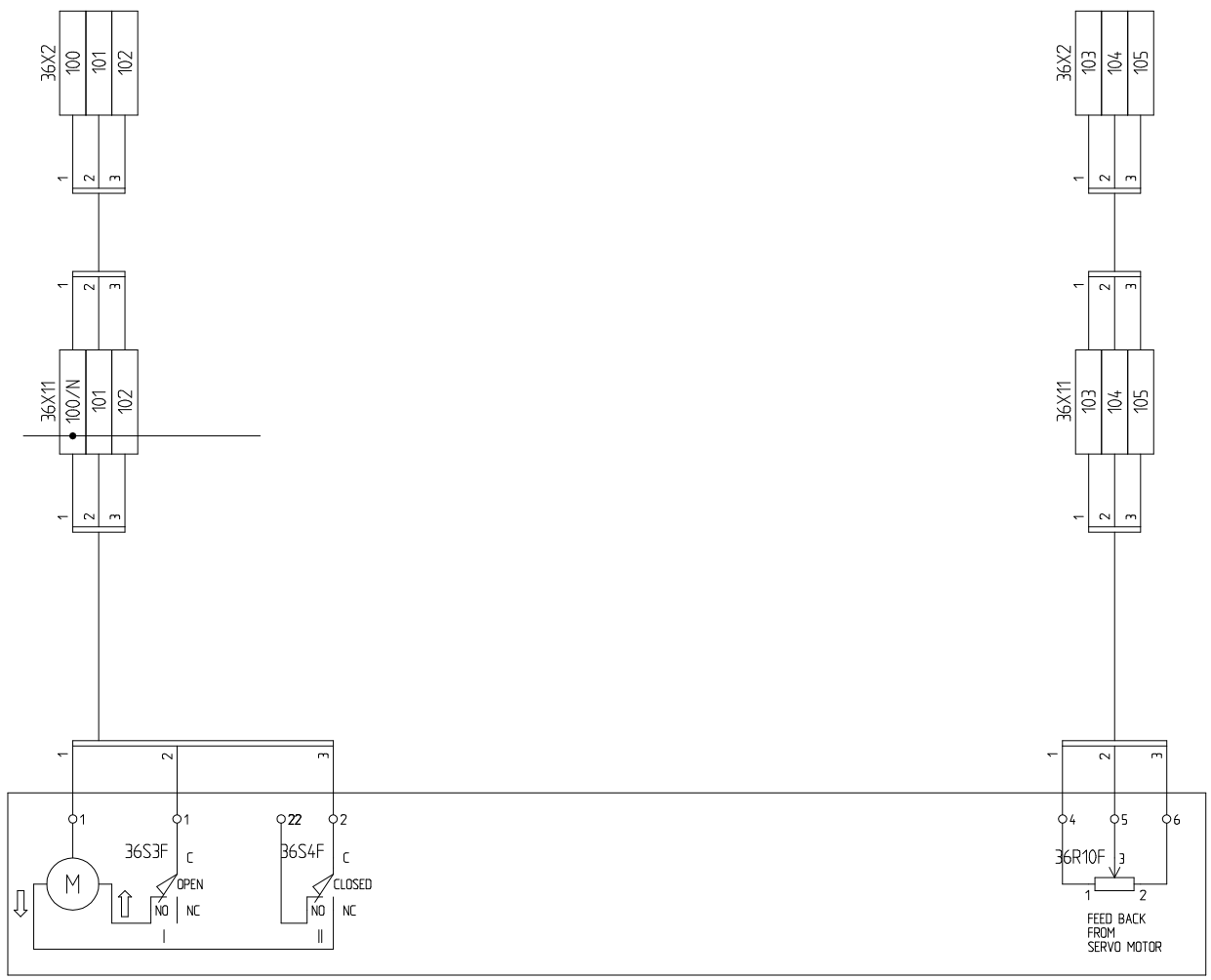


TITLE: CONTROL PANEL				ORIGINAL DRAWING NO.:	
A	SERVO MOTOR CHANGED	06 JUL 07	IMJ/172	DRAWN BY / DATE: ESP/181 — 16 OCT 06	CHECKED BY / CHECKED DATE: HOV/182 — 17 OCT 06
				DRAWING NUMBER: 63X03:043507	REV.: A — SHEET: 117
REV.	DESCRIPTION	DATE	NAME		

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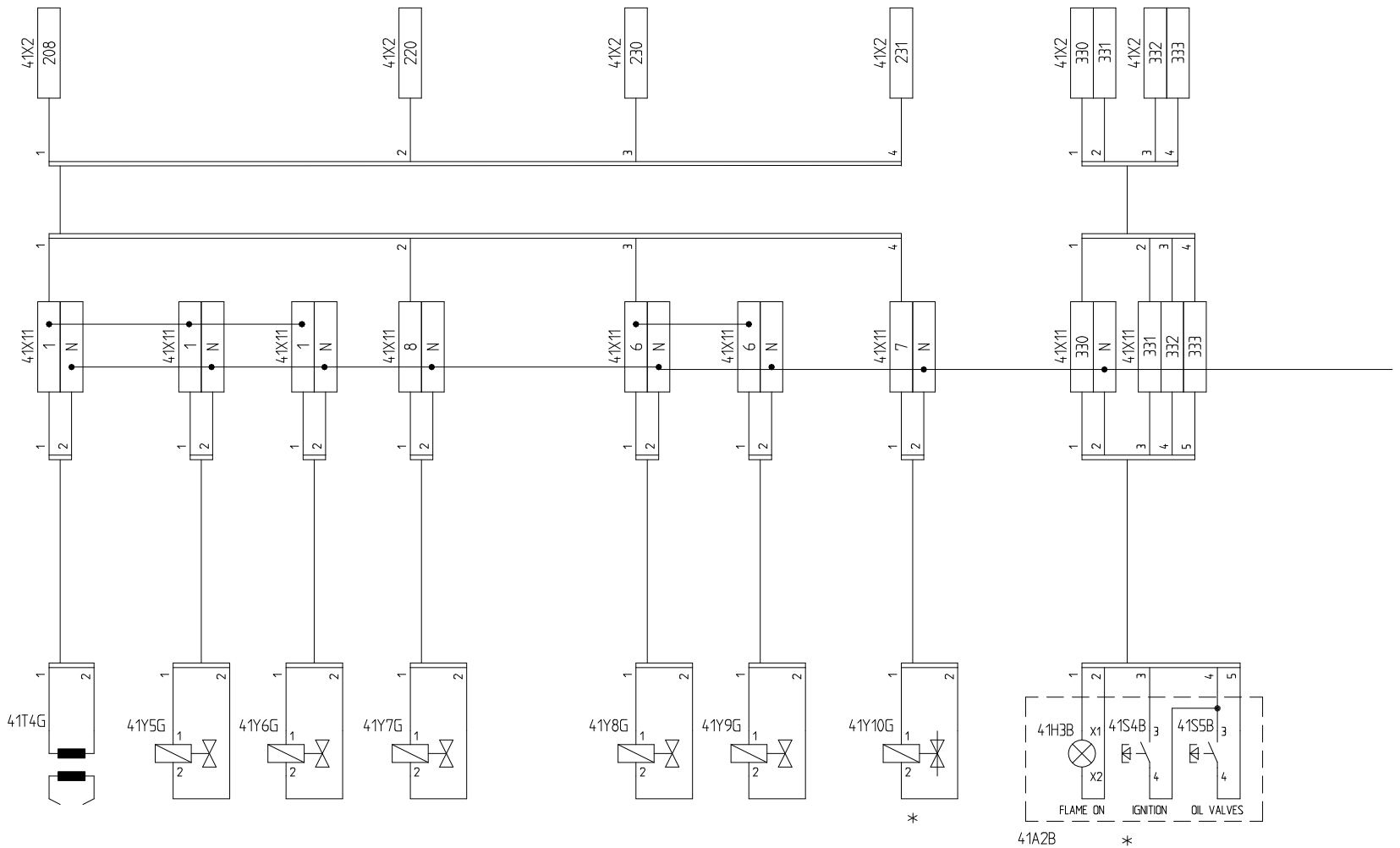
AIR SERVO MOTOR
SHOWN IN CLOSED POS. = 0°

TITLE: CONTROL PANEL				ORIGINAL DRAWING NO.:	
A	SERVO MOTOR CHANGED	06 JUL 07	IMJ/172	DRAWN BY / DATE	CHECKED BY / CHECKED DATE
				ESP/181 16 OCT 06	HOV/182 17 OCT 06
				DRAWING NUMBER	REV. / SHEET
REV.	DESCRIPTION	DATE	NAME	63X03:043507	A / 118

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TITLE: CONTROL PANEL			ORIGINAL DRAWING NO.:
			DRAWN BY: ESP/181 · DATE: 16 OCT 06 · CHECKED BY: HOV/182 · CHECKED DATE: 17 OCT 06
C	UPDATE FOR PRODUCTION: 41X2: 232 - 235 EXCHANGED TO 330-333 /41A10G - 41Y8G CHANGE ITEM DESIGNATION	22 NOV 07	IMJ/188
B	FUEL OIL SET POINT VALVE ON BURNER ADDED/EMERGENCY OPERATION MOVED TO BURNER	18 OCT 07	LBS/188
REV.	DESCRIPTION	DATE	NAME

AALBORG INDUSTRIES

DRAWING NUMBER: 63X03:043507 · REV.: C · SHEET: 119

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TITLE: CONTROL PANEL

REV.	DESCRIPTION	DATE	NAME

ORIGINAL DRAWING NO.:

DRAWN BY	DATE	CHECKED BY	CHECKED DATE
ESP/181	16 OCT 06	HOV/182	17 OCT 06

DRAWING NUMBER	REV.	SHEET
63X03:043507		121

A	B	C	D	E	F	G	H	

1	2	3	4	5	6	7	8	9	10	11	12	13	14

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AALBORG INDUSTRIES

TITLE: CONTROL PANEL

REV.	DESCRIPTION	DATE	NAME

ORIGINAL DRAWING NO.:

DRAWN BY	DATE	CHECKED BY	CHECKED DATE
ESP/181	16 OCT 06	HOV/182	17 OCT 06

DRAWING NUMBER	REV.	SHEET
63X03:043507		123

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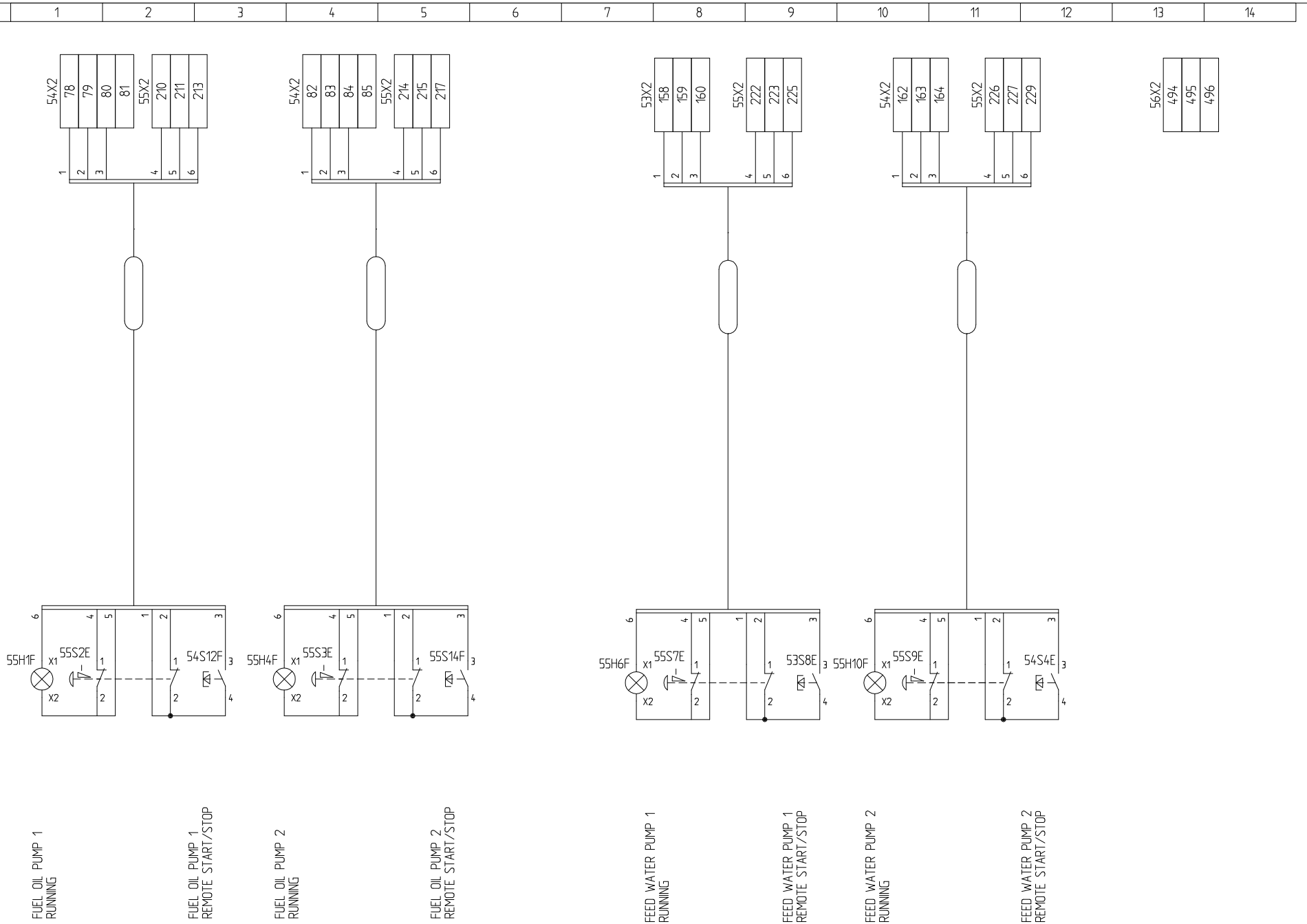


AALBORG INDUSTRIES

TITLE: CONTROL PANEL				ORIGINAL DRAWING NO.:			
				DRAWN BY	DATE	CHECKED BY	CHECKED DATE
				ESP/181	16 OCT 06	HOV/182	17 OCT 06
				DRAWING NUMBER		REV.	SHEET
REV.	DESCRIPTION	DATE	NAME	63X03:043507			124

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AALBORG INDUSTRIES

TITLE: CONTROL PANEL

ORIGINAL DRAWING NO.:

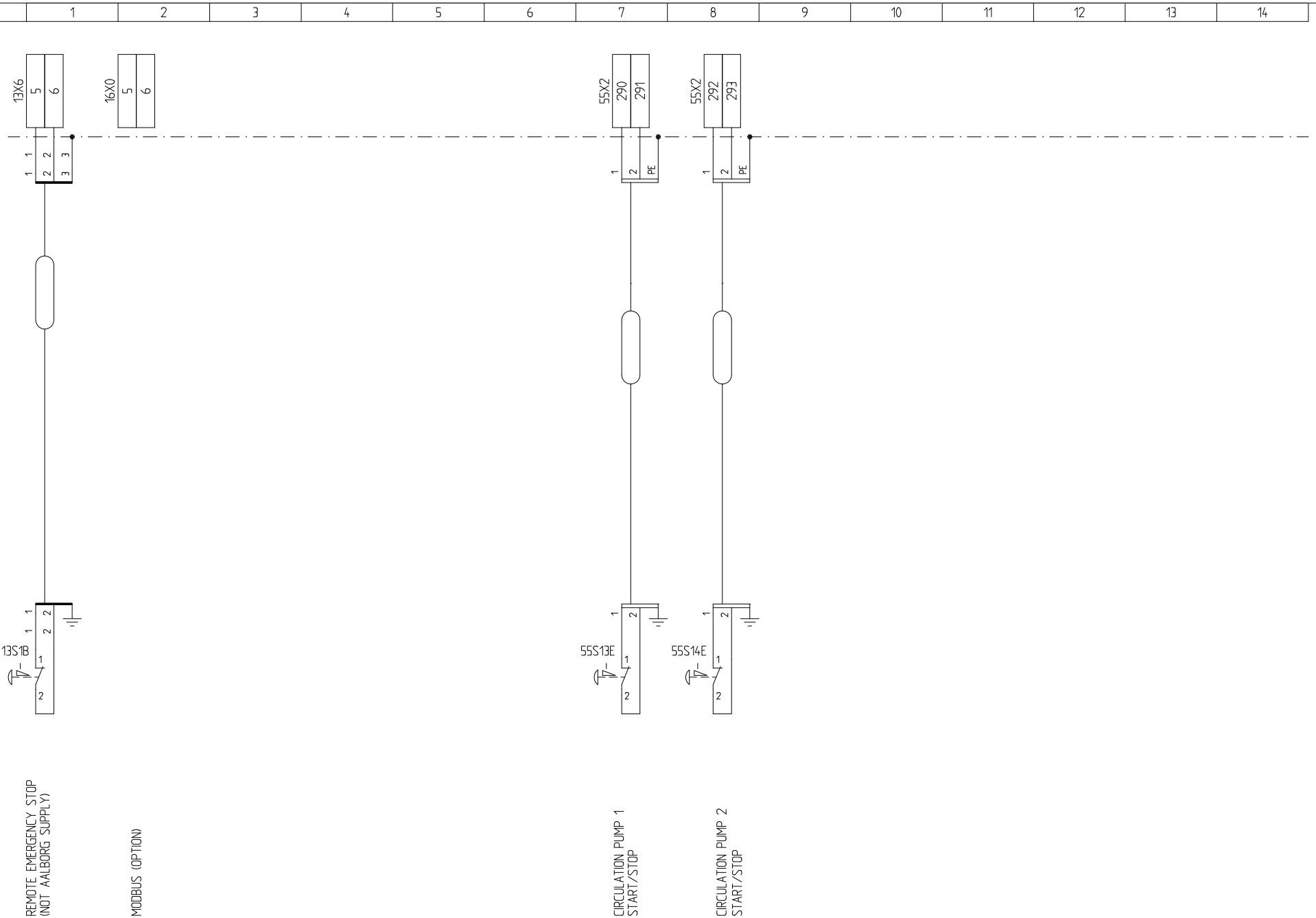
REV.	DESCRIPTION	DATE	NAME
C	UPDATE FOR PRODUCTION: 56X2: 494-496 DELETED	22 NOV 07	IMJ/188

DRAWN BY	DATE	CHECKED BY	CHECKED DATE
ESP/181	16 OCT 06	HOV/182	17 OCT 06

DRAWING NUMBER	REV.	SHEET
63X03:043507	C	126

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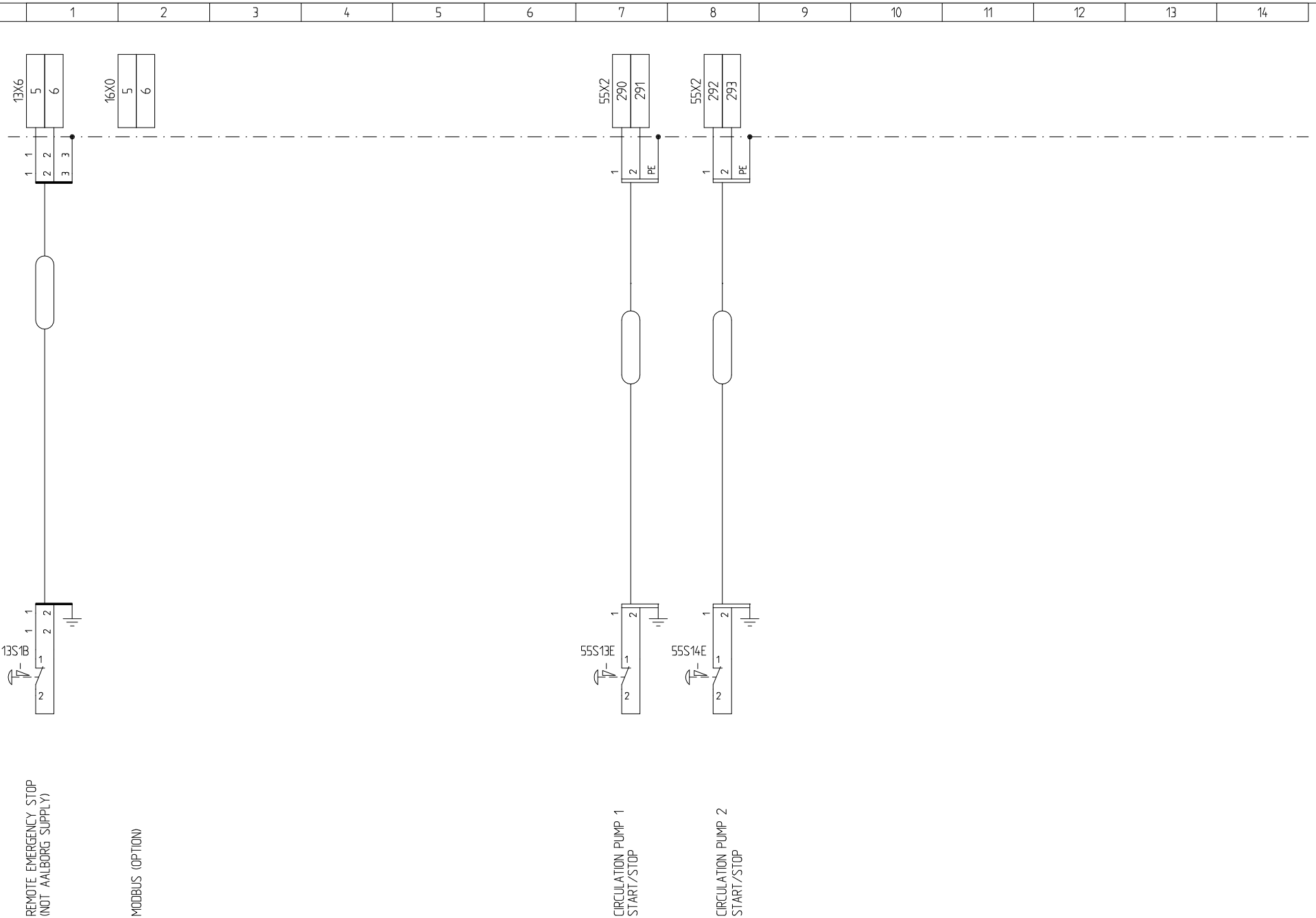


AALBORG INDUSTRIES

TITLE: CONTROL PANEL				ORIGINAL DRAWING NO.:			
				DRAWN BY	DATE	CHECKED BY	CHECKED DATE
				ESP/181	16 OCT 06	HOV/182	17 OCT 06
				DRAWING NUMBER		REV.	SHEET
REV.	DESCRIPTION	DATE	NAME	63X03:043507			128

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AALBORG INDUSTRIES

TITLE: CONTROL PANEL				ORIGINAL DRAWING NO.:			
				DRAWN BY	DATE	CHECKED BY	CHECKED DATE
				ESP/181	16 OCT 06	HOV/182	17 OCT 06
				DRAWING NUMBER		REV.	SHEET
REV.	DESCRIPTION	DATE	NAME	63X03:043507			128

Table of contents

Set point diagrams

Set point list.....42-2
Alarm list.....42-4
Shut down list.....42-5
Modbus list.....42-6

Item	Units	Range	Default Set point	Type	ITEM NO IN DRAWING 1) Steam/water P/I diagram 2) Oil flow diagram 3) Burner drawing: 4) Wiring diagram: 1	2	3	4	Element Terminal No. in wiring diagram	Bnr Trip	Physical Location	Remarks
Oil fired boiler / Burner												
Safety Valve	BAR		10.0	25.912								Mechanical
High Steam Pressure Switch	BAR	1-10	9.0	RT30		C35		33S2F	X2:222/223	X	Boiler	
High Steam Pressure ME. Slow d.	BAR	1-10	9.5	RT30							Boiler	Signal to ECR only
Steam Pressure Transmitter Boiler	BAR	0-10		MBS 5100		C48		30A1F	X2:10/11		Boiler	
High steam pressure	BAR	0-10	9.0	-		-		-	-	X		
Low steam pressure	BAR	0-10	5	-		-		-	-			
Start/Stop Pressure	BAR	0-10	7.2-8.0	-		-		-	-			
Steam pressure set point	BAR	0-10	7	-		-		-				
Steam dump set point	BAR	0-10	8.5	-	-			-				
Water Level Transmitter (4-20mA)	mA	4-20		ERAB /CLT	W33			30A11F	X1:14/15/16/17		Boiler	
Too high water level	mm WG		+180	-	-			-		X		
High Water Level	mm WG		+150	-	-			-			Boiler	
Normal Water Level	mm WG		0	-	-			-				
Stand by feed water pump	mm WG			-	-			-				
Low Water Level	mm WG		-135	-	-			-			Boiler	
Too Low Water Level 1	mm WG		-180	NRG				15A1A	component	X	Boiler	
Too Low Water Level 2	mm WG		-180	NRG				15A8A	component	X	Boiler	
Oil Pressure Transmitter Burner (4-20mA)	BAR	0-10		MBS 5100			F225	30A14F	X1:18/19		Boiler	
High oil pressure	BAR	0-10	2.3	-			-	-	-	X		
Low oil pressure	BAR	0-10	0.8	-			-	-	-	X		
Oil pressure set point	BAR	0-10	1.8	-			-	-	-			
Stand by oil pump start	BAR	0-10	1.2	-			-	-	-			
Oil temperature Transmitter Burner (4-20mA)	°C	0-150					F212	30A3F	X1:12/13		Boiler	
High oil temperature	°C	0-150	100				-	-		HFO		
Low oil temperature	°C	0-150	65				-	-		HFO		
Temp. Control Switch Heat Cable	°C	30-90	85	RAM 42.001				43S2D	X1: 44-45		Burner	
Low Com. Air Pressure Switch	mBAR	2,5-50	5	GW 50 A4			R3	14S6B	X1: 38-39	X	Burner	
Low Atomizing Air Pressure Switch	mBAR	2,5-50	10	GW 50 AV			R10	14S8B	X1: 36-37	X	Burner	
Burner Swing Out / Burner Open	Limit Sw.						F224	33S3F	X1: 32-33	X	Panel	
Flame Failure 1				RAR7/LAE10			F32	40P5D		X	Bnr. + Panel	Cut Off Oil Supply
Flame Failure 2				RAR7/LAE10			F33	40P11D	X1: 40-41		Bnr. + Panel	Cut Off Oil Supply
High temperature in preheater	°C	0-160	125				F223	34S5F		X		
Temperature transmitter in preheater (for reg.)	°C	PT100					F222	31A3E				
Oil temperature set point (380cSt@50°C)	°C	0-150	85				-	-				

Item	Units	Range	Default Set point	Type	ITEM NO IN DRAWING 1) Steam/water P/I diagram 2) Oil flow diagram 3) Burner drawing: 4) Wiring diagram: 1	2	3	4	Element Terminal No. in wiring diagram	Bnr Trip	Physical Location	Remarks
Oil Servo Motor Limit Switches:							F184					See sheet 35 in wiring
Max. Position	Degr.	0-90	90	To be set during commisioning			-				Burner	diagram and burner
Min. Position	Degr.	0-90	0	To be set during commisioning			-				Burner	instruction manual
Air Servo Motor Limit Switches:							F7					See sheet 36 in wiring
Max. Position	Degr.	0-90	90	To be set during commisioning			-				Burner	diagram and burner
Min. Position	Degr.	0-90	0	To be set during commisioning			-				Burner	instruction manual
General signals												
Thermal Overload Relays:												
Burner Motor	A	6-10	6.3	GV2-P14				07F6B		X	Panel	
Combustion Air Fan	A	17-23	20	GV2-P21				08F2B		X	Panel	
Ignition Oil Pump	A	0.4-0.63	0.6	GV2-P04				08F4B			Panel	
Oil transfer pump 1	A	1-1.6	1.54	GV2-P06				07F2B			Panel	
Oil transfer pump 2	A	1-1.6	1.54	GV2-P06				07F4B			Panel	
Feed water pump 1 - (Oil fired boiler)	A	13-18	13.5	GV2-P20				12F2B			Panel	
Feed water pump 2 - (Oil fired boiler)	A	13-18	13.5	GV2-P20				12F4B			Panel	
Circulation pump 1 (EGE)	A	6-10	7.5	GV2-P14				12F10B			Panel	
Circulation pump 2 (EGE)	A	6-10	7.5	GV2-P14				12F12B			Panel	
Timers:												
Delay Too Low Water Level 1	Sec.	3-60	15	NRG				15A1A			Panel	
Delay Too Low Water Level 2	Sec.	3-60	15	NRG				15A8A			Panel	
Delay Low Combustion Air Press.	Sec.	3-60	15	Brodersen							Panel	
Delay Low Atomizing Air Press.	Sec.	3-60	15	Software							Panel	
Delay After Running Time For Rot.	Sec.		50	Software							Panel	
Delay St.By Oil Transfer Pump	Sec.		10	Software							Panel	
Fuel oil Flow meter	P/liter	100						31A12F				
Power Failure										X	Panel	
High temperature in up take	^{0}C	20-500	450	JUMO				34S2F	X1: 29-30	X	Up take	
High oil content				MCU200				20A8D				
High Salinity	ppm	0-1000	8	SL700				20A3D				
Hotwell too low stop feed water pumps	Limit Sw.							53S11E				
Feed water pump (oil fired) stby start	BAR	1-10	3	RT30				53S12E				
Economizier												
Circulation pump stby start (EGE)	BAR	0-1	60%	Tempress	M136			54S2E				
Low circulation flow (EGE)	BAR	0-1	80%	-	-			54S2E				

	Burnertype: KBE		Step.											
	Alarm Text	Alarm Group	Shutdown	Stopped	0, Ready	1, Starting	2, Purge	3, Ingition pos.	4, Ignition	5, Safty time	6, Flame stable	7, Low fire	8, Rising	9, Mod. Fr
0	FUEL PUMP 1 NO FEEDBACK	2	x	x	x	x	x	x	x	x	x	x	x	x
1	FUEL PUMP 2 NO FEEDBACK	2	x	x	x	x	x	x	x	x	x	x	x	x
2	WATER PUMP 1 NO FEEDBACK	2	x	x	x	x	x	x	x	x	x	x	x	x
3	WATER PUMP 2 NO FEEDBACK	2	x	x	x	x	x	x	x	x	x	x	x	x
8	OIL CONTENT HIGH	2	x	x	x	x	x	x	x	x	x	x	x	x
9	WAR_SALINITY_HIGH	2	x	x	x	x	x	x	x	x	x	x	x	x
12	HIGH GAS TEMP AT EGB	2	x	x	x	x	x	x	x	x	x	x	x	x
15	BOILER PRESSURE LOW	2	x	x	x	x	x	x	x	x	x	x	x	x
17	WATER LEVEL HIGH	4	x	x	x	x	x	x	x	x	x	x	x	x
18	WATER LEVEL LOW	3	x	x	x	x	x	x	x	x	x	x	x	x
19	FUEL OIL PRESSURE LOW	2	x	x	x	x	x	x	x	x	x	x	x	x
20	FUEL OIL TEMPERATURE LOW	2	x	x	x	x	x	x	x	x	x	x	x	x
21	STEAM PRESSURE COMMON LOW	2	x	x	x	x	x	x	x	x	x	x	x	x
22	SMOKE DENSITY HIGH	2	x	x	x	x	x	x	x	x	x	x	x	x
23	OXYGEN SENSOR HIGH	2	x	x	x	x	x	x	x	x	x	x	x	x
24	FUEL PUMP 1 OVERLOAD	2	x	x	x	x	x	x	x	x	x	x	x	x
25	FUEL PUMP 2 OVERLOAD	2	x	x	x	x	x	x	x	x	x	x	x	x
26	WATER PUMP 1 OVERLOAD	2	x	x	x	x	x	x	x	x	x	x	x	x
27	WATER PUMP 2 OVERLOAD	2	x	x	x	x	x	x	x	x	x	x	x	x
30	CIRC. PUMP 1 OVERLOAD	2	x	x	x	x	x	x	x	x	x	x	x	x
31	CIRC. PUMP 2 OVERLOAD	2	x	x	x	x	x	x	x	x	x	x	x	x
32	ST. BY FUEL PUMP STARTED	2	x	x	x	x	x	x	x	x	x	x	x	x
33	ST. BY WATER PUMP STARTED	2	x	x	x	x	x	x	x	x	x	x	x	x
34	ST. BY CIRC. PUMP STARTED	2	x	x	x	x	x	x	x	x	x	x	x	x
35	SALINITY HIGH ANALOG	2	x	x	x	x	x	x	x	x	x	x	x	x
36	TEMP. UPTAKE HIGH	2	x	x	x	x	x	x	x	x	x	x	x	x
37	EXTERN STOP	2	x	x	x	x	x	x	x	x	x	x	x	x
38	BOILER PRESS. HIGH	2	x	x	x	x	x	x	x	x	x	x	x	x
39	BOOTED WITHOUT PARTNER	2	x	x	x	x	x	x	x	x	x	x	x	x
40	FUEL OIL TEMPERATUREHIGH	2	x	x	x	x	x	x	x	x	x	x	x	x
50	FUEL OIL TEMPERATURE HIGH IN PREHEATER	2	x	x	x	x	x	x	x	x	x	x	x	x
51	FUEL OIL TEMPERATURE LOW IN PREHEATER	2	x	x	x	x	x	x	x	x	x	x	x	x
58	HOTWELL LOW FEED PUMPS STOPPED	2	x	x	x	x	x	x	x	x	x	x	x	x
66	AUX PUMP OVERLOAD	2	x	x	x	x	x	x	x	x	x	x	x	x
67	AUX PUMP FEEDBACK	2	x	x	x	x	x	x	x	x	x	x	x	x
68	NO FUEL PUMPS AVAILABLE	2			x	x	x	x	x	x	x	x	x	x
70	BOILER PRESSURE	2	x	x	x	x	x	x	x	x	x	x	x	x
73	WATER LEVEL MANUAL	2	x	x	x	x	x	x	x	x	x	x	x	x
80	STEAM DUMP MANUAL	2	x	x	x	x	x	x	x	x	x	x	x	x
81	KEY SYSTEM DISABLED	2	x	x	x	x	x	x	x	x	x	x	x	x
82	COMBUSTION AIR FAN NEED SERVICE	2	x	x	x	x	x	x	x	x	x	x	x	x
83	BURNER MOTOR NEED SERVICE	2	x	x	x	x	x	x	x	x	x	x	x	x
85	FUEL PUMP 1 NEED SERVICE	2	x	x	x	x	x	x	x	x	x	x	x	x
86	FUEL PUMP 2 NEED SERVICE	2	x	x	x	x	x	x	x	x	x	x	x	x
87	CIRCULATION PUMP 1 NEED SERVICE	2	x	x	x	x	x	x	x	x	x	x	x	x
88	CIRCULATION PUMP 2 NEED SERVICE	2	x	x	x	x	x	x	x	x	x	x	x	x
89	CHEMICAL PUMP 1 NEED SERVICE	2	x	x	x	x	x	x	x	x	x	x	x	x
90	CHEMICAL PUMP 2 NEED SERVICE	2	x	x	x	x	x	x	x	x	x	x	x	x
91	FEED WATER PUMP 1 NEED SERVICE	2	x	x	x	x	x	x	x	x	x	x	x	x
92	FEED WATER PUMP 2 NEED SERVICE	2	x	x	x	x	x	x	x	x	x	x	x	x
95	OIL SUMMARIZER CAUSED SERVICE	2	x	x	x	x	x	x	x	x	x	x	x	x
98	BURNER LOAD >25% CAUSED SERVICE	2	x	x	x	x	x	x	x	x	x	x	x	x
99	BURNER LOAD >50% CAUSED SERVICE	2	x	x	x	x	x	x	x	x	x	x	x	x
100	BURNER LOAD >75% CAUSED SERVICE	2	x	x	x	x	x	x	x	x	x	x	x	x
101	BURNER LOAD CAUSED SERVICE	2	x	x	x	x	x	x	x	x	x	x	x	x
102	SMOKE BLOWER NEED SERVICE	2	x	x	x	x	x	x	x	x	x	x	x	x
104	OIL SERVO MANUAL	2	x	x	x	x	x	x	x	x	x	x	x	x
105	AIR SERVO MANUAL	2	x	x	x	x	x	x	x	x	x	x	x	x

Shutdowns

	Burnertype: KBE	Alarm Group	Step.											
			Shutdown	Stopped	0, Ready	1, Starting	2, Purge	3, Ingition pos.	4, Ignition	5, Safty time	6, Flame stable	7, Low fire	8, Rising	9, Mod. Free
0	MOTOR STARTER ERROR COMB.AIR FAN	1	x	x	x	x	x	x	x	x	x	x	x	x
1	HIGH STEAM PRESSURE SWITCH	1	x	x	x	x	x	x	x	x	x	x	x	x
2	TOO LOW WATER LEVEL SWITCH	1	x	x	x	x	x	x	x	x	x	x	x	x
3	BURNER NOT READY	1	x	x	x	x	x	x	x	x	x	x	x	x
4	MOTOR OVERLOAD ERRORCOMB.AIR FAN	1	x	x	x	x	x	x	x	x	x	x	x	x
5	FLAME OUT	1								x	x	x	x	x
6	AIR SERVO ERROR	1	x	x	x		x	x				x		
7	NO FUEL PUMPS AVAILABLE	1	x	x	x	x	x	x	x	x	x	x	x	x
8	NO START PERMISSION FROM PMS	1	x	x	x	x	x	x	x	x	x	x	x	x
9	POWER PANEL1 OFFLINE	1	x	x	x	x	x	x	x	x	x	x	x	x
11	OIL SERVO ERROR	1	x	x	x		x	x				x		
14	START SEQUENCE MAX TIME EXPIRED	1	x	x	x	x	x	x	x	x	x	x	x	x
15	PHOTO CELL FAILURE	1				x	x	x						
18	HIGH TEMPERATURE UPTAKE	1	x	x	x	x	x	x	x	x	x	x	x	x
21	BURNER SWING OUT	1	x	x	x	x	x	x	x	x	x	x	x	x
24	FUEL OIL TEMPERATURE HIGH	1	x	x	x	x	x	x	x	x	x	x	x	x
25	FUEL OIL TEMPERATURE LOW	1	x	x	x	x	x	x	x	x	x	x	x	x
26	FUEL OIL PRESSURE LOW	1	x	x	x	x	x	x	x	x	x	x	x	x
27	WATER LEVEL HIGH	1	x	x	x	x	x	x	x	x	x	x	x	x
28	WATER LEVEL LOW	1	x	x	x	x	x	x	x	x	x	x	x	x
29	BOILER PRESSURE HIGH	1	x	x	x	x	x	x	x	x	x	x	x	x
31	STEAM PRESSURE COMMON HIGH	1	x	x	x	x	x	x	x	x	x	x	x	x
33	LOW COMB AIR PRESS SWITCH	1	x	x	x	x	x	x	x	x	x	x	x	x
34	BURNER MOTOR OVERLOAD	1	x	x	x	x	x	x	x	x	x	x	x	x
36	SALINITY HIGH	1	x	x	x	x	x	x	x	x	x	x	x	x
37	TEMP. UPTAKE HIGH	1	x	x	x	x	x	x	x	x	x	x	x	x
39	EXTERN SHUTDOWN	1	x	x	x	x	x	x	x	x	x	x	x	x
56	LOW ATM. AIR PRESSURE	1								x	x	x	x	x
57	OIL CONTENT HIGH	1	x	x	x	x	x	x	x	x	x	x	x	x
59	COMB. AIR FAN MOTOR OVERLOAD	1	x	x	x	x	x	x	x	x	x	x	x	x
60	HIGH OIL TEMP SW IN PREHEATER	1	x	x	x	x	x	x	x	x	x	x	x	x
61	FUEL OIL PRESSURE HIGH	1	x	x	x	x	x	x	x	x	x	x	x	x
62	FUEL OIL TEMPERATURE HIGH IN BURNER	1	x	x	x	x	x	x	x	x	x	x	x	x
63	FUEL OIL TEMPERATURE LOW IN BURNER	1	x	x	x	x	x	x	x	x	x	x	x	x
64	TEMPERATURE IN WINDBOX HIGH	1	x	x	x	x	x	x	x	x	x	x	x	x
65	FLAME OUT SCANNER 2	1								X	x	x	x	x

Modbus address list

Please Reserve Adress 40000 - 40999 to AI Modbus

	Modbus Addr.	Word no.	Type	Description
Operation	**40525**		AI	Command operation mode
	40527		AI	Command stop
	40523		AI	Boiler pressure manuel increase
	40524		AI	Boiler pressure manuel decrease
	40522.12		AI	Unit of measurement (pressure values only) Status feedback
	40600			
Analog inputs			AI	
	40020		AI	Burner Load
	40010		AI	Steam pressure (boiler)
	40022		AI	Water level boiler
	40107		AI	O2 monitor
	40109		AI	Temperature boiler uptake
	40077		AI	Fuel Oil pressure
	40063		AI	Fuel Oil temperature
			AI	Steam pressure common line
	40105		AI	Smoke density monitor
Digital outputs	**40502.06**		DO	Combustion air fan, start/stop
	40508.02		DO	Fuel oil pump 1, start/stop
	40508.03		DO	Fuel oil pump 2, start/stop
	40509.01		DO	Chemical dosing station 1
	40509.02		DO	Chemical dosing station 2
	40508.05		DO	Feed water pump 1 start/stop
	40508.06		DO	Feed water pump 2 start/stop
	40502.10		DO	DO/HFO operation
Analog inputs XS 2V				
Digital outputs XS 2V				
	40515.00			FUEL PUMP 1 NO FEEDBACK
	40515.01			FUEL PUMP 2 NO FEEDBACK
	40515.02			WATER PUMP 1 NO FEEDBACK
	40515.03			WATER PUMP 2 NO FEEDBACK
	40515.08			OIL CONTENT HIGH
	40515.09			WAR_SALINITY_HIGH
	40515.12			HIGH GAS TEMP AT EGB
	40515.15			BOILER PRESSURE LOW
	40516.01			WATER LEVEL HIGH
	40516.02			WATER LEVEL LOW
	40516.03			FUEL OIL PRESSURE LOW
	40516.04			FUEL OIL TEMPERATURE LOW

	40516.05	STEAM PRESSURE COMMON LOW
	40516.06	SMOKE DENSITY HIGH
	40516.07	OXYGEN SENSOR HIGH
	40516.08	FUEL PUMP 1 OVERLOAD
	40516.09	FUEL PUMP 2 OVERLOAD
	40516.10	WATER PUMP 1 OVERLOAD
	40516.11	WATER PUMP 2 OVERLOAD
	40516.14	CIRC. PUMP 1 OVERLOAD
	40516.15	CIRC. PUMP 2 OVERLOAD
	40517.00	ST. BY FUEL PUMP STARTED
	40517.01	ST. BY WATER PUMP STARTED
	40517.02	ST. BY CIRC. PUMP STARTED
	40517.03	SALINITY HIGH ANALOG
	40517.04	TEMP. UPTAKE HIGH
	40517.05	EXTERN STOP
	40517.06	BOILER PRESS. HIGH
Alarms	**40517.07**	BOOTED WITHOUT PARTNER
	40517.08	FUEL OIL TEMPERATUREHIGH
	40518.02	FUEL OIL TEMPERATURE HIGH IN PREHEATER
	40518.03	FUEL OIL TEMPERATURE LOW IN PREHEATER
	40518.10	HOTWELL LOW FEED PUMPS STOPPED
	40458.01	AUX PUMP OVERLOAD
	40458.02	AUX PUMP FEEDBACK
	40697.01	BOILER PRESSURE
	40697.04	WATER LEVEL MANUAL
	40697.11	STEAM DUMP MANUAL
	40697.12	KEY SYSTEM DISABLED
	40697.13	COMBUSTION AIR FAN NEED SERVICE
	40697.14	BURNER MOTOR NEED SERVICE
	40417.00	FUEL PUMP 1 NEED SERVICE
	40417.01	FUEL PUMP 2 NEED SERVICE
	40417.02	CIRCULATION PUMP 1 NEED SERVICE
	40417.03	CIRCULATION PUMP 2 NEED SERVICE
	40417.04	CHEMICAL PUMP 1 NEED SERVICE
	40417.05	CHEMICAL PUMP 2 NEED SERVICE
	40417.06	FEED WATER PUMP 1 NEED SERVICE
	40417.07	FEED WATER PUMP 2 NEED SERVICE
	40417.10	OIL SUMMARIZER CAUSED SERVICE
	40417.13	BURNER LOAD >25% CAUSED SERVICE
	40417.14	BURNER LOAD >50% CAUSED SERVICE
	40417.15	BURNER LOAD >75% CAUSED SERVICE
	40418.00	BURNER LOAD CAUSED SERVICE
	40418.01	SMOKE BLOWER NEED SERVICE
	40418.03	OIL SERVO MANUAL
	40418.04	AIR SERVO MANUAL
	40510.00	MOTOR STARTER ERROR COMB.AIR FAN
	40510.01	HIGH STEAM PRESSURE SWITCH
	40510.02	TOO LOW WATER LEVEL SWITCH
	40510.03	BURNER NOT READY
	40510.04	MOTOR OVERLOAD ERRORCOMB.AIR FAN
	40510.05	FLAME OUT
	40510.06	AIR SERVO ERROR
	40510.07	NO FUEL PUMPS AVAILABLE
	40510.08	NO START PERMISSION FROM PMS

	40510.09	POWER PANEL1 OFFLINE
	40510.11	OIL SERVO ERROR
	40510.14	START SEQUENCE MAX TIME EXPIRED
	40510.15	PHOTO CELL FAILURE
	40511.02	HIGH TEMPERATURE UPTAKE
	40511.05	BURNER SWING OUT
	40511.08	FUEL OIL TEMPERATURE HIGH
	40511.09	FUEL OIL TEMPERATURE LOW
Shutdown	**40511.10**	FUEL OIL PRESSURE LOW
	40511.11	WATER LEVEL HIGH
	40511.12	WATER LEVEL LOW
	40511.13	BOILER PRESSURE HIGH
	40511.15	STEAM PRESSURE COMMON HIGH
	40512.01	LOW COMB AIR PRESS SWITCH
	40512.02	BURNER MOTOR OVERLOAD
	40512.04	SALINITY HIGH
	40512.05	TEMP. UPTAKE HIGH
	40512.07	EXTERN SHUTDOWN
	40513.08	LOW ATM. AIR PRESSURE
	40513.09	OIL CONTENT HIGH
	40513.11	COMB. AIR FAN MOTOR OVERLOAD
	40513.12	HIGH OIL TEMP SW IN PREHEATER
	40513.13	FUEL OIL PRESSURE HIGH
	40513.14	FUEL OIL TEMPERATURE HIGH IN BURNER
	40513.15	FUEL OIL TEMPERATURE LOW IN BURNER
	40514.00	TEMPERATURE IN WINDBOX HIGH
	40514.01	FLAME OUT SCANNER 2

Burnertype: KBE Boiler: EGB	
Function description	Remarks
0 = stopped; 1 = manual; 2= auto;	
0 = no command; 1 = start; 2 = stop (only possible in manual mode)	
0 = 1/10 bar; 1 = 1/10 kg/cm; 2 = 1/100 Mpa	
0 = STOPPED; 1 = SHUTDOWN; 2 = READY; 3 = STARTING; 4 = PURGE; 5 = IGNITION POSITION; 6 = IGNITION; 7 = SAFETY TIME; 8 = FLAME STABLE; 9 = LOW FIRING; 10 = RISING; 11 = MOD FREE; 12 = STEAM PURGE POSITION; 13 = STEAM PURGE 1; 14 = STEAM PURGE 2; 15 = POST PURGE	
%	
Unit of measurement - See word 11	
mmWC	
1/10 %	Option
1/10 °C	Option
Unit of measurement - See word 11	
1/10 °C	
Unit of measurement - See word 11	Option (Double plant)
1/10 %	Option
0 = Stopped; 1 = Running	
0 = Stopped; 1 = Running	
0 = Stopped; 1 = Running	
0 = Stopped; 1 = Running	Option
0 = Stopped; 1 = Running	Option
0 = Stopped; 1 = Running	Option
0 = Stopped; 1 = Running	Option
0 = DO; 1 = HFO	

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Data sheets

6638231	Pressure transmitter 0 - 10 bar	43-2
6639045	Photo cell	43-4
6312127	Flame safeguard	43-5

Type:

- Pressure transmitter
- MBS 5100

Size:

- 0 - 10 bar

Application:

- The pressure transmitter converts pressure to an electric signal. This is proportional to, and linear with, the value of the pressure to which the pressure-sensitive element is subjected by the medium. The units are supplied as two wire transmitters with an output signal of 4-20 mA. The transmitters have a zero-point displacement facility for equalizing static pressure.
  Span adjustment is also possible.

Material:

- Housing material: Anodized AlMgSiPb

Technical data:

Performance:

- Accuracy (incl. non-linearity, hysteresis and repeatability): ±0.1% fs (typ.) / ±0.3% FS (max.)
- Non-linearity (best fit straight line): < ±0.2% FS
- Hysteresis and repeatability: ≤ ±0.1% FS
- Thermal zero point shift: ≤ ±0.1% FS/10K (typ.) / ≤ ±0.2% FS/10K (max.)
- Thermal sensitivity (span) shift: ≤ ±0.01% FS/K (typ.) / ≤ ±0.02% FS/K (max.)
- Response time: < 4 rms

Electrical specification:

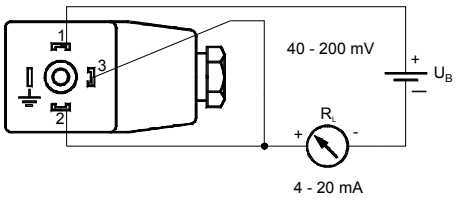
- Rated output signal: 4 to 20 mA
- Supply voltage, V_{supply} (polarity protected): 10 to 32 V d.c.
- Voltage dependency: < 0.01% FS/V
- Current limitation (linear output signal up to 1.5 x nom range): 28 mA (typ.)
- Max. load R_L: $R_L \leq [(Vsupply - 10V)/0.02A] - 10\ \Omega$

Mechanical:

- Connection: G 1/2" –m (EN 837-1-G ½ A)
- Max. operating pressure: 20 bar
- Min. burst pressure: 50 bar
- Operating temperature range: - 40 to 85°C
- Compensated temperature range: 0 to 80°C
- Transport temperature range: - 50 to 85°C
- Cable entry: PG 11
- Enclosure: IP 65
- Weight: 0.4 kg

Installation:

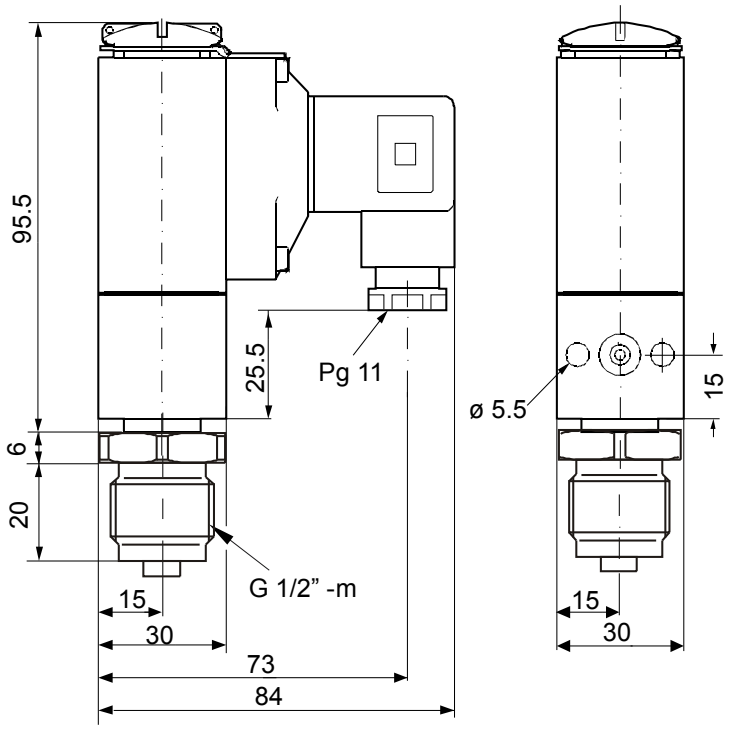
- There are facilities for adjusting zero point and span.
  Zero point adjustments is necessary to equalise pressure arising from any differences in level between the pressure transmitter and the medium being measured.
  Zero point adjustment results in a parallel displacement of span.
  Both zero point and span must be adjusted on the side of the unit with cover removed

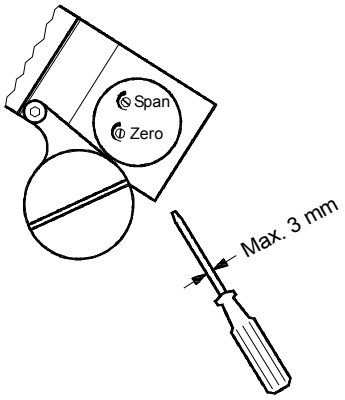


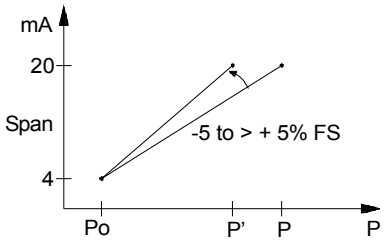
1. Supply +
2. Supply –
3. Function test

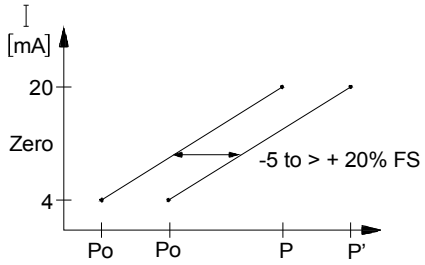
⏚ Connected to MBS transmitter enclosure

Type No.: 8010 Version: A.2	**Pressure transmitter 0 - 10 bar**	**6638231**









Type No.: 8010 **Version: A.2**	**Pressure transmitter 0 - 10 bar**	**6638231**

Type:

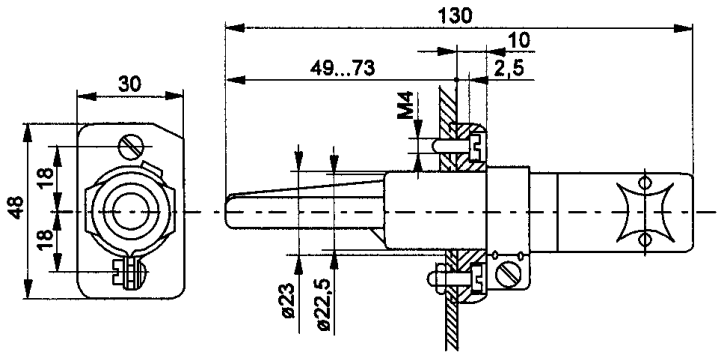
- Photo cell
- RAR7

Application:

- The RAR7 detector is used for supervision of yellow burning oil flames.

Technical data:

- Length of detector lead: up to 20 m
- Permissible ambient temperature: -20°C to + 60°
- Protection standard: I
- Degree of protection: IP 40
- Weight: approx. 85 g



Type No.: 8630 Version: A.2	Photo cell	6639045

Type:

- Flame safeguard
- LAE10

Application:

- Used for supervision of oil flames

Technical data:

- Main voltage: 220 V_{AC} ÷15%….240V_{AC} +10%
- Frequency: 50 Hz / 60 Hz
- Fuse (external): max. 10 A slow
- Internal consumption: 4.5 VA
- Radio interference protection: N according to VDE 0875
- Max. permissible contact loading: 2 A
- Protection: IP40
- Permissible ambient temperature: -20°C to + 60°C
- Mounting position: optional
- Weight: 0.305 kg

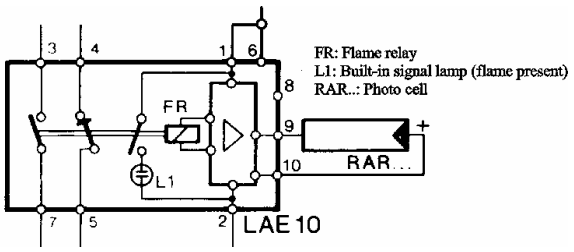
Flame supervision:

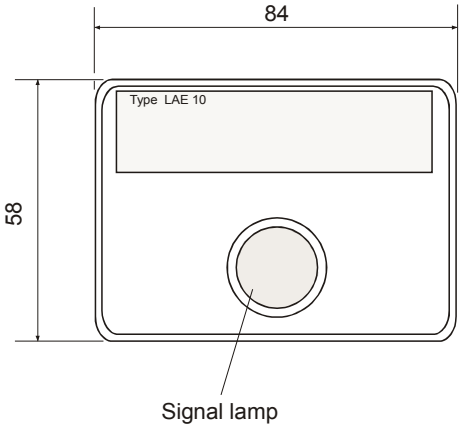
- Min. required detector: Selenium photocell
- Current at nominal voltage: min 8 **m**A
- Max. possible detector current at nominal voltage: approx 25 **m**A

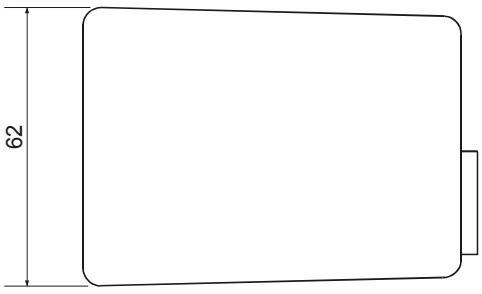
Detector:

- Permissible cable run: 20 m
- Permissible ambient temperature: 60°C

Connection diagram:







Type No.: 8210 Version: A.2	**Flame safeguard**	**6312127**

Table of contents

Spare parts

Spareparts for MISSION™ OS.....44-2
Spare parts for boiler XS-7V.....44-3
Spare parts for burner.....44-4

Spareparts for MISSION™ OS.

Boiler plant:.....1 x MISSION™ OS + 1 x MISSION™ XS-7V
Request No.:.....**051868**
Configuration No.:.....1
Hull No./Nos.:.....H2390, H2391, H2392, H2393, H2403, H2404, H2405, H2406
Project No./Nos:.....051868-01, -02, -03, -04, -05, -06, -07, -08
Date:.....10 October 2007

The spare parts supplied in the scope of delivery for included MISSION™ OS boilers are listed in the table below.

1 Spare parts

Tag No.	Qty.	Application	Spare part No.
Spare parts for the boiler			
S-C1-5	1	Spring for safety valve, OD50	8580000002
S-C17-1/S-C18-1	2	Water level glass, type A, size 8	8590000021
S-C17-2/S-C18-2	4	Gasket for water gauge stud	2163719
S-C-1	4	Gasket for manhole	2158320
S-C-2	16	Gasket for handhole, 150x100x1.5	2158609
S-C-3	4	Plug f. pinelement	6494971
S-C-8	1	Plistix 14 (25 kg)	2118236
Spare parts for commissioning			
S-C-5	2	Gasket for manhole	2158320
S-C-6	8	Gasket for handhole	2158609

Spare parts for XS-7V boiler

1 Spare parts

The spare parts included in the scope of delivery of a standard AQ-7 boiler are listed in the following tables.

Spare parts for boiler		
Pcs.	**Designation**	**Spare Part No.**
1	Spring for safety valve - 25.912 32/50	8580000001 / S-C1-3
1	Pressure gauge - ø160, 0-20 bar	6632998 / S-C33-1
24	Tube plug - ø76.1mm	6494108 / S-C-7
2	Gaskets for manholes – 425 x 325 x 2 mm	2158320 / S-C-1
10	Gaskets for hand holes – 150 x 100	2158609 / S-C-2

Table 1

Yards Spare		
Pcs.	**Designation**	**Spare Part No.**
2	Gaskets for manholes – 425 x 325 x 2 mm	2158320 / S-C-5
10	Gaskets for hand holes – 150 x 100	2158609 / S-C-6

Table 2

Spare parts for XS-7V boiler

1 Spare parts

The spare parts included in the scope of delivery of a standard AQ-7 boiler are listed in the following tables.

Spare parts for boiler		
Pcs.	**Designation**	**Spare Part No.**
1	Spring for safety valve - 25.912 32/50	8580000001 / S-C1-3
1	Pressure gauge - ø160, 0-20 bar	6632998 / S-C33-1
24	Tube plug - ø76.1mm	6494108 / S-C-7
2	Gaskets for manholes – 425 x 325 x 2 mm	2158320 / S-C-1
10	Gaskets for hand holes – 150 x 100	2158609 / S-C-2

Table 1

Yards Spare		
Pcs.	**Designation**	**Spare Part No.**
2	Gaskets for manholes – 425 x 325 x 2 mm	2158320 / S-C-5
10	Gaskets for hand holes – 150 x 100	2158609 / S-C-6

Table 2