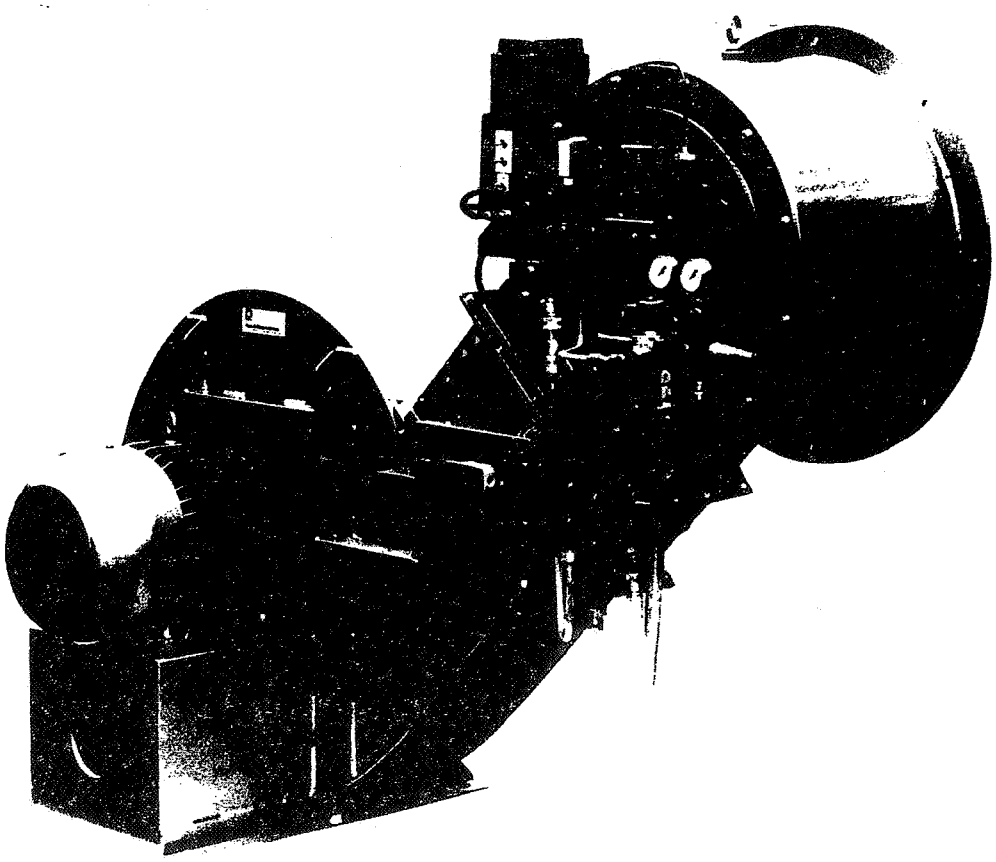
BY APPOINTMENT TO HER MAJESTY THE QUEEN MANUFACTURERS OF COMBUSTION EQUIPMENT NU-WAY LIMITED DARTFORD

NU-WAY

Handbook

Fully modulating automatic oil burners Model PF



The PF Series of fully automatic oil burner equipment is offered for industrial boiler and air heater applications. This versatile range of fully modulating burners is available in two forms, to use Distillate or Residual fuels.
Each Burner System is made up of performance-matched units which together ensure safe, efficient and reliable operation. These Systems are built up from the following units:-

- Burner Head
- Modulating Air/Oil Control System
- Oil Services Unit
- Fan Unit
- Control Panel

PF Burner equipment has a wide range of throughput, varying from 3.66 MW-11.0 MW(3,150,000-9,450,000 kcal/h; 12,500,000-37,500,000 Btu/h), and offers a standard turndown of 3:1 approx.

The units are suitable for use with fuels having the following viscosities:-

Distillate	Class D (1.5 - 5.5 cSt @ 80°C) Reference L (light)
Residual	Class F (13.5 cSt @ 80°C) Reference H (heavy)
Residual	Class G (13.5 cSt @ 80°C) Reference X (extra heavy)

BURNER HEAD/AIR DAMPER SECTION

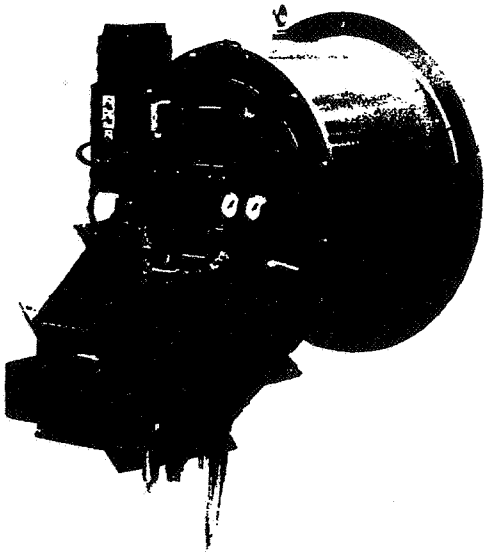
The PF Burner Head Assembly is robustly constructed in mild steel and is stove enamelled for durability. The head is bolted directly onto the appliance frontplate (hence the designation F - Fixed plenum). The inner assembly can be readily detached, providing easy access to the Combustion Head components.

The Burner has a metal, diffuser type, Combustion Head, producing efficient combustion and flame stability.

External fittings include: flame failure viewing equipment, Transformer, Air Pressure Switch, Pressure Gauge and Terminal Box facilities.

Attached to the above casing is an Air Damper section, containing the Motorised Control Assembly. This assembly operates a set of adjustable cams which maintain the optimum Air/Oil mixture throughout the modulating range.

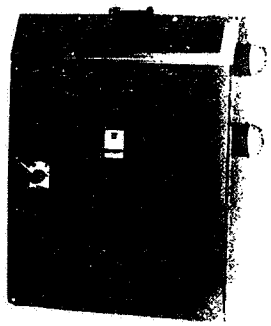
The Inlet Duct is flanged and drilled for easy assembly onto the Fan Unit.



CONTROL PANEL

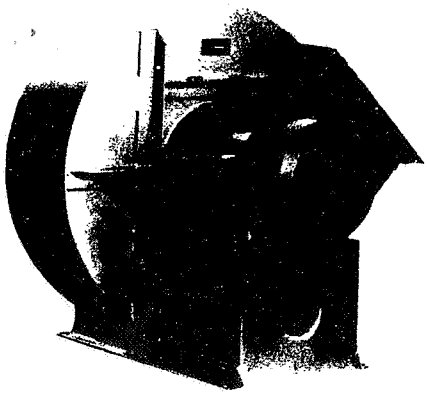
The Control Unit is built into a free-standing/wall mounted cabinet which incorporates a Photo-electric Sequence Controller, Modulating Control Gear, Starters for the Fan, Fuel Pumps and Boiler water feed pump, Motors, Low Water Cut-Out Relays and other safety devices.

Fitted into the sloping top of the cabinet are test switches, re-set buttons and signal lights, which indicate the operating condition of the Burner and Pre-Heater Tank. The access door on the front of the panel carries the mains isolator switch, which is interlocked with the door catch. All components are pre-wired, input and output circuits being grouped for ease of connection to the power supply and to electrical equipment on the burner head, air damper and pumping unit.



FAN UNIT

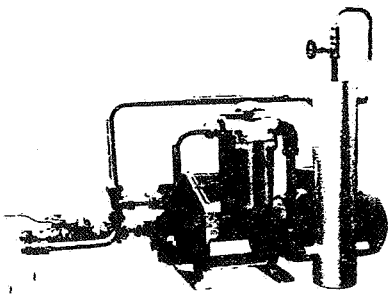
A floor mounted fan provides the air supply for the system. It has a rectangular outlet which is flanged and drilled for bolting onto the burner head/air damper section. The circular inlet is guarded by a wire mesh screen. The motor unit is enclosed, fan cooled and mounted on a rigid base.

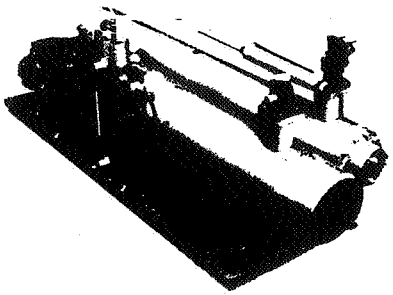


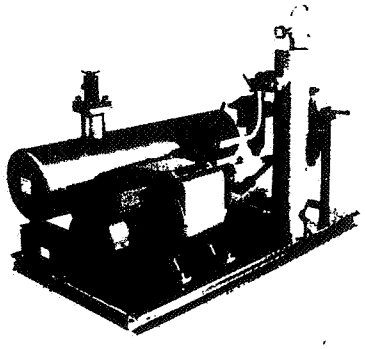
OIL SERVICES UNIT

Distillate Oil pumping is achieved by the use of a pump/motor arrangement, mounted on a rigid, cast aluminium, floor standing bracket. A Metal Edge Oil Suction Filter is mounted on the inlet of the unit and an Air Separator Bottle with vent valve is also included.

For Residual Oil models, a similar arrangement to that above is used, with the addition of single or duplex line heaters. These can be supplied as either electric, steam or combined steam/electric version. A Hot Oil Filter, Thermometer and Heater controls are integral parts of the Pre-Heater Unit.

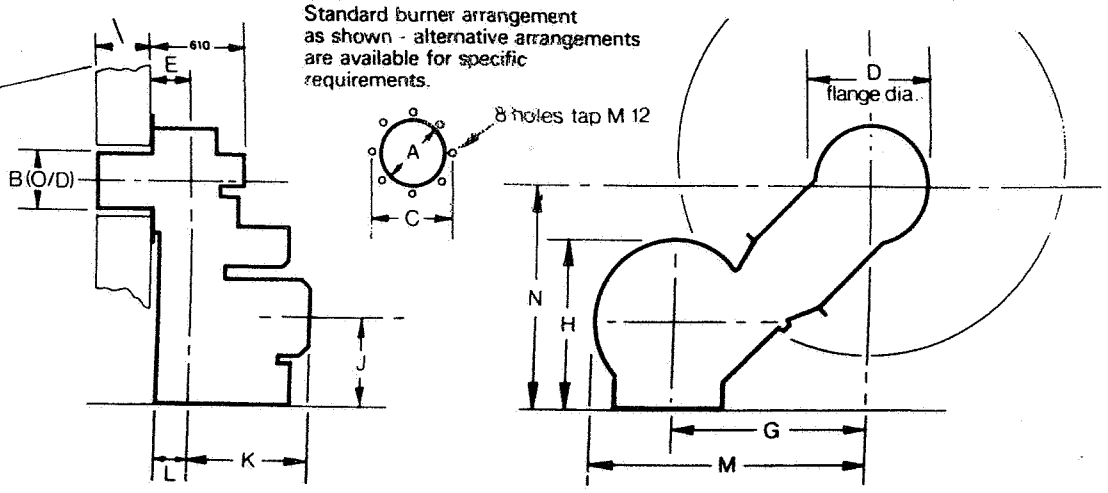






LEADING DIMENSIONS

Flame Tube projection
STD. lengths: **230 305 405**
Other sizes available on request.



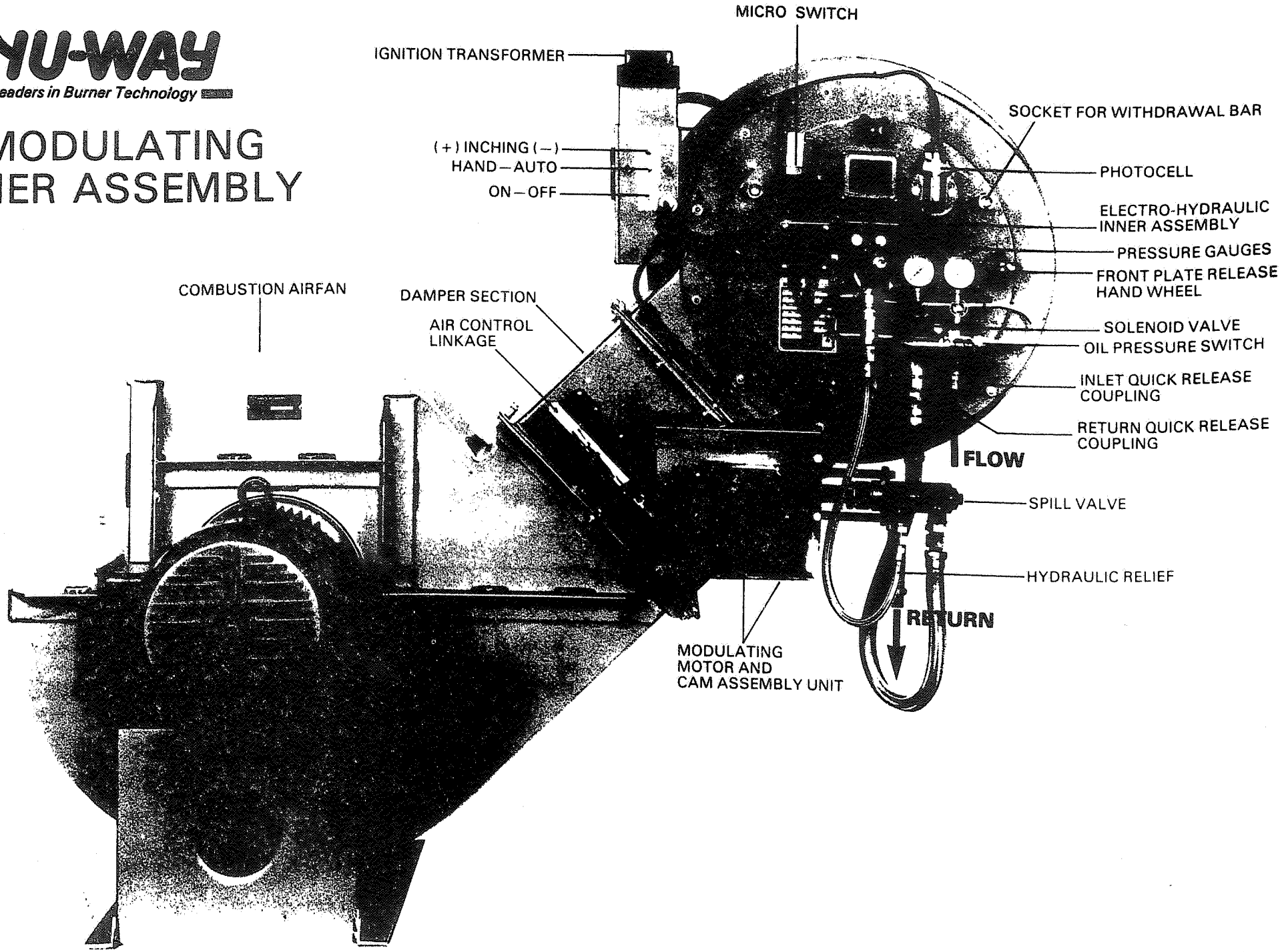
Note:
Standard burner arrangement as shown - alternative arrangements are available for specific requirements.

BURNER		FAN	A	B	C	D	E	G	H	J	K	L	M	N	FAN STATIC
PF4	A	500 BC2	375	334	610	660	270	844	797	438	501	130	1222	927	
	B		375	334	610	660	270	844	797	438	501	130	1222	927	
	C	560 BC2	375	334	610	660	270	878	849	464	501	130	1284	947	
	D		375	334	610	660	270	878	849	464	501	130	1284	947	
PF5	A		375	334	672	724	235	914	849	464	501	130	1320	983	
	B		375	334	672	724	235	937	880	477	648	194	1368	1018	
	C		375	334	672	724	235	937	880	477	648	194	1368	1018	
	D	560 BC4	400	359	672	724	235	937	880	477	648	194	1368	1018	
	E		400	359	672	724	235	937	880	477	648	194	1368	1018	
	F		400	359	672	724	235	937	880	477	648	194	1368	1018	10"
	G		400	359	672	724	235	937	880	477	648	194	1368	1018	
PF6	A		425	385	672	724	215	995	880	477	648	194	1426	1076	W.G.
	B		425	385	672	724	215	1023	925	495	667	214	1480	1119	
	C		425	385	672	724	215	1023	925	495	667	214	1480	1119	
	D	570 BC6	425	385	672	724	215	1023	925	495	667	214	1480	1119	
	E		425	385	672	724	215	1023	925	495	667	214	1480	1119	
PF7	A		450	410	672	724	215	1023	925	495	667	214	1480	1119	
	B		450	410	672	724	215	1023	925	495	667	214	1480	1119	
	C		450	410	672	724	215	1023	925	495	667	214	1480	1119	
	D	650 BC6	450	410	672	724	215	1070	1004	534	736	214	1567	1147	
	E		450	410	672	724	215	1070	1004	534	736	214	1567	1147	
PF7	F		450	410	672										
	G		450	410	672										
PF4	A	560 BC2	375	334	610	660	270	878	849	464	501	130	1284	947	
	B		375	334	610	660	270	878	849	464	501	130	1284	947	
	C		375	334	610	660	270	901	880	477	648	194	1332	982	
	D		375	334	610	660	270	901	880	477	648	194	1332	982	
PF5	A		375	334	672	724	235	937	880	477	648	194	1368	1018	
	B	560 BC4	375	334	672	724	235	937	880	477	648	194	1368	1018	
	C		375	334	672	724	235	937	880	477	648	194	1368	1018	
	D		400	359	672	724	235	937	880	477	648	194	1368	1018	
	E		400	359	672	724	235	977	937	502	648	194	1441	1038	15"
	F	622 BC4	400	359	672	724	235	977	937	502	648	194	1441	1038	
	G		400	359	672	724	235	977	937	502	648	194	1441	1038	W.G.
PF6	A		425	385	672	724	215	1035	937	502	648	194	1499	1096	
	B	570 BC6	425	385	672	724	215	1023	925	495	667	214	1480	1119	
	C		425	385	672	724	215	1023	925	495	667	214	1480	1119	
	D		425	385	572	724	215	1070	1004	534	736	214	1567	1147	
	E		425	385	672	724	215	1070	1004	534	736	214	1567	1147	
PF7	A		450	410	672	724	215	1070	1004	534	736	214	1567	1147	
	B	650 BC6	450	410	672	724	215	1070	1004	534	736	214	1567	1147	
	C		450	410	672	724	215	1070	1004	534	736	214	1567	1147	
	D		450	410	672	724	215	1070	1004	534	736	214	1567	1147	
	E		450	410	672	724	215	1070	1004	534	736	214	1567	1147	
PF8	A		450	410	672										

IMPORTANT NOTE!
Dimensions shown above are typical measurements for a standard layout, these can vary according to your specific requirements and circumstances. A detailed enquiry will enable us to determine burner details appropriate to your needs.

NU-WAY
Leaders in Burner Technology

P.F. MODULATING BURNER ASSEMBLY



INTRODUCTION

This manual covers two types of burner:
Models PFH (X) Modulating (Class F & G fuel)
Models PFL Modulating (Class D fuel).
Where an instruction or information is applicable to only one of the burner types, then it is identified in the text. The burner series nominated above are manufactured for fully modulating operation.

GENERAL

The Nu-Way PF manual is structured to enable the user to proceed from the delivery of the burner to its commissioning and use.
Burner assembly, components, controls used and adjustments to be made are dealt with in a sequence which should be followed for correct assembly, installation and use. Pre-commissioning and live-run are described and the location of components are illustrated or indicated and supported by appropriate tabular matter and graphs.
Routine maintenance, fault finding and wiring diagrams complete the manual. Literature on proprietary components is included.

SAFETY

Before attempting to assemble, install or commission the Nu-Way modulating PF burner series, it is essential that the following instructions are carefully read and understood. It is also recommended that such work is carried out by experienced and qualified oil burner commissioning engineers.
The manufacturer cannot be held responsible for any consequential damage, loss or personal injury as a result of customers failing to follow these instructions or as a result of mis-use.

DESPATCH FOR TRANSIT

The PF modulating burner is supplied in partly assembled form consisting of the following:-

A. Burner Head and air plenum chamber.
B. Damper section with modulating air/oil system.
C. Combustion air fan.
D. Floor mounted burner control panel.
E. A pumping and heating unit, or pumping unit in the case of light oil burners, is supplied as a separate component inclusive of flexible pipes to make all necessary oil connections.

BURNER

Assembly:

Fit the burner head to the prepared appliance frontplate (see appliance front plate drilling details). Ensure the gasket provided is between appliance and mounting flange.

Now fit damper section to the burner head using the fasteners and gasket provided. Place combustion air fan into the required position and connect the damper section using the fasteners and gasket provided.

Place the pumping and heating unit (or pumping unit) in the desired position. Connect the flexible oil pipes from the oil inlet and return to the pumping and heating, or pumping unit, and the main oil supply pipework.

Place the control panel into the required position and execute the necessary interconnections between the burner head pumping and heating (or pumping unit) and other auxillary appliance controls. See wiring diagrams in this manual. All electrical wiring must comply with all applicable Codes and Standards.

FITTING TO THE APPLIANCE

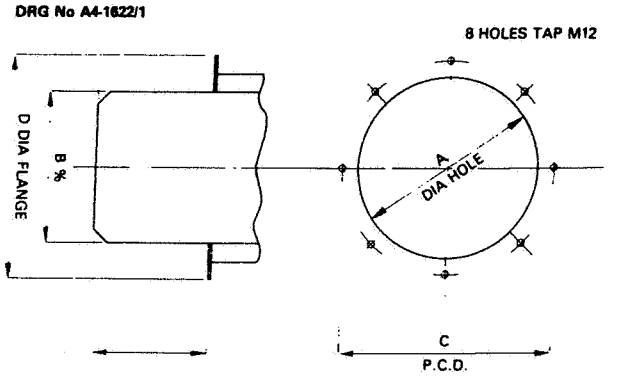
If the burner is to be fitted to a new packaged unit with over-pressure conditions, refer to the manufacturers recommendations.
If the burner is to be used with an existing appliance, the chimney, flues, passageways and heat transfer surfaces must be cleaned. Prepare burner mounting plate (see frontplate drilling details) A4/1622/1. Ensure that the joint between the burner mounting plate and the appliance is effectively sealed.

FLUE AND CHIMNEY REQUIREMENTS

The top of the chimney/flue should be above all roofs within a radius of 10 metres.
Ensure that the flue pipe from the appliance does not protrude into the chimney beyond the wall thickness.
If more than one appliance is connected to a common flue/chimney, ensure that the cross section of the flue/chimney is adequate for the total volume of flue gases from the appliance, and complies with local regulations.
It is recommended that each appliance should be exhausted into a separate flue.

FRONTPLATE DRILLING DETAILS FOR PF BURNERS

DRG No A4-1622/1



FLAME TUBE PROJECTION
STD LENGTHS 230, 305, 405

N.B. JOINT BETWEEN BURNER MOUNTING FLANGE AND APPLIANCE MUST BE EFFECTIVELY SEALED WITH APPROPRIATE GASKET MATERIAL.

BURNER	A	B	C	D
PF4 A-D	375	335	610	660
PF5 A-C	375	335	672	724
PF5 D-G	400	360	672	724
PF6 A-E	425	385	672	724
PF7 A-G	450	410	672	724
PF8 A-	450	410	672	724

COMBUSTION CHAMBER CONDITIONS

When the burner is fitted to an appliance designed to work under balanced or negative combustion chamber conditions, the overfire draught must not exceed 0.05 kPa (.02"Wg, .5 mbar, 5mm Wg).
Should the overfire draught exceed this figure, then steps should be taken to reduce it to this level.

PLANT ROOM VENTILATION

An adequate supply of dust free fresh air is required as combustion air for the burner(s). The minimum area of entry requirements is 0.2 ft^2/Imp. gall/hr being burned. To this should be added extra free area for the adequate ventilation of the boilerhouse, the air being introduced at both high and low levels to promote natural convection.

SITE SERVICES

ELECTRICAL POWER SUPPLY

Connect the appropriate electricity supply to the burner observing all applicable codes of practice and standards. Refer to the specific burner wiring diagrams included in the manual, or supplied with the burner instruction pack attached to the burner, or the appliance manufacturers handbook. Connect external auxiliary control circuits by reference to the appropriate wiring diagram. Check all systems and circuits are correctly fused.

OIL SYSTEM - RESIDUAL FUEL - DISTILLATE FUEL

See burner oil system diagram Drawing A4-1620/1 on

MAIN OIL STORAGE TANK
Residual oils must be maintained at all times at a temperature specified by the supplier.

OIL SUPPLY TO THE BURNER
Oil from the tank to the burner must be supplied by pumped ring main system. Oil inlet pressure to burner pump determined from inlet pressure graph. Fig 13 page 18. Maximum oil pressure inlet to burner 5 bar.

PUMPED RING MAIN SYSTEM
This is the recommended system of oil supply, and is essential for multiple burner installations and where heavy residual fuel oils are to be used.
The ring main pumps and pipe size must be designed to at least 1.25 times the total full swept volume of the burner pump/pumps it is to supply.
Recommended oil pressure distillate oil 1 bar.
All oil supply pipes must be constructed and installed to comply with local conditions and appropriate codes of practice and standards. All pipework must be firmly supported, and in the case of residual fuel oils, lagged, traced and thermostatically controlled. (Minimum pipe size 1½" B.S.P.)
See Fig 13 page 18 for pump inlet pressure. Residual fuels max pressure 5 bar.

OIL TEMPERATURE FOR RESIDUAL FUELS

Fuel Class BS2869 1970	Viscosity Nominal cSt @ 80.0°C	Minimum Storage Temperature		Temperature required at burner unit		Atomising Oil Temperature	
		°C	°F	°C	°F	°C	°F
F	35	25	77	43	110	110	220
G	85	40	104	82	180	143	290

BURNER DESCRIPTION
Nu-Way PF modulating series fully automatic oil burner units are of packaged design and meet the relevant National and International Standards based on the ISO System of measurement and fastening.

See Para. (Despatch for Transit) for description of its basic components. Also photographs of burner at front of manual.

The system of pressure atomisation employing a single spill back nozzle is used throughout the range. The method of operation is based on the Landis & Gyr RWF 31 Universal Controller, which has been designed for use in oil firec installation. It mainly provides temperature or pressure control by controlling modulating burners, i.e. burners with a continuously adjustable fuel throughput.

The control output of the RWF 32/RWF 31 controller is a potential-free, three position switch used for the control of reversible motors. The control signals for the OPEN (Y1) and CLOSED (Y2) are indicated by light emitting diodes.

The adaption of the controller to the controlled value and the setting is achieved by "setting range inserts":-

- in connection with passive detectors type QAE 21 (temperature) and QBE 61 (pressure), for further information on the universal controller type RWF and its associated components refer to specific data provided in this manual on page 21 to 34.

When the boiler control calls for heat, the modulating unit will travel to the "high" position and interlock the control circuit. Pre-purging will take place at this position for 22.5 seconds. At the end of the pre-purge, the sequence control will stop, but remain energised. The modulating unit will travel to the "low" position and interlock the control circuit again. The sequence control then recommences its operational cycle and the burner will light at this rate and remain there until the high flame release signal is given by the sequence control. The unit will now move to the high flame position and remain in this state unitl the desired boiler pressure/temperature is attained. At this stage the modulating unit will commence to move towards the low flame position, but, depending on the demand for pressure/temperature, will stop in any intermediate position between low and high flame.

BURNER MODULATING CONTROL
The Nu-Way modulating unit consists of a reversible motor which is directly coupled to the cam shaft of the modulating unit. Two adjustable cams are mounted on this shaft, one of which operates the air linkage connected to the burner air inlet control damper. This cam is of the variable contour type (see Fig. 1). The second cam is the modulating oil cam and is ilustrated in Fig. 2.

Drawing A4-1620/1 shows the hydraulic circuit for the burner. Oil for combustion is drawn from the supply through a fixed displacement pump, and supplied to the burner nozzle. A return line from the back of the nozzle is connected to a "spill regulating valve" which regulates the pressure at the nozzle according to the position of an internal piston, which is moved by the oil cam in the modulating unit (see Fig. 2).

There is a well-defined relationship between the delivery of oil through the nozzle and the pressure behind the nozzle, therefore movement of the oil cam "modulates" the nozzle output and hence the output of the burner. (See Nozzle Output Charts).

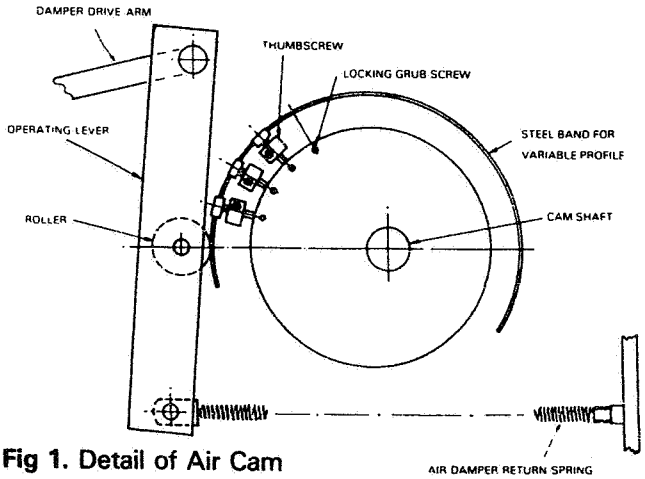


Fig 1. Detail of Air Cam

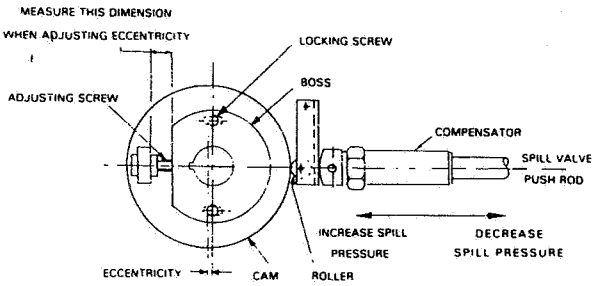
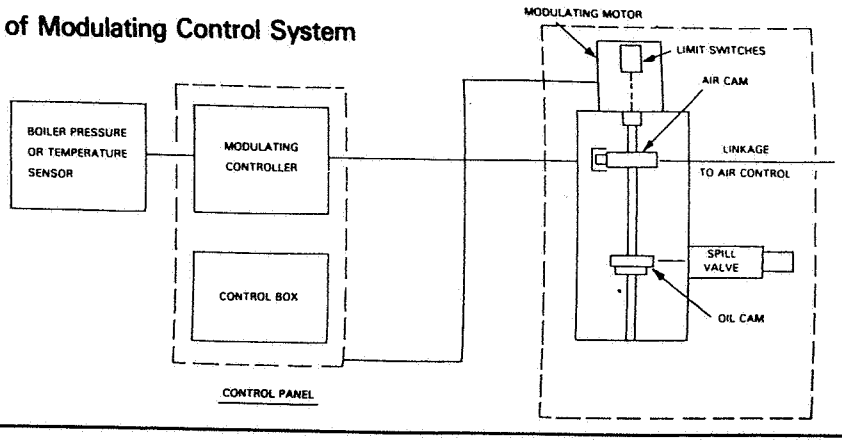


Fig 2 Detail of Modulating Oil Cam in Low Flame position

Fig 3 Block diagram of Modulating Control System



The volume of air required for combustion must also be varied as the nozzle output varies, and this is done by the air control damper, operated by push rods connected to a lever bearing against the air control cam (see Fig. 1). Once the oil cam has been adjusted as described under COMMISSIONING PROCEDURE, the profile of the air cam is adjusted to give the desired combustion conditions by adjusting the thumbscrews under the cam strip in or out as the burner is "inched" through its firing range.
The air control damper is spring-loaded to open for safety in the event of linkage failure.

COMMISSIONING PROCEDURE FOR BURNERS WITH SAFAG SPILL VALVE

With the HAND/AUTO switch set to "HAND", "inch" the camshaft round until the back of the oil cam is in line with the spill valve push rod. This is the "low flame" position. (Fig. 2).
Adjust the oil cam (see Fig. 2) to about 1.5mm throw (3mm stroke) and lock in that position.
Check to ensure the spill valve push rod bears lightly against the cam (see Fig. 2).
Turning now to the cam, adjust the thumbscrews out to a reasonable maximum and adjust the linkage until the air inlet damper is fully closed. Note the position of the operating lever against the air damper position scale in the cam box (see Fig. 1).

"Inch" the cam shaft to the "high flame" position, i.e. through 180°, and adjust the band by means of the thumbscrews until the air inlet damper is open to suit the desired high flame position. Again note the operating lever position on the scale. At this stage it will have been found that nearly all the thumbscrews have been adjusted to avoid straining the band, which will now have a fairly smooth contour between the low flame and high flame positions.
"Inch" the camshaft back to the low flame position, and adjust the thumbscrews to give a small opening at the air damper, using the scale as a guide.
Check all fuel and electrical supply connections to the burners. Set HAND/AUTO switch to "AUTO".
Open main oil valve and bleed the pipe line and the oil pump. If residual fuel is used check that the oil supply is at the required temperature. Also ensure pressure inlet to pump is as indicated on graph, for residual oil For distillate oil pressure 1 bar.
Check motor rotation is correct for the pump.
Switch on burner. The modulating camshaft should now rotate to high flame setting, and the fan motor will start the pre-purge.

Allow fan to run up to speed, switch off burner and check direction of rotation as it slows down.
Ensure that the air pressure switch is adjusted correctly. Remove and cover photo-cell, switch on burner, and allow to run through to lockout. During this run, check that ignition spark is occurring, and note the spill and line pressures at the moment of ignition. Reset sequence control and repeat if necessary to check these correct figure according to the nozzle specification and the pump outlet pressure at the pump pressure regulating valve, to 30 BAR (435 PSI).

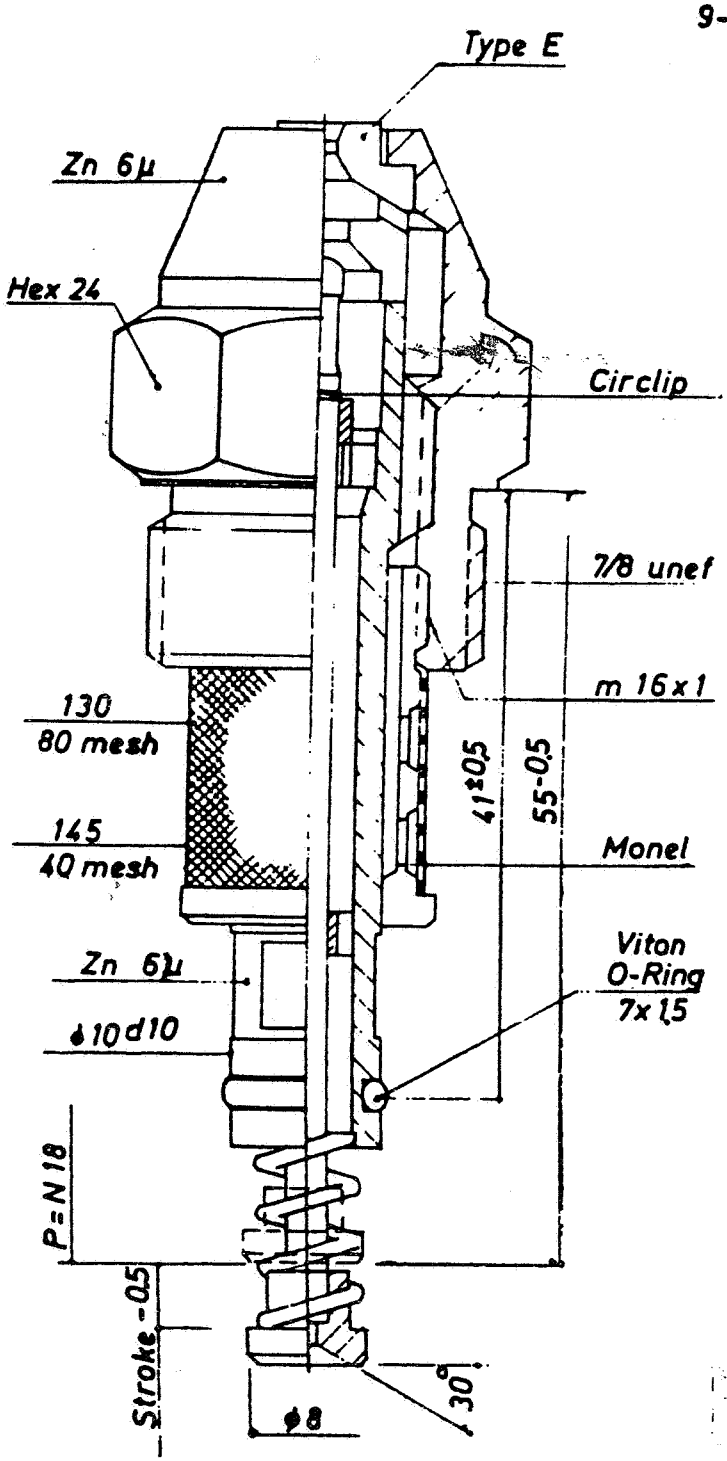
Uncover and replace the photocell. Reset the sequence controller and allow the burner to start pump. Immediately the burner starts, switch the HAND/AUTO selector to the "HAND" positioin and hold low flame until the appliance is ready to accept high flame. During this period check and adjust the low flame oil throughput.
Check flame visually. If flame is not clean, adjust the air cam. When a satisfactory flame is achieved, again check line and spill pressures. The oil consumption rate should now be between 40 and 50% of the rated maximum.
Measure flue gas compositin and adjust air as necessary.
Use the "inching" switch to modulate to high flame and adjust air cam to give a reasonable flame.
Check the oil consumption. If this is not correct for the full burner rating the oil cam must be adjusted as follows:-
"Inch" burner to low flame, and carefully note spill pressure.
To increase the minimum rate adjust as shown on Fig. 2.
Adjust to give more eccentricity for more oil at high flame, and vice-versa.
Return to minimum setting and compensate for any changes.
"Inch" the burner to high flame and again check oil flow.
Continue to repeat the above procedure until the high flame oil rate is correct.
"Inch" the burner to two or three intermediate positions between low and high flame, and adjust the air cam at each position to give the desired flue gas analysis.
Check burner performance through the range, adjust air cam as necessary and secure the thumbscrews by means of the grubscrews.
Adjust the modulating control to the required pressure/temperature.
Allow the boiler to attain the correct working pressure/temperature and adjust the "on/off" and "limit" instruments to the desired values.
Switch the "HAND/AUTO" selector switch to "AUTO". The plant is now under the control of the pressure/temperature controllers for Modulation, On/Off and High Limit Control.
If the Burner Control panel is inclusive of Low - Excess Low - and High Water interlocks and alarms, (steam boiler panels), test these for correct operation. Ensure that the boiler feed pump switch gear provided in the burner panel is operating correctly.

NOTE: HAND/AUTO Selector switch.
This switch must always be in the "AUTO" position when the burner is required to start. The "HAND" selection can be made immediately the burner has started to fire. Should the burner stop in the "HAND" position it will restart but will not modulate until

FLUIDICS W1 ATOMIZER

9-79

Size	Output max	Output min	Strk
40	40	10	4.3
50	50	12	4.5
60	60	15	4.6
70	70	18	4.7
80	80	20	4.8
90	90	22	4.9
100	100	25	5.0
115	115	29	5.2
130	130	32	5.5
145	145	36	5.7
160	160	40	5.9
180	180	45	6.0
200	200	50	6.2
225	225	56	6.4
250	250	62	6.6
275	275	68	6.8
300	300	75	6.9
330	330	82	7.1
360	360	90	7.2
400	400	100	7.3
450	450	112	7.4
500	500	125	7.5
550	550	138	7.6
600	600	150	7.7
650	650	162	7.8
700	700	175	7.8



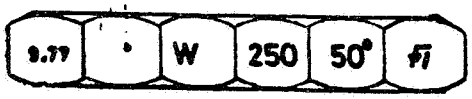
Output in kg/h

Test oil 5 cSt - mm^2/s

Supply pressure 25 Bar

Return pr 7 Bar - 10 Bar

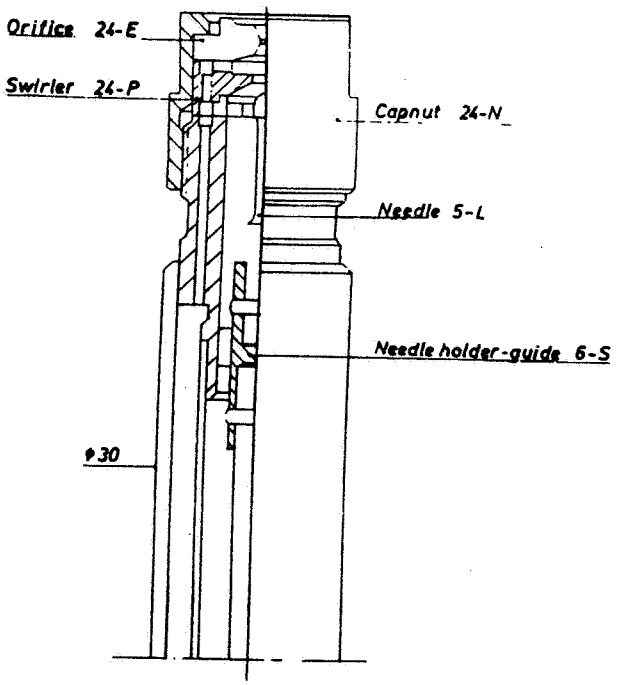
DIN Approval nr 1X 11782 S



Output tol : till 80 ÷ 8% — till 300 ÷ 6% — over 300 ÷ 45%

Spray angle : at max 50°÷5° — at min 68°÷5°

Fluidics Atomizer
2 Plate spill-back type P
for Burnerlance 12-EHF-N



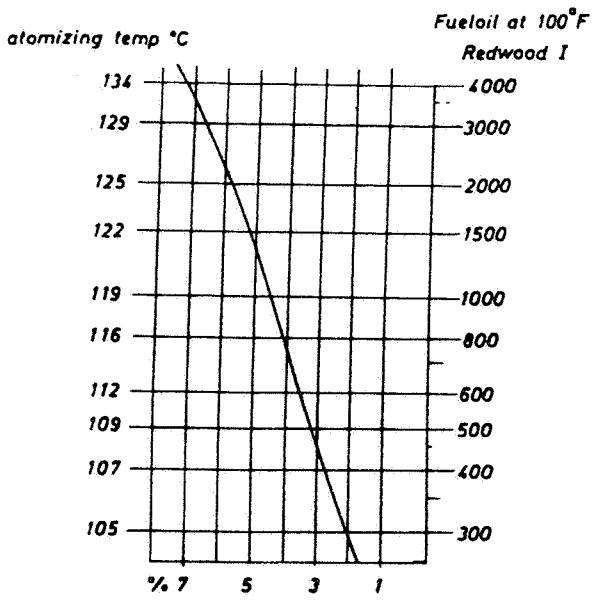
24-P nr.	8 - 10 - 13	16 - 20 - 24	28 - 32
Needle	5-L-2,8	5-L-3,8	5-L-4,8

Output 300 - 1200 kg/h

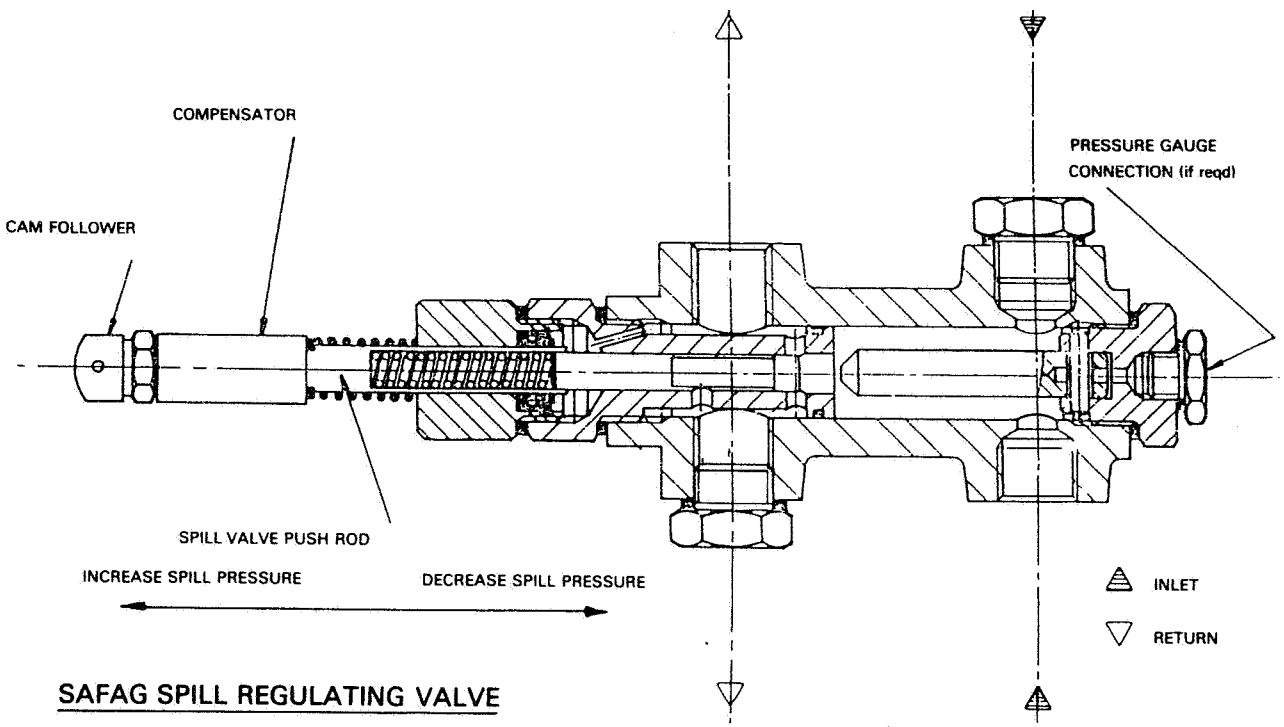
Spray angle 45°-70° on max output

Techn. Inf. 24-432

Fluidics Atomizer



THROUGHPUT VARIATION
FOR DIFFERENT
TEMPERATURE / VISCOSITIES



SAFAG SPILL REGULATING VALVE
ON MODULATING UNIT

24—E / 24—P Combination	spray angle	max return pressure	FLUIDICS ATOMIZER OUTPUT CHARACTERISTICS *Supply pressure 28 Bar Viscosity 5 c St Output at return pressure*							
			Max	22	20	18	16	13	10	7
1.8-10	58	20.6	270	—	245	190	145	120	95	65
1.8-13	53	22.4	310	285	225	180	150	115	80	60
2.0-10	61	19.5	315	—	—	250	205	155	115	85
2.0-13	56	21.3	360	—	295	240	195	150	110	80
2.0-16	52	22.8	395	350	280	230	190	145	105	75
2.25-13	60	20.1	425	—	415	325	265	200	155	115
2.25-16	56	21.5	475	—	385	310	255	195	145	105
2.25-20	52	23.1	530	450	360	300	250	190	140	95
2.5-16	59	20.4	555	—	515	405	325	250	190	140
2.5-20	55	22.0	620	—	485	385	320	245	180	130
2.5-24	52	23.3	680	560	460	375	315	240	175	125
2.75-20	58	20.9	715	—	630	490	405	315	235	165
2.75-24	55	22.3	785	735	570	470	390	305	210	150
2.75-28	52	23.4	845	690	550	460	385	295	205	145
3.0-24	57	21.3	890	—	730	600	490	390	285	205
3.0-28	54	22.4	960	895	700	570	475	365	260	195
3.0-32	52	23.5	1030	830	670	555	470	360	250	175

The nozzle output varies at different supply pressures. The figures shown above are based on a supply pressure of 28 Bar. The burner described in this Manual operates at 30 Bar supply pressure.

The nozzle output at different pressure will vary as the square root of the pressure changes i.e. $\sqrt{\frac{30}{28}} = 1.035$.

Furthermore the nozzle calibration tests are carried out with oil having a viscosity of 5 cSt. See Data 12-350 which gives the percentage increase for the various other viscosities and atomising temperatures.

The burnerlance is designed to operate spill-back atomizers having a spring loaded orifice shut-off needle and a ⅞" x 20 u.n.s. fixing thread.

The shut-off needle is closed by the spring of the actuating-piston of the burnerlance, therefore a reliable shut-off is guaranteed under all conditions.

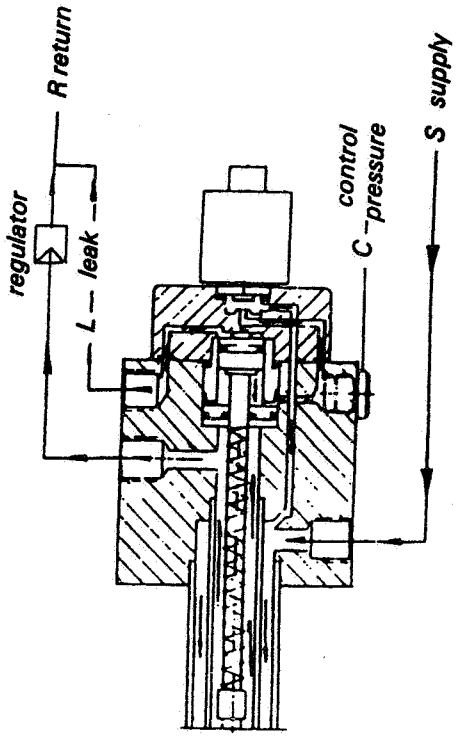
The piston is actuated by the branched-off supply pressure and controlled by the solenoid.

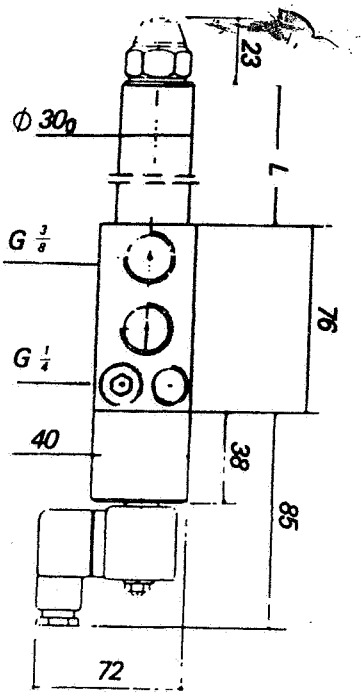
The orifice shut-off needle of the atomizer opens by means of the needle spring into the correct position against a fixed stop on the needle itself.

During the pre-purge period the needle is holding the orifice closed and the fuel oil circulates through the lance and the atomizer under the set supply and return pressure.

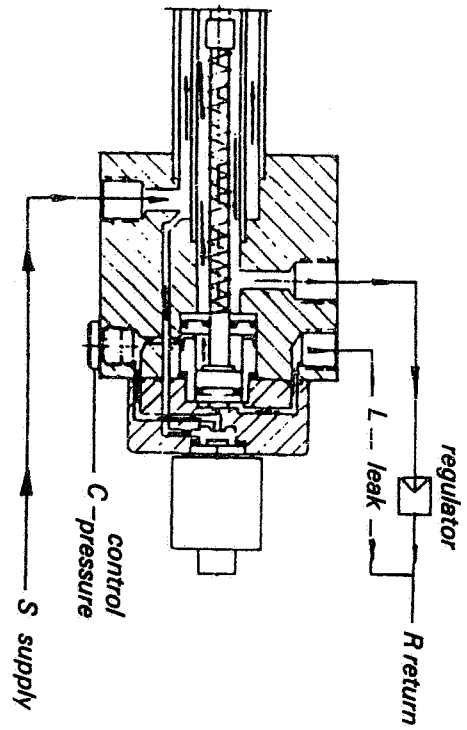
On actuating the solenoid an immediate atomization and perfect ignition is guaranteed.

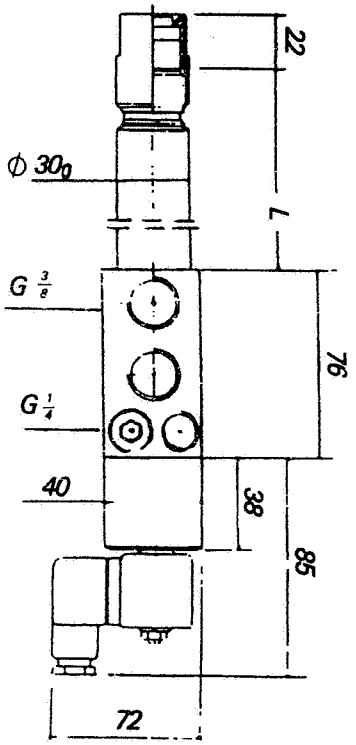
FLUIDICS EHF BURNER LANCE

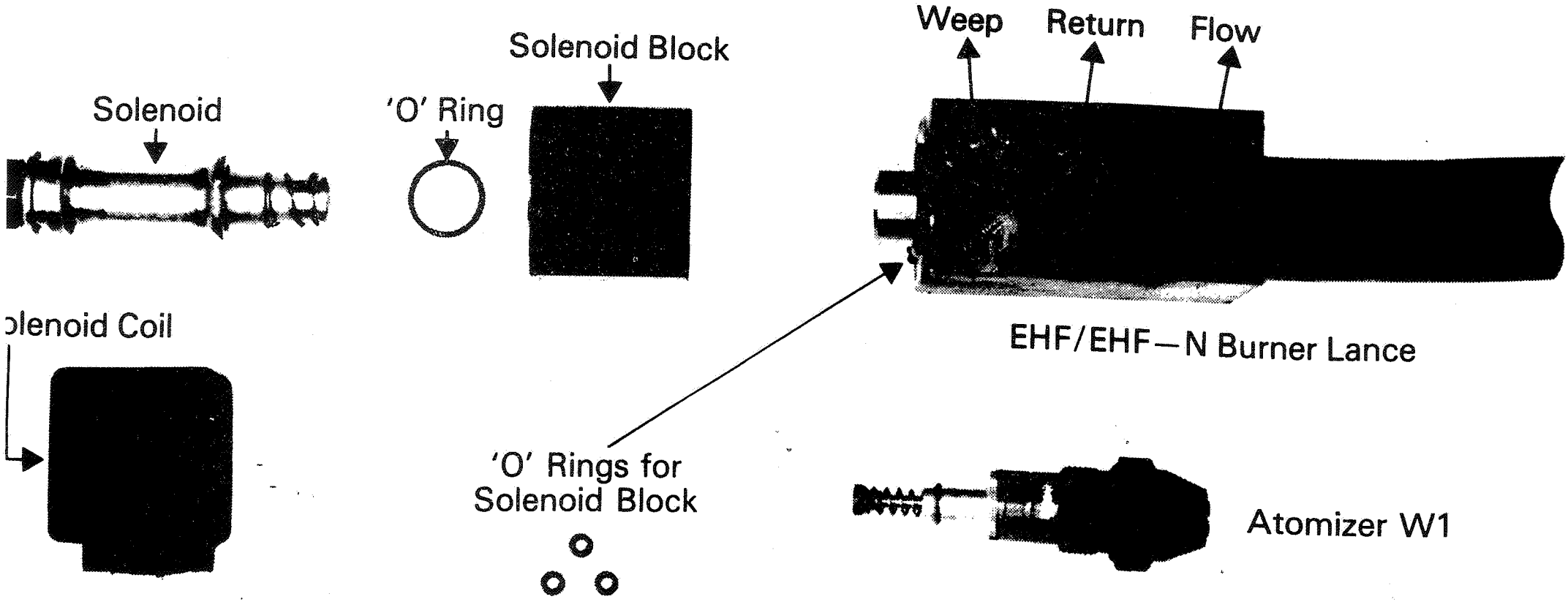




Fluidics Burnerlance EHF-N



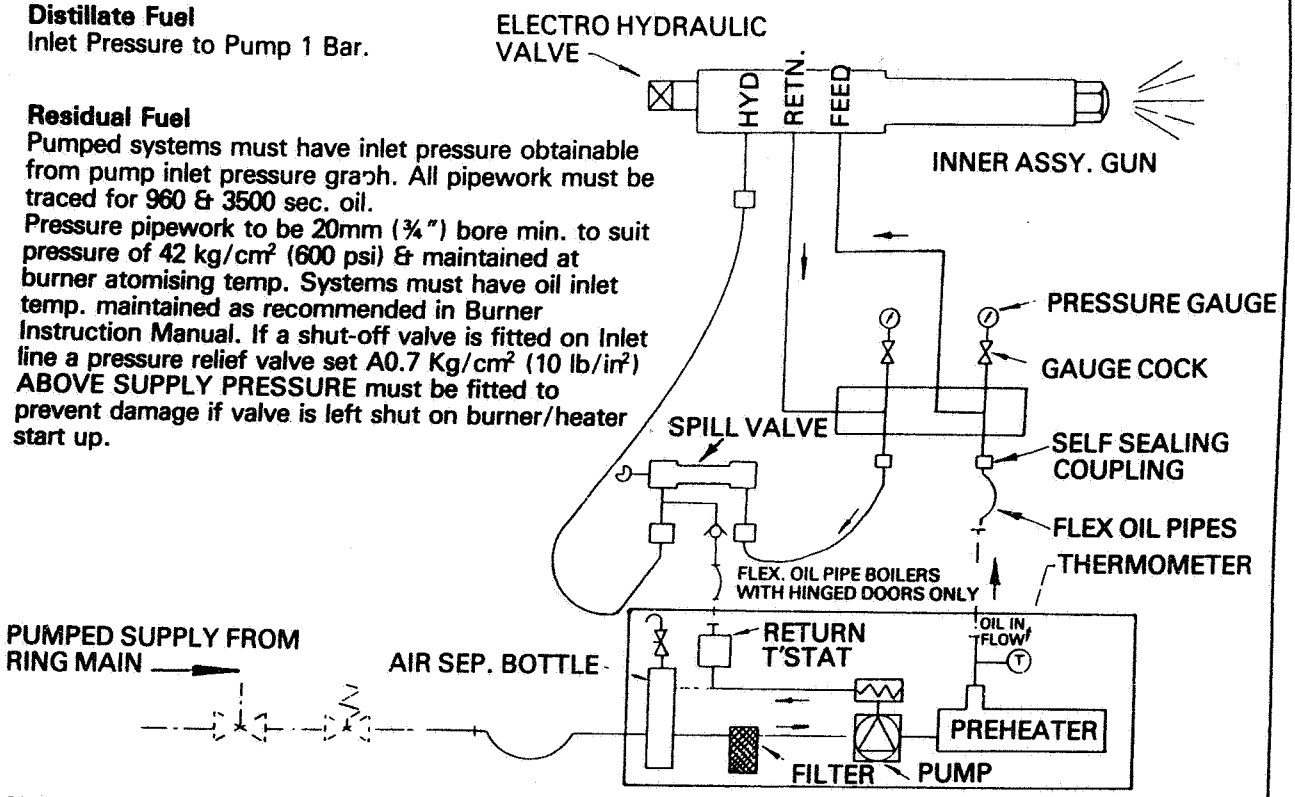



Solenoid
'O' Ring
Solenoid Block
Weep
Return
Flow
olenoid Coil
EHF/EHF—N Burner Lance
'O' Rings for
Solenoid Block
Atomizer W1
DIN Plug
Swirler Disc
Orifice
Plate
Cap Nut

PIPEWORK SHOWN IN
CHAIN DOT NOT SUPPLIED
BY NU-WAY

Distillate Fuel
Inlet Pressure to Pump 1 Bar.

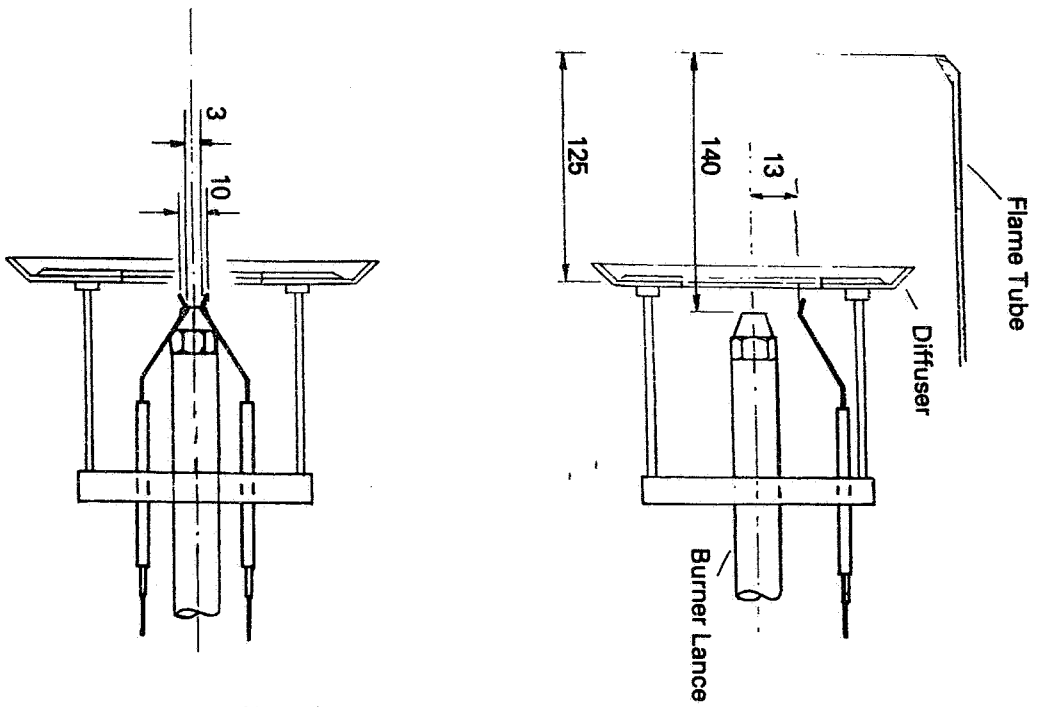
Residual Fuel
Pumped systems must have inlet pressure obtainable from pump inlet pressure graph. All pipework must be traced for 960 & 3500 sec. oil.
Pressure pipework to be 20mm (¾") bore min. to suit pressure of 42 kg/cm² (600 psi) & maintained at burner atomising temp. Systems must have oil inlet temp. maintained as recommended in Burner Instruction Manual. If a shut-off valve is fitted on Inlet line a pressure relief valve set A0.7 Kg/cm² (10 lb/in²) ABOVE SUPPLY PRESSURE must be fitted to prevent damage if valve is left shut on burner/heater start up.



NOTE: FOR LIGHT OIL PREHEATER STAT & THERMOMETER ARE OMITTED

DRG. No. A4-1620/1

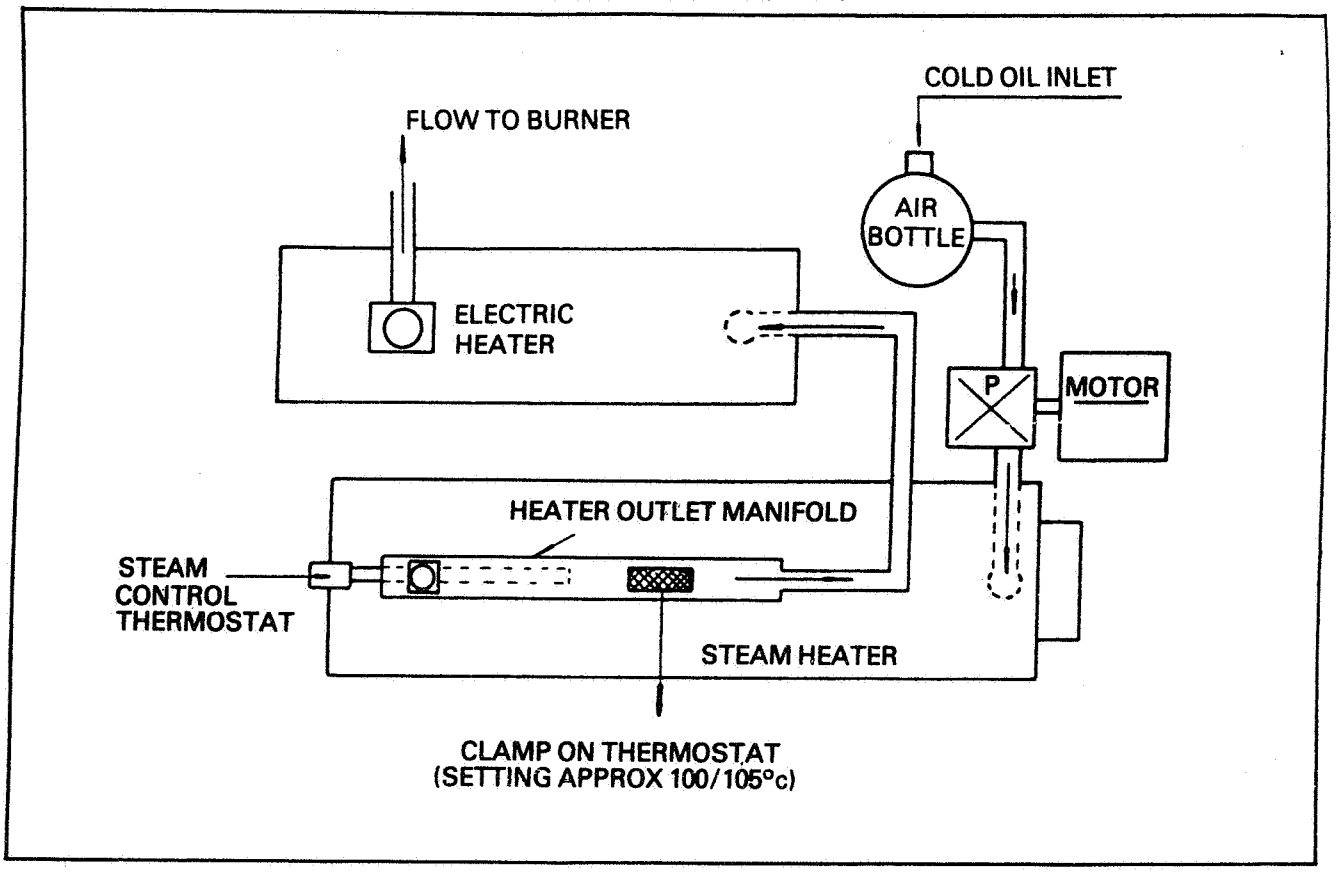
Electrode settings for PF burner



Note: Electrodes at narrowest point to be in line with front face of nozzle.

DRG. No. A4-1621

OIL FLOW DIAGRAM & SCHEMATIC ARRANGEMENT OF STEAM-ELECTRIC PUMPING & HEATING UNIT



Steam Electric Pumping & Heating Units with less than full load electric heaters have a "Clamp On" Thermostat fitted to the outlet manifold of the steam heater. This is to provide "LOW FIRE HOLD" until steam is available for full capacity oil heating.

It is essential that the Boiler Steam Outlet Valve remains closed until steam pressure of at least 4.0 Bar (60 P.S.I). Before using steam for other sources the steam heater must be fully operational and provide the full capacity of heated oil or the burner will return to "LOW FIRE HOLD".

The "LOW FIRE HOLD" feature is omitted when a full load electric heater is fitted.

ROUTINE MAINTENANCE OF MODULATING 'PF' BURNERS

It is vitally important that personnel responsible for the day to day operation and maintenance of the plant are instructed by the commissioning engineer on the basic function of the burner as well as the need for routine maintenance and daily checking of burner operations. Final adjustments, which will have been made during the commissioning, must be recorded on the form provided in this manual.

Burner should be kept clean inside and out. It will be more reliable and if an oil leak occurs, it will be more quickly spotted.

Inspect burner daily to see if there is any variatioin from correct operating sequence, as follows:

Is oil pressure correct on Nozzle Line Gauge (should be 30 BAR/435 PSI). If (on heavy fuel) it has fallen back, clean pre-heater filter, which is situated in block on top of pre-heater. Remove by taking out four retaining bolts and disconnect oil line. Lift filter out and wash in kerosene. If oil pressure is still low check oil supply, stop valves, fire valves, ring main pumps, oil temperature etc. and also cold oil filter.

If there is an inspection window in appliance through which the ignition spark and the flame can be observed, ignition and flame should be inspected and if any irregularities are seen, action should be taken i.e. nozzle/electrodes cleaned and any deposit removed from inside of flame tube and diffuser.

To clean nozzle/electrodes, switch off electric supply to burner, and disconnect quick-release on oil line couplings on burner. Unplug the multi-pin socket on electrical lead between panel and terminal box and withdraw PE cell from its housing.

Insert withdrawal bars through sockets provided. The front-plate can now be withdrawn to commence servicing the burner head.

N.B. Never use anything abrasive which can damage the finely finished surfaces of the nozzle.

NOZZLE LIFE IS APPROX 5000 HRS OPERATION, after which a new nozzle should be fitted, otherwise nozzle performance and firing efficiency will deteriorate.

Check PE cell and clean if necessary.

Rotate cleaning knob of cold oil filter (heavy oil) daily.

Check pre-heater oil temperature.

Cold oil filter (heavy) should have plug removed from sump and sludge water drained off approximately every six weeks. Light oil filter should have bowl removed and filter washed in kerosene every six months. Disposal type filter elements should be completely renewed.

It is good practice to shut boiler/s off whilst delivery of oil is being made and allow approximately 30 mins. for sediment to settle, before restarting burners.

It is essential that burner(s) can always obtain sufficient air combustion; never block up any ventilation areas.

Keep internal boiler surfaces clean. Any accumulation of soot increases the gas exit temperature and reduces boiler efficiency. Always cover burner during boiler cleaning operation.

FAULT FINDING

If burner fails to start, make sure all thermostats and switches in control circuit have contacts in 'made' position and oil pre-heater 'Excess Limit' thermostat has not tripped. Reset if required. Check that Low Oil temperature thermostat is set for the appropriate fuel.
Check that electrical supply to the burner is 'live' and control or main circuit fuses have not blown.
Check that "Water Level Interblocks" are in the 'made' position (steam boilers only). Check that thermostats or pressure switches are calling for heat.
If burner is found at 'Lockout' (Red Light Showing) reset and observe starting sequence. i.e. ignition, followed by oil release and low fire.
Check fan and pump motor overloads. Reset if necessary.
Check air pressure switch. Failure to operate is indicated by Lockout.
If flame occurs, followed by immediate lockout — check PE cell — check air regulator sequence — observe that oil pressure is correct, if not check pre-heater (heavy oil) — see there is sufficient oil in storage tank — vent oil pump in case it is partially air locked.
Check to see that stop valve/fire valve in oil supply is fully open — check oil temperature (heavy oil) — check ring main oil lines for correct operation in respect of temperature and pressure.
If burner starts with correct oil pressure/temperature but no flame is established, check ignition system/H T lead connections and insulators and electrode spark gap.
Check nozzle for blockage. Check that air damper linkage is not broken or disconnected (air damper will be fully open). If lockout persists after two attempts to restart do not attempt repeated resetting of lockout button.
To check modulating control system refer to information on Landis & Gyr RWF31 Universal Controller. If malfunction is suspected check function of the system as outlined, and ascertain that only compatible components, such as the correct "range insert", temperature or pressure controller have been used.

INDIVIDUAL SETTING RECORD

This manual contains a record sheet of essential information and should have been completed by the commissioning engineer with individual details of the burner(s). These details should be verified periodically and adjusted if variations are noted.

DANFOSS KSA FUEL PUMP

INSTALLATION

The pump dataplate gives direction of rotation and connection port indication.
P = nozzle connection
S = suction line
R = return line
The pump is also fitted with two measuring ports, Pn for nozzle pressure and Ps for suction/feed pressure.
Ports P, Pn and S, Ps change position in groups depending on the direction of rotation.

Fig. 4 shows the respective connections for clockwise and counter-clockwise pumps.

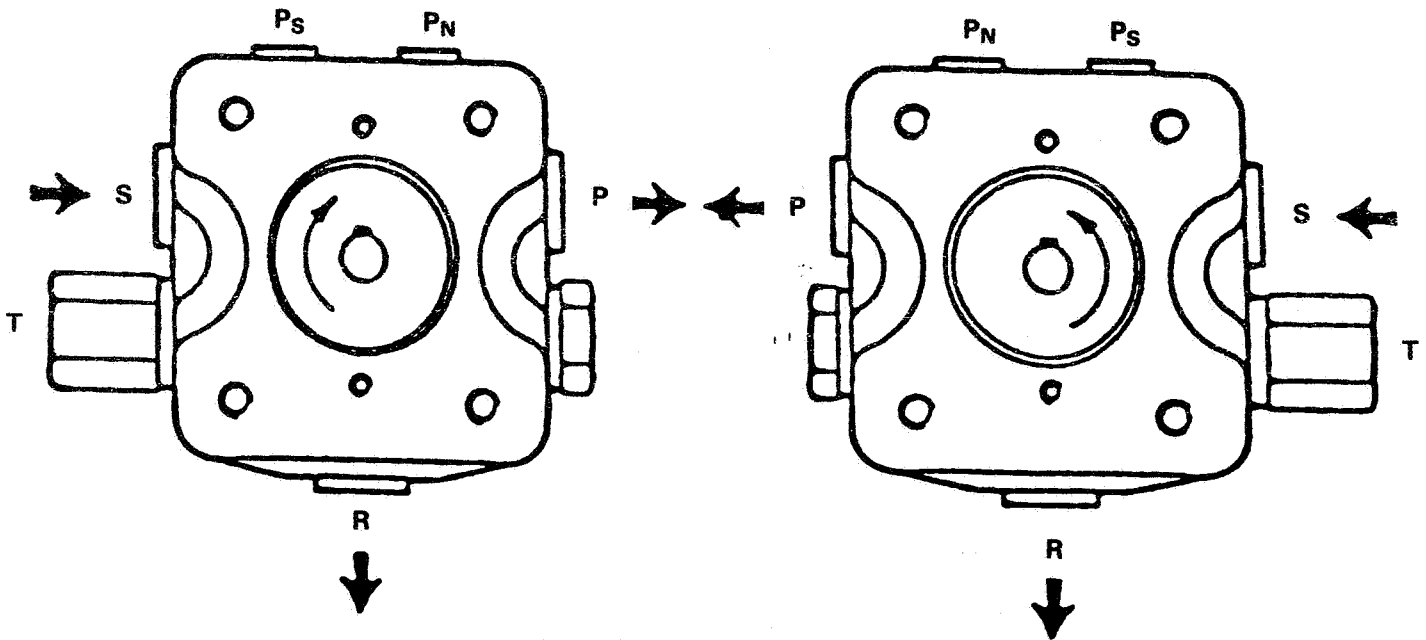


Fig. 4 Schematic Build-up

The hydraulic pressure regulating valve built into the pumps maintains constant pump pressure, but as the valve has no cut-off function the nozzle line must be fitted with an external cut-off valve.
The KSA series consists of pure 2-pipe pumps which must therefore always be connected to a return line. In 1-pipe systems with positive feed pressure the return line must take the form of an external bypass. See Fig. 5.

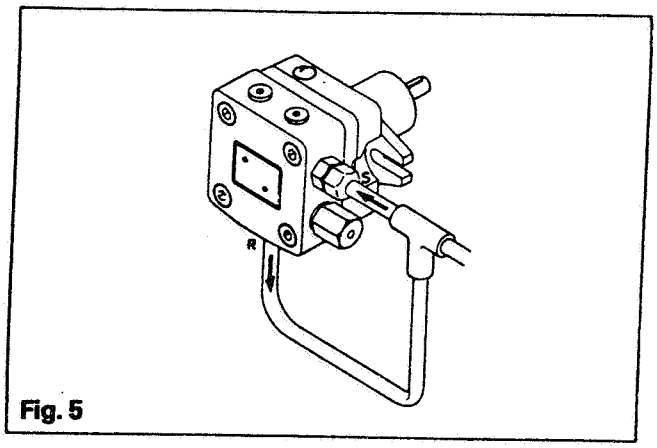


Fig. 5

When the pump is started, oil is sucked through pump suction port 'S' to the suction side 'C' of the gearwheel set (Fig. 6).

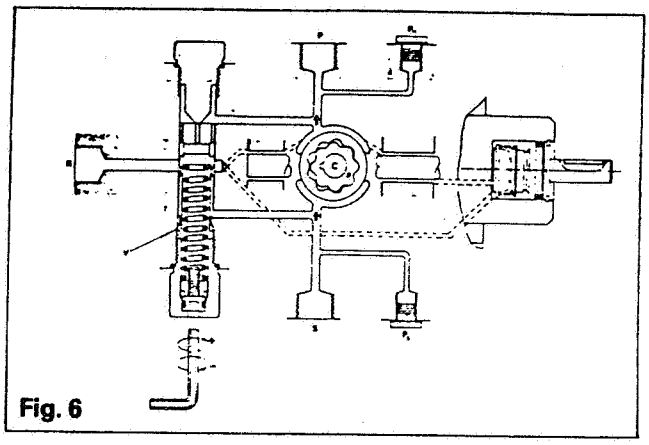


Fig. 6

From here the gearwheel set pumps oil to the pressure side while building pressure in the oil. This pressure is controlled and held constant at the pressure set on the regulating valve 'V'. The valve distributes oil supplied by the gearwheel set 'C' through port 'P' and pump return side 'R'. The quantity of oil deliveries is determined by the pressure on regulating valve 'V' and the oil nozzle/resistance in the nozzle line.

INITIAL START

With oils under 20mm²/s KSA pumps are self-priming and self-venting in 2-pipe systems. During starting with cut-off nozzle line, venting is via the return line. During operation with open nozzle line, venting is partly via the nozzle and partly via the return line.
The installation must be equipped with prefilters, in accordance with current rules/practice.
When starting a light oil system with empty piping the KSA oil pump should not be allowed to run without oil for more than 5 minutes, assuming the pump contains oil before starting.
KSA pumps are supplied with pressure setting on minimum.

On light oil systems the regulating valve built into the pump must be adjusted to the required pressure when oil reaches the pump.
With heavy fuel oil the pump shaft must be turneed slowly until hot oil reaches the nozzle outlet or the pressure measuring port. After burner start the pump must then be adjusted evenly up to the required pressure. The same method must be used after a stop when the oil has become partially or completely cold.
After this adjustment the pump will run under normal operating conditions.

If the pump becomes overloaded, i.e. more oil is demanded than the gearwheel set can deliver under the existing operating conditions, the oil pressure will fall under the set value because valve 'V' will close the return side 'R' and go to start position (Fig. 6). This condition can be remedied by:
- reducing the pump pressure,
- reducing the output, i.e. smaller oil nozzle or greater resistance,
- changing to a pump type with higher output.

SUNTEC TA OIL PUMP

OIL FLOW DIAGRAM

Oil entering the unit becomes trapped between the teeth of the involute gears and is expelled under pressure when the gears come back into mesh.
An internal passage connects the pump outlet to the integral valve which regulates the oil pressure, dumping all oil excess to requirement to the return line if fitted, or on a 1 pipe system back to the pump inlet.

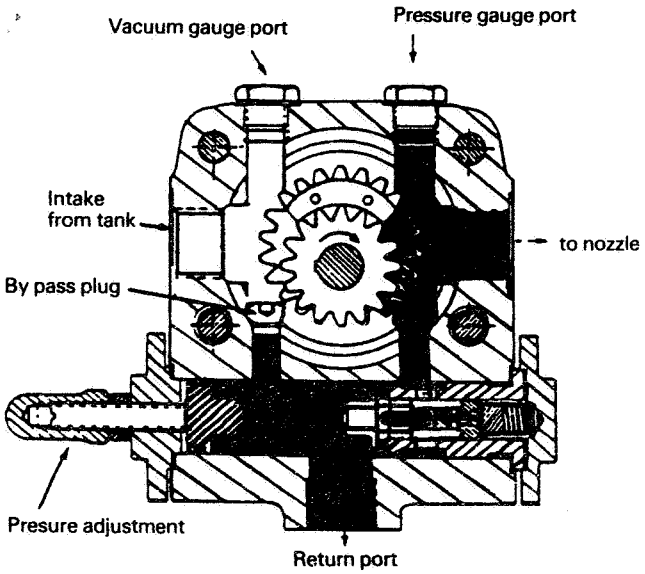


Fig. 7 Two pipe system

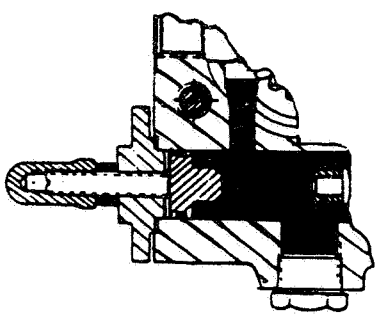
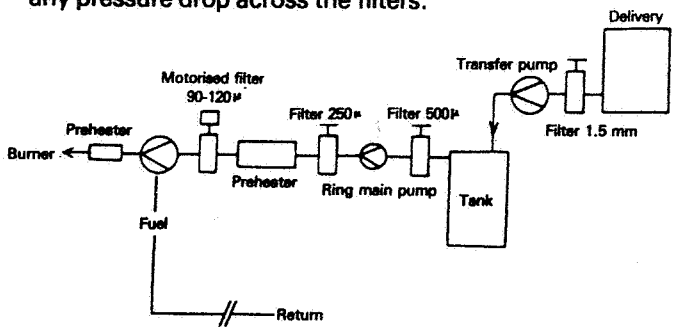


Fig. 8 One-pipe system

SPECIAL PRECAUTIONS FOR USE WITH HEAVY OIL

FILTRATION

When using heavy oil, the filtration of the oil is essential. The filtration system should be chosen according to the individual features of the installation. The diagram gives some basic guidelines. When checking the ring main pressure, this should be measured at the pump vacuum gauge port to allow for any pressure drop across the filters.



PREHEATER FACILITY

Care should be taken to avoid starting the pump with cold oil which can be excessively thick, leading to pump and coupling damage. For this reason, the pump body includes a drilling to accept an electric preheater. This is positioned so as to dissipate the heat in the centre of the pump, but without coming into contact with the oil. Heaters should be connected for a period of time prior to starting the pump.

Note oil: supply pipes, filters etc, should be heated separately.

PUMP INLET PRESSURE

The vaporization of light fractions of heated heavy oil causes premature pump wear. To avoid this, use inlet pressures shown on the graph.

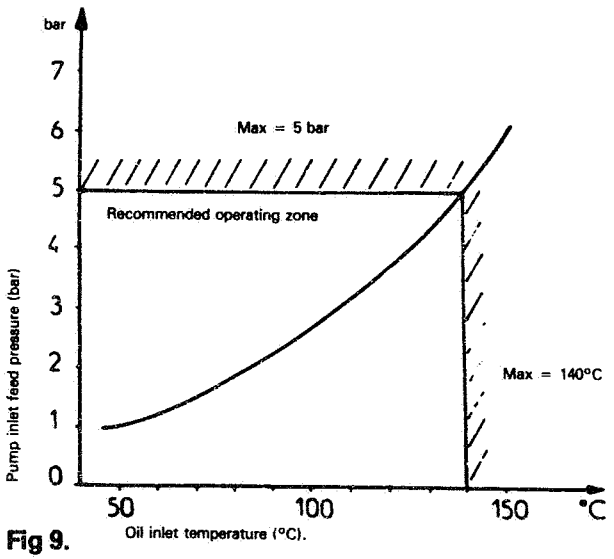


Fig 9.

SARCO TEMPERATURE CONTROL SYSTEMS TYPES ST 121, 122, 123, 1219 & 1239

Installation

Check that the control system supplied is of the temperature required. It is importnt that the whole of the temperature sensing area of the sensor is fully immersed in the fluid being controlled, as Fig 10 not as Fig 11.

Sensors Types 121, 1219, 122, 123, 1239 and 128 can be held in a screwed nipple by means of a compression ring over the sensor. Insert the sensor fully into the nipple and tighten up the nut and compression ring. Do not overtighten.

Where the Types 121, 1219, 122, 123, 1239 and 128 are used in conjunction with a pocket, either to allow easy withdrawal or as a protection against corrosion, the separate screwed nipple is dispensed with and the union nut and compression ring attach directly to the top of the pocket. Therefore insert the pocket in place of the screwed nipple.

When using a special long pocket with the Type 122, 123 or 1239 sensor, the screwed nipple, compression ring and nut are dispensed with and a rubber sealing bung provided.

Screw the pocket into place, then feed the sensor bulb in until it reaches the bottom of the pocket, using the rubber bung to seal the top.

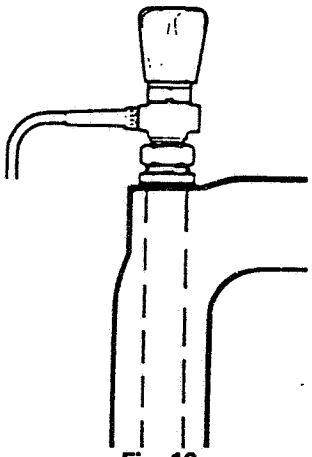


Fig. 10
Correct Installation

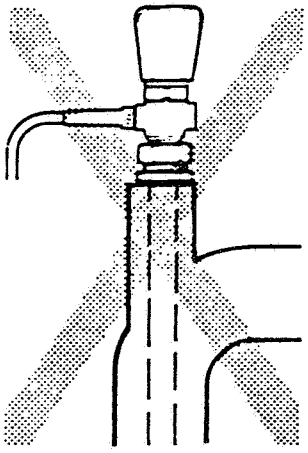


Fig. 11 Incorrect Installation

When using a pocket it is advisable to fill the gap between the pocket and the sensor with a heat conducting medium such as oil, but when using a special long pocket in conjunction with the Type 122, 123 or 1239 sensors it should not be filled above the top of the bulb.

The type 121 sensor, intended for controlling from room temperature, and the control head of the Type 123 or 1239 sensors, are held in plastic brackets. For fixing, remove the circlip and washer on the extreme end of the unit and withdraw through the plastic bracket. This will reveal screw holes to enable the bracket to be fitted on the wall. Replace the unit, washer and circlip.

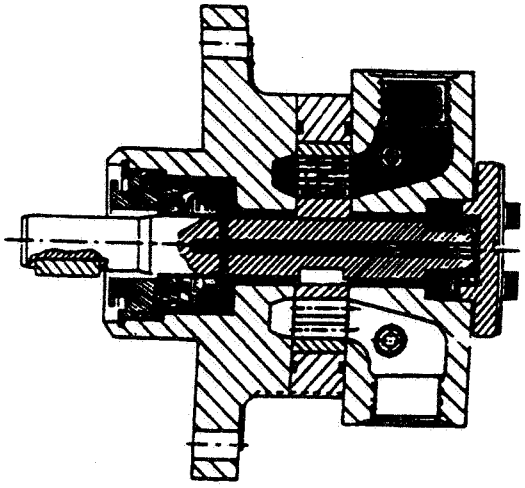
The capillary tube between the sensor and the valve must be run and supported in such a way that it will not become damaged. Avoid all sharp bends.

Temperature Adjustment

The sensor is despatched with its adjustment set to the highest limit and should be set on site to suit the individual requirements.

To make any adjustments the red knob is turned clockwise to lower the temperature, anti-clockwise to increase it. It is advisable to initially set to a slightly lower temperature, gradually increasing to the required control point.

After setting, if desired, tampering can be prevented by prising out the black plastic cap B from the adjustment knob and turning screw C clockwise as far as it will go using a 3mm A/F Allen key. The adjustment knob will now spin freely without changing the temperature setting. Cap B should be replaced.



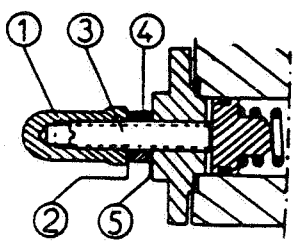
TWO-PIPE SYSTEM (Fig. 7)
Check the presence of by-pass plug in vacuum gauge port.
Connect the suction line to the inlet port, the return line to the return port, and the nozzle line to the nozzle outlet.
Fill the pump with oil through the vacuum gauge port.
Use pressure gauge port for air bleeding.

ONE-PIPE SYSTEM (Fig. 8)
Remove by-pass plug from vacuum gauge port. Fit steel plug and gasket in return port. Connect the suction line to the suction port, and the nozzzle line to the nozzle outlet. Fill the pump with oil through the vacuum gauge port.
Use pressure gauge port for air bleeding.

COMMISSIONING
Ensure that pump and inlet pipes are fully primed with warm oil. Oil starvation during start-up and normal operation may cause pump seizure.

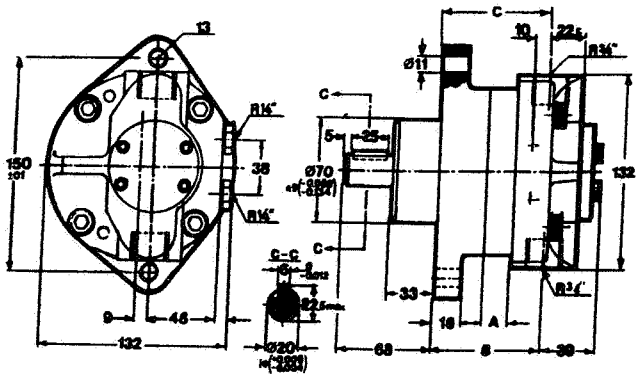
MOUNTING POSITIONS
TA pumps may be mounted in any position except with the shaft upwards.

PRESSURE ADJUSTMENT
Note: the maximum allowable pressure for model TA5 is 30 bar.
Remove cap-nut (1) and washer (2) unscrew lock-nut (4).
To increase pressure, turn adjusting screw (3) clockwise. To decrease pressure, turn screw anti-clockwise.
Block lock-nut (4), refasten washer (2) and cap-nut (1).



1. Cap-nut
2. Washer
3. Adjusting screw
4. Lock nut
5. Washer

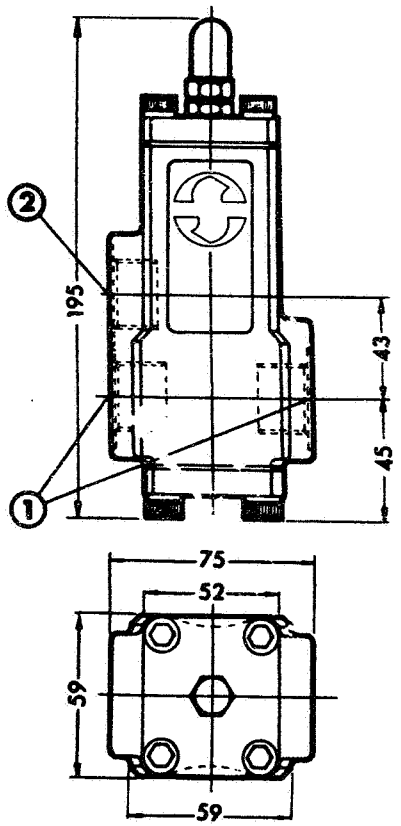
SUNSTRAND T SELF PURGING OIL PUMP
Working Temp = max. 140°C (280°F)
Suction Head = max. 5 kp/cm² (70 PSI)
Vacuum = max. 0.5 kp/cm² (7 PSI)
Operating Pressure Head = max. 40 kp/cm² (560 PSI), type T5: max 30 kp/cm² (420 PSI)
Speed = max. 3600 rpm



Note: Model T is not provided with a built-in valve. A separate pressure regulating valve, type TV4, is used.

MODEL TV PRESSURE REGULATING VALVE
Model TV was developed mainly for use with the Sundstrand model T fuel unit. This separate pressure regulating valve, easily installed into the nozzle line, is designed to keep constant pressure, even if the output capacity is changed. A built-in dampening device absorbs vibrations in the valve, effectively eliminating pulsations in the nozzle line.

DIMENSIONS



① Intage or outlet R3/4" ② Return R3/4"

After setting the plant to work, compare the thermometer reading with the scale reading on the temperature control system.
This may be found to differ by a few degrees and if precise control is required can be adjusted by resetting the scale as follows:-
Slacken the two screws A and slide the scale up or down so that it more closely corresponds to the acual temperature, see Fig. 11. Tighten the screws after setting.

Maintenance
The control system is an entirely sealed unit and requires no maintenance.

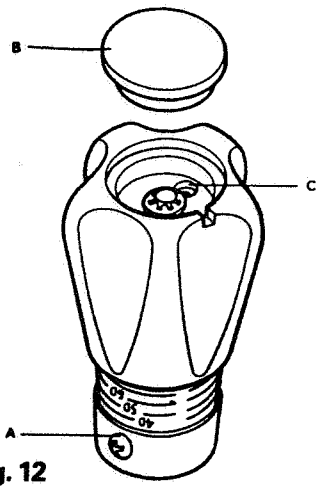
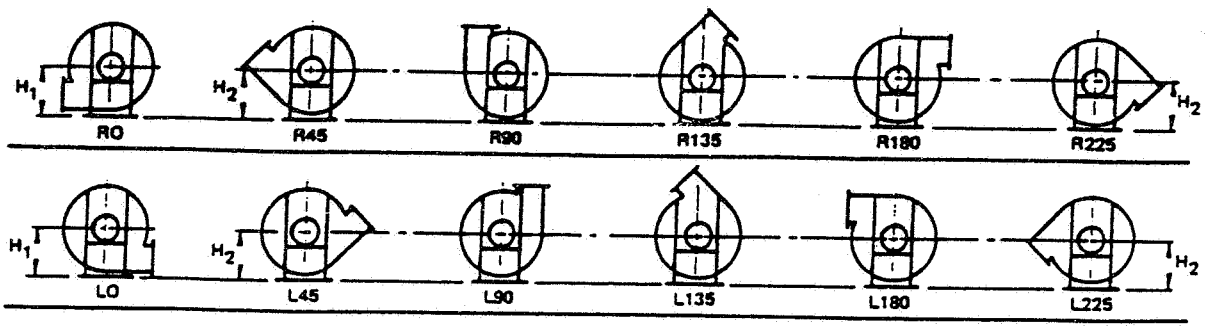
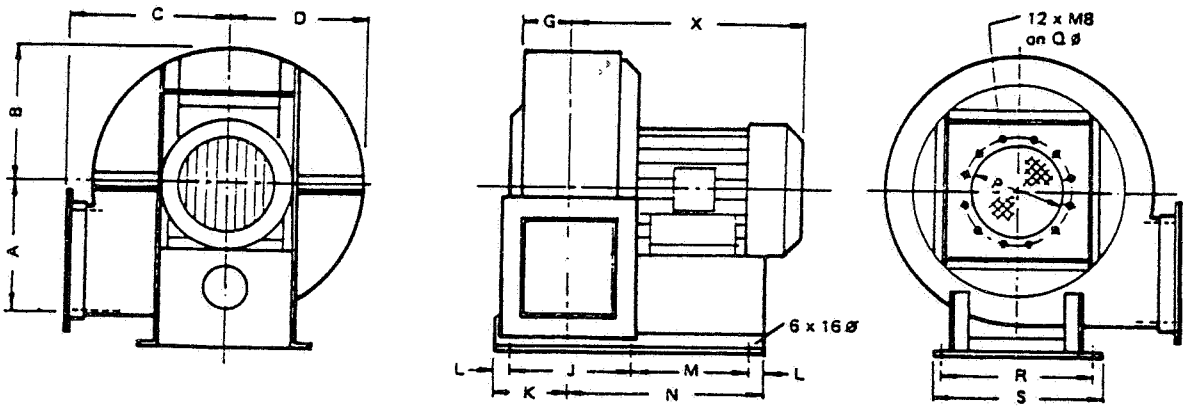


Fig. 12

FANS & BLOWERS BC FAN UNITS





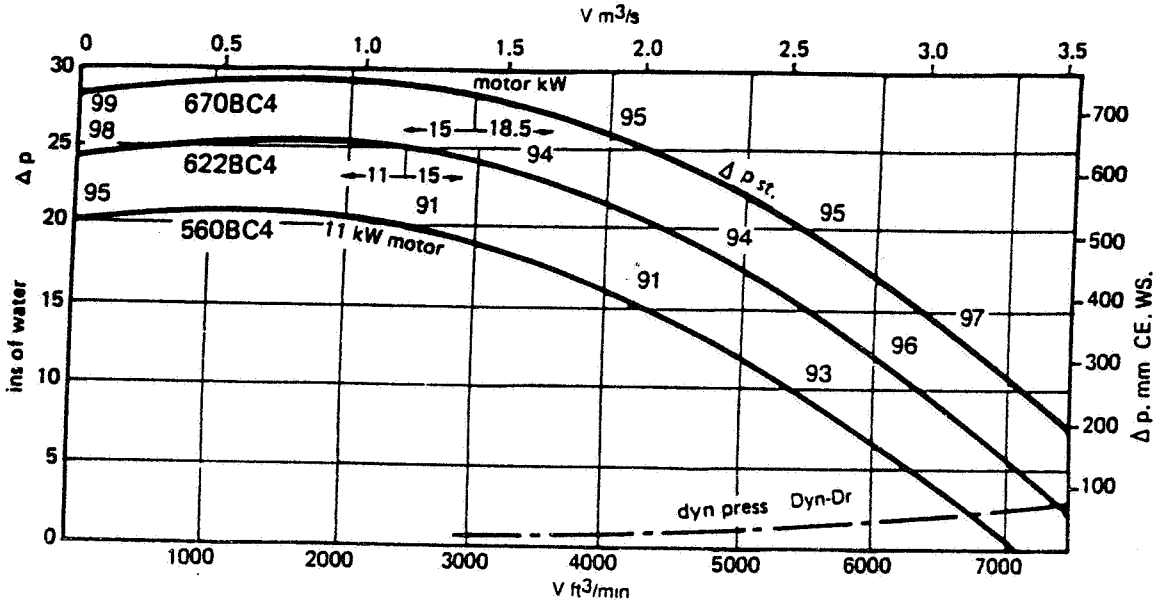
Type	Motor kW	X	A	B	C	D			G	H_1	H_2	J	K	L	M	N	P	Q	R	S
560 BC4	11	648	451	403	432	432			146	515	477	336	194	32	330	536	414	457	426	470
622 BC4	11 15	648	483	435	457	464			146	546	502	336	194	32	330	536	414	457	426	470
670 BC4	15 18.5	648 685	507	459	483	487			146	572	527	336	194	32	372	578	414	457	426	470
570 BC6	15	667	479	430	470	457			167	550	495	378	214	32	330	558	470	515	426	470
650 BC6	22	736	520	470	495	497			167	589	534	378	214	32	394	622	470	515	489	534
715 BC6	30	825	552	504	534	530			167	622	565	378	214	32	445	673	470	515	489	534
770 BC6	30 37	825	580	530	546	556			167	648	590	378	214	32	445	673	470	515	489	534
750 BC8	45	900	599	541	560	571			192	675	615	425	237	32	474	726	535	580	540	585
804 BC8	55	940	626	568	590	598			192	702	635	425	237	32	532	784	535	580	590	635
884 BC8	75	970	666	608	625	638			192	740	680	425	237	32	532	784	535	580	590	635

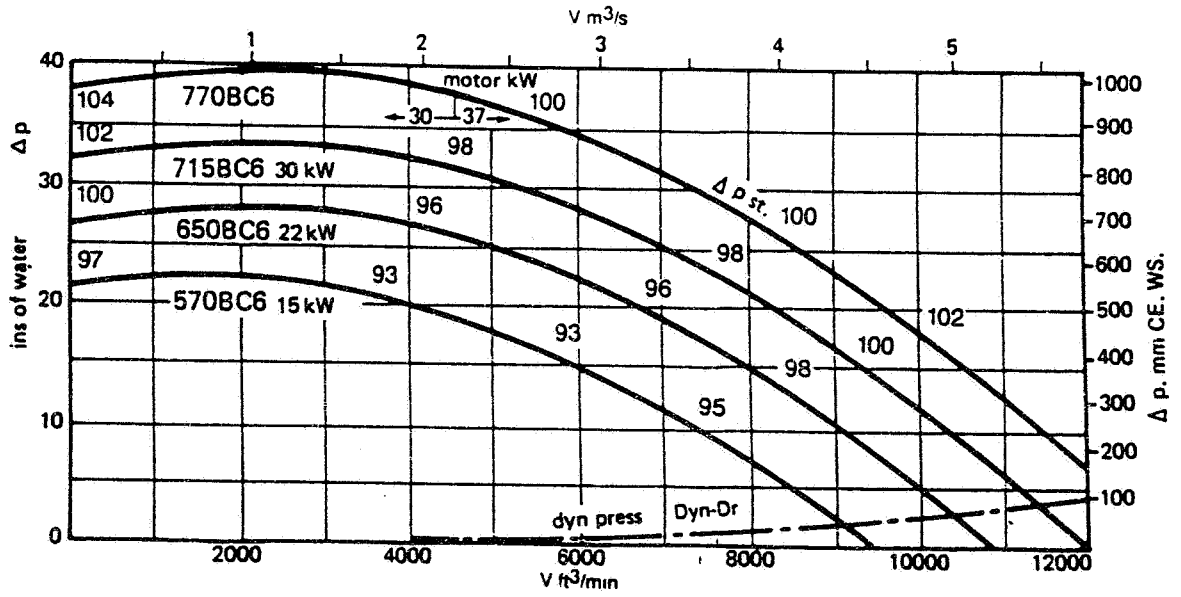
Type	a	b	c	d
BC 4	330	394	114	40
BC 6	372	445	114	40
BC 8	431	515	140	50

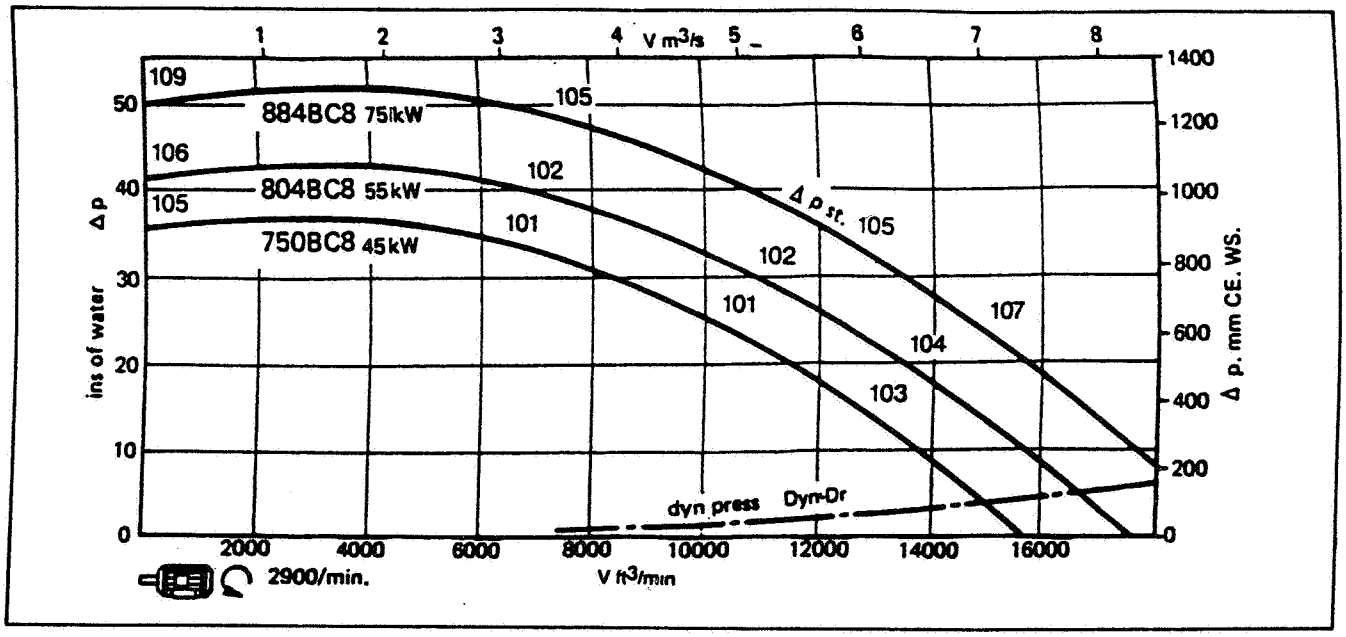
2900/min. 3PH 50Hz

Inlet volume
V = Volume d'admission
Ansaug Volumen

d = 1.2 kg/m³







LANDIS & GYR LAL OIL BURNER CONTROLS

Application range

The burner control units type LAL are designed to provide control and supervision for atomizing oil burners of medium to high capacity. They are universally applicable for both multi-stage and modulating type burners.

For reasons of safety (self-testing of the flame supervision circuit, etc.) at least one controlled shutdown must be provided every 24 hours.

OPERATION

The diagrams at the top show both the connection circuit and the control programme of the sequence switch 'P'.

The required resp. permissible input signals to the control cicuit and to the flame supervision circuit 'F' are shown shaded. If these input signals have not been registered, the control unit stops the firing sequence, which is indicated by symbols, and goes to lockout where this is required by the safety regulations. The symbols used are identical to those on the lockout indicator.

A Start command given by the control thermostat or pressurestat 'R'
A-B Start-up sequence
B-C Burner operation (heat generation according to the control commands given by the load controller 'LR')
C Controlled shut-down by 'R'
C-D Sequence switch runs through to its start position A

During burner-off periods the flame supervision circuit 'F' is under voltage.

Prerequisites for burner start-up
- Control unit reset
- Sequence switch in start position (with LAL1 indicated by voltage on terminals 4 and 11, resp. terminals 11 and 12 with LAL2 types.
- Air damper closed. The limit switch 'Z' for the CLOSED position must supply voltage from terminal 11 to terminal 8.
- The contact of the limit thermosat or pressurestat 'W' as well as the contacts of other switching devices contained in the control loop to terminal 5 must be closed (e.g. check-contacts for oil preheater).

Additional prerequisites with LAL2 types:
- Check-contacts between terminal 12 and the air pressure monitor 'LP' must be closed.
- The normally closed contact of the air pressure monitor 'LP' must be closed (LP test), i.e. terminal 4 must be under voltage.

Start-up sequence

A Start command by 'R'

(i.e. 'R' closes the control loop betwen terminals 4 and 5).

The sequence switch starts to run and the fan motor receives voltage over terminal 6 (only pre-purge). After completion of t7 the motor of the flue gas ventilator also receives voltage over terminal 7 (pre- and post-purge). After completion of t16 the control command to open the air damper is given via terminal 9. During the running time of the motor the sequence switch does not operate as terminal 8 is not under voltage during that time. The sequence switch starts again only after the air damper is fully open and the limit switch 'A' has changed over to supply voltage to terminal 8.

The control programmes now:

t1 **Pre-purge time** with air damper fully open (nominal combustion air)
During the pre-purge time the safe functioning of the flame supervision circuit is tested (de-energizing of the flame relay). The control goes to lockout if the relay does not function.

With LAL2 types:
Shortly after the start of the pre-purge time the air pressure monitor must change over, thus disconnecting terminal 13 from terminal 4. Otherwise the control unit would go to lockout (start of air pressure check). At the same time terminal 14 must be under voltage to provide power for the ignition transformer and the fuel valves.

t3'' **Long pre-ignition time** (transformer connected to terminal 15!).
With the LAL1 types the ignition transformer is switched on at the start command given by the thermostat or pressurestat 'R'. With LAL2, pre-ignition starts when the air pressure monitor closes the control loop between terminals 4 and 14.

After completion of the pre-purge time the control unit via terminal 10 runs the air damper to the low-flame position which is determined by the changeover point of the auxiliary switch 'M'. During the running time the sequence switch stops again until such time as terminal 8 receives voltage from 'M'. A short time later the motor of the sequence switch is switched over to the control section of the control unit. Therefore, control signals to terminal 8 have, from now on, no influence upon the further start-up of the burner (and the subsequent burner operation):

t3 **Short pre-ignition time,** provided that the ignition transformer is connected to terminal 16; then release of fuel on terminal 18.

t2 **Safety time**
On completion of the safety time a flame signal must be available at input 22 of the flame signal amplifier. Otherwise the control unit goes to lockout.

t3n **Post-ignition time,** if the ignition transformer is connected to terminal 15. With short pre-ignition (connection to terminal 16) it remains switched on only up to the end of the safety time.

t4 **Interval.** On completion of t4 terminal 19 is under voltage. This terminal serves for the voltage supply of the fuel valve at the auxiliary switch 'V' of the air damper motor.

t4 **Interval.** On completion of t5 terminal 20 receives voltage and, simultaneously, control outputs 9 to 11 as well as input 8 are galvanically separated from the control section of the control unit so that the latter is protected against reverse voltages from the load control circuit.
The start-up sequence of the control unit ends with the release of the load controller 'LR' at terminal 20. The sequence switch switches itself off automatically, which takes place either immediately or after some so-called 'idle steps', i.e. steps without changing the contact positions.

B Operating position of the burner

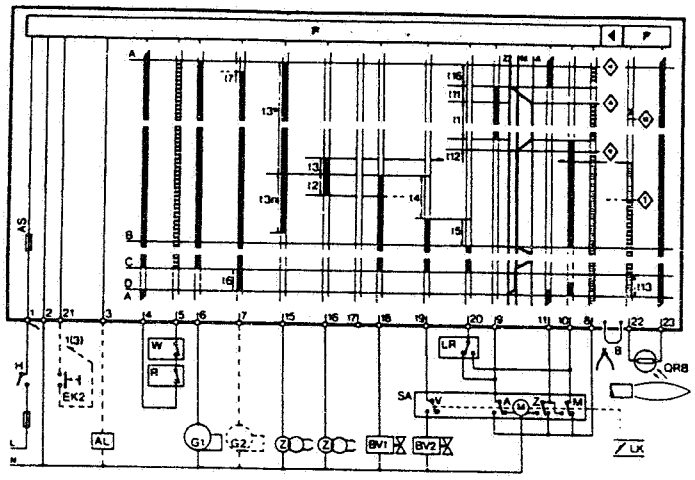
B-C Burner operation (heat generation)
During burner operation the load controller runs the air damper to the nominal load or low-flame position, depending on the heat requirements. The release of the nominal load is achieved by the auxiliary switch 'V' in the damper motor.
With flame failure during operation the LAL types go to lockout. If, instead of this, **automatic repetition of the start-up sequence** is desired, a clearly marked wire link ('B') at the baseplate must be removed.

C Controlled shut-down by 'R'
With controlled shut-down the fuel valves are closed immediately and, simultaneously, the sequence switch starts again and programmes

t6 **Post-purge time** (post purge with fan G2 at terminal 7).
Shortly after the start of the post-purge time the voltage at terminal 10 is reinstated, so that the air damper travels to the MIN position.
The complete closing of the air damper commences only shortly before the completion of the post-purge time, initiated by the control signal on terminal 11. Terminal 11 also remains under voltage during the following burner-off period.

t13 **Permissible after-burn time.** During this time the flame supervision circuit may still receive a flame signal without initiating burner lockout.

D-A End of control programme (= start position)
When, on completion of t6, the sequence switch has reset the control contacts to their start position, thereby switching itself off, the detector and flame simulation test starts again.
Voltage on terminal 4 (with LAL2 types: terminal 12) is the signal indicating that the start position has been reached.



Control signals of the control unit

Permissible input signals

Required input signals (if these signals are not received at the points marked by symbols or during the shaded phase, the control unit interrupts the start-up of the burner or goes to lockout).

LAL1

A	Limit switch for OPEN position of air damper
AL	Remote lockout warning device (alarm)
AS	Unit fuse
B	Wire link
BV	Fuel valve
F	Flame supervision circuit
EK	Lockout reset button
G	Fan or burner motor
H	Mains isolator
L	Lockout warning lamp
LK	Air damper
LP	Air pressure monitor
LR	Load controller
M	Auxiliary switch for MIN position of air damper
P	Control section of control unit
QRB	Photoresistive detector
R	Control thermostat or pressurestat
RAR	Selenium photocell detector
S	Fuse
SA	Air damper motor
V	In the air damper motor: auxiliary switch for the release of fuel according to air damper position
W	Limit thermostat or pressurestat
Z	Ignition transformer
Z	In the air damper motor: limit switch for the CLOSED position

CONTROL PROGRAMME UNDER FAULT CONDITION AND LOCKOUT INDICATION

In the event of fault conditions the sequence switch stops and simultaneously the lockout indicator. The symbol appearing above the reading mark indicates the kind of fault:

◀ **No start,** because, e.g. the CLOSE signal has not been supplied to terminal 8 by the limit switch 'Z' (or the auxiliary switch 'M'), or a contact has not been closed between terminals 12 and 4 or 4 and 5.

▲ **Shut down or start-up sequence,** because the OPEN signal has not been supplied to terminal 8 by the limit switch 'A'. Terminals 6 and 7 (with LAL1 types also terminal 15) remain under voltage until the fault is corrected.

■ **Lockout** due to a fault in the flame supervision circuit.

▼ **Shut-down of start-up sequence,** because the position signal for the low-flame position has not been supplied to terminal 8 by the auxiliary switch 'M'. Terminals 6, 7 and 15 remain under voltage until the fault is corrected.

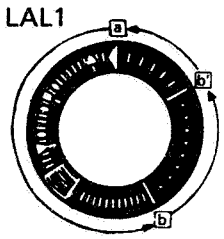
1 **Lockout,** because no flame signal has been received on completion of the safety time.

| **Lockout,** because the flame signal has been lost during burner operation or air pressure failure has occured.

◀ **Lockout on completion or after completion or control programme sequence** due to extraneous light (e.g. flame not extinguished, leaking fuel valve) or due to a faulty flame signal (e.g. fault in flame supervision circuit or similar).

a – b
Start-up sequence
b – b'
'idle steps' up to the self shut-down of the sequence switch

b(b') – a
Post-purge sequence



When lockout occurs, the control can be reset immediately. After the resetting (and also after the correction of a fault which resulted in a controlled shut-down, or after each mains failure) the sequence switch always runs through to its start position, whereby only terminals 7, 9, 10 and 11 receive voltage in accordance with the control programme. It is only then that the control unit programmes a fresh burner start-up.

ENGINEERING GUIDELINES

The installation of switches, fuse earthing etc. must be in compliance with the local safety regulations.
If any adjustment on the controls is necessary, or any wiring change has to be made, the electrical supply to the control unit must be isolated before this work is undertaken!

1 The phase and neutral connections may not be reversed!
Max. permissible input current: 5A continuous, peaks of max. 20A (e.g. motor starting current)
Safety limit thermostats (with hand reset, e.g. STB) are normally connected in the line.

2 Remote reset: When button 'EK2' is connected to terminal 3, only remote reset is possible; when it is connected to terminal 1, remote emergency shut-down is also possible.

3 Required switching capacity
— contacts between terminals 4 and 5: 1 A

4 Check-contacts of other switching devices in the burner installation are to be connected (in series) as follows:

To terminal 4 or 5: Contacts which must be closed from start to the controlled shut-down (otherwise no start or controlled shut-down).
To terminal 12 of the LAL2 types: Contacts which must be closed only during the start phase (otherwise no start).
To terminal 14 of the LAL2 types: Contacts which must be closed latest at the start of the pre-ignition time and which must remain closed until a controlled shut-down (otherwise lockout): this is valid for both long and short pre-ignition.

Maximum loading of the control terminals 3, 6, 7, 9, 10, 11, 15 to 20: 4A each terminal, total maximum 5A: peak currents of max. 20A (e.g. starting current of G1 or G2).

'Z' to terminal 15: Long pre-ignition t3'' and post ignition t3n.
'Z' to terminal 16: Short pre-ignition t3. The ignition transformer remains under voltage up to the end of the safety time t2.

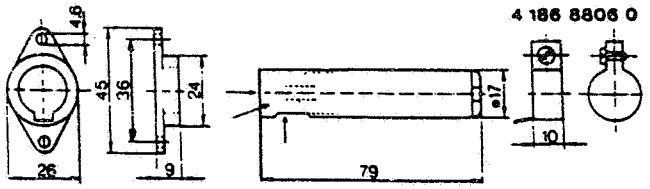
Connection of a fuel valve to terminal 20. See following notes and diagram.

Variants of the air damper control and guidelines for burners without air damper: see following notes and diagrams.

Wire link 'B': The burner controls go to lockout if flame failure occurs during operation; If, instead of this, repetition of the start-up sequence is desired, the clearly marked wire link 'B' at the baseplate must be removed (just cutting is not permitted).

DESIGN OF THE LIGHT DETECTORS QRB

QRB3 with protective housing, normal sensitivity. Housing ø 17mm. Delivered without connecting cable. Terminal block easily accessible. Delivered complete with mounting flange and detector clamp.



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QRB3

LANDIS & GYR RWF31 UNIVERSAL CONTROLLER

APPLICATION

The electronic controller POLYGYR RWF31 has been designed for use in oil- or gas-fired heating installations where it mainly provides temperature and pressure control by controlling modulating burners. i.e. burners with continuously adjustable fuel throughput. Another field of application is the control of the vacuum in the combustion chamber.

The control characteristics of the RWF31 can be selected: PID, PI or P. Since D-part, integral action time and P-Part can be adjusted over a wide range, the characteristics of the controller can be precisely adapted to the individual installation. The running time of the motor for the compound control of fuel and air for the range 'low-fire position - nominal output position' must be at least 20 s.

Submodules which are plugged into the controller shift the setpoint according to the outside temperature (submodule AZY61.9) or initiate additional control functions when certain control deviations occur (limti value supervision with submodule AZY61.31). Other submodules which are available within the POLYGYR system **cannot** be used in connection with the RWF31 controller.

The RWF31 is designed for 220/240 V a.c. operation, but can be internally switched over to 24 V a.c. However a 24 V transformer is required only if other **power consuming** units of the POLYGYR system are included in the controlled system, for example:

- a universal shift controller
- a three position converter for slave control of a second burner
- an indicating unit for the indication of the actual value
- an on/off switch for the initiation of a position dependent control signal
- a measuring amplifier for multiple use of the detector signal, etc.

DESIGN FEATURES OF THE RWF31 CONTROLLER

The controller is normally supplied complete with casing panel or flush mounting* The printed circuit board with DIN-plugs is inserted in the casing. The front plate of the controller which carries the setting controls, signal lamps, etc., is rigidly connected to the printed circuit board. All controls with the exception of the setting unit are protected by a clip-on plate to prevent unauthorized settings.

The front of the unit is protected by a hinged transparent cover and the terminal base forms the rear of the controller. To facilitate the installation, the large connecting terminals are designated according to function, taking IEC-recommendation 113-2 and DIN 40719 into consideration.

The plug-in section of the module and the corresponding plug-in base are designed in such a way that the erroneous plugging-in of another module is normally not possible.

The control output of the controller is a potential-free three position switch used for the control of reversible motors. The control signals for OPEN (Y1) and CLOSED (Y2) are indicated by light emitting diodes.

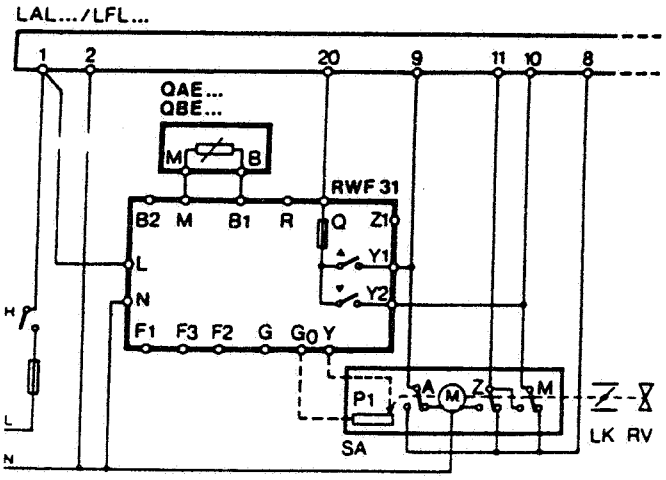
The adaptation of the controller to the controlled value and the corresponding range is achieved by inserting the so-called **setting range insert** which is the detector's part of the measuring bridge of the controller. This insert also carries the scale with the setting range. The setting unit itself is part of the controller and can be switched over to a remote setting unit.

Temperature or pressure control

Control of a burner with fuel throughput continuously adjustable (modulating burner). Start-up of burner and flame supervision by burner control type LAL or LFL. Air damper closed when burner is not in operation. Potentiometer 'P1', 0 - 1000 Ω, is required with P-control only.

Operating voltage: 220/240 V, 50/60 Hz, the voltage selector plug in the controller must be set to '24 V int.' (as delivered).

Before any adjustment to the controls or wiring is made, the electrical supply to the control unit must be isolated. All installation and repair work must only be carried out by a qualified person.



For other connections refer to the data sheet of the corresponding burner control.

Position-dependent generation of a control signal using on/off switch SEZ61.1.

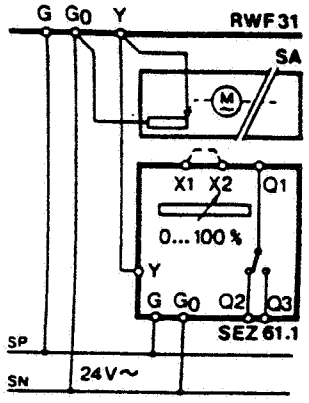
Q1-Q3 closes when the selected value is reached and the switching differential 'SD' traversed. The switching differential is selectable: 10% if the wire link across X1-X2 is fitted (corresponding to 1V d.c.), 5% if the link is removed (corresponding to 0.5V d.c.).

When the SEZ61.1 on/off switch is used, the power must be supplied by a 24V transformer.

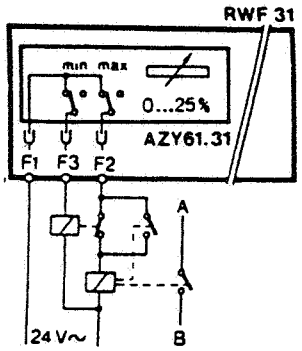
Supervision of deviations from desired value using submodule AZY61.31.

The selected value indicates the permissible deviation of the actual value from the desired value in both directions. If the actual value exceeds the desired value by the selected value, the 'max.' contact opens. If the actual value falls below the desired value by the same amount, the 'min.' contact opens.

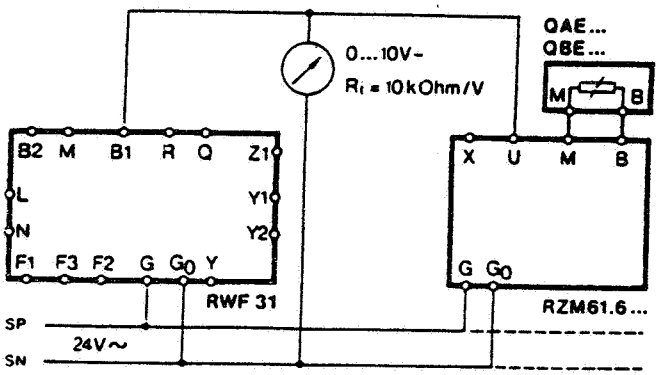
The connection example shows the use of the sub-module for the simulation of a thermostat function (A-B = controlled electrical circuit).



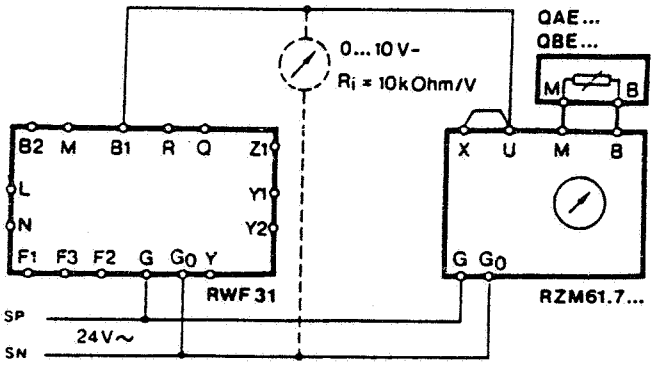
Required resistance of the potentiometer in the motor 'SA': 1000 Ω.



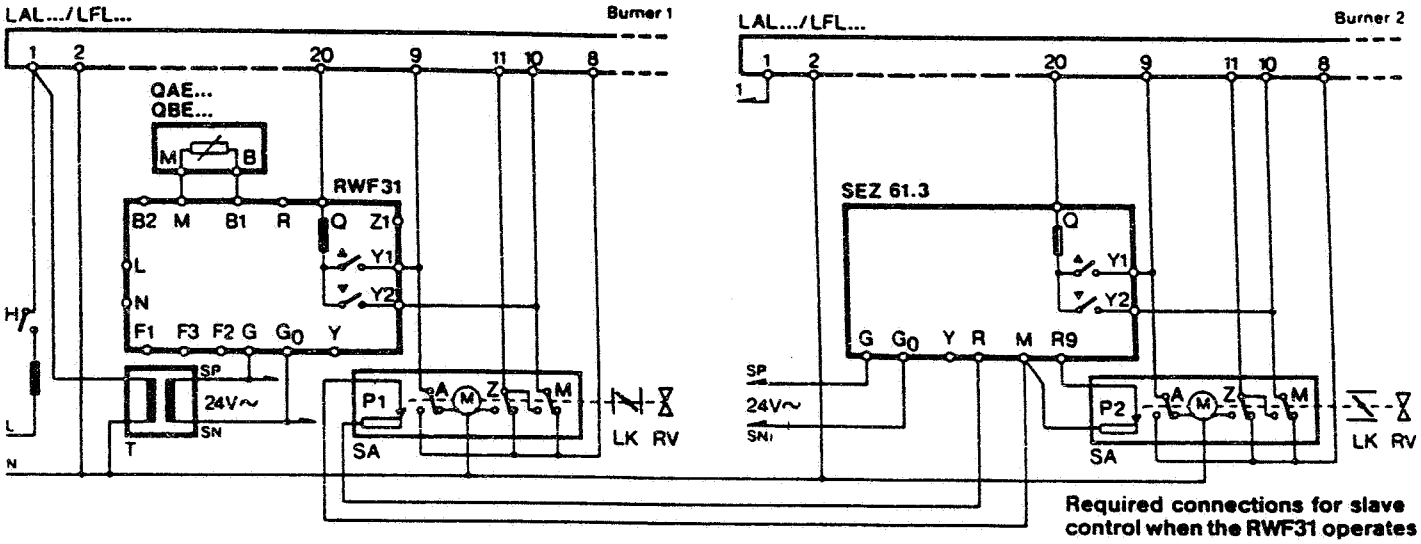
Permissible load at the control outputs F2 and F3: 24 V~, max. 0.5A (lamp current max. 0.1A).



Remote indication of the actual value by means of a mesuring amplifier and a standard indicating unit for 0-10 V d.c., internal resistance 10kΩ/V.
Scale of the indicating unit by others. The output signal of the measuring amplifier RZM61.6 - At terminal 'U' can be used tenfold.
Note: The RWF31 must be employed with a setting range insert type AZW61.2 for active signals.
When the RZM measuring amplifier is used, the power must be supplied by a 24V transformer.



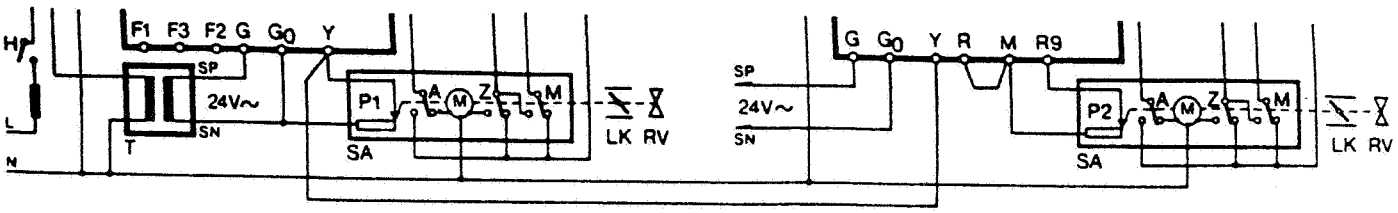
(Remote) indication of the actual value by means of an indicating unit type RZM61.7 with inbuilt measuring amplifier.
The output signal of the indicating unit at terminal 'U' can be used tenfold (e.g. for the simultaneous indication of the actual value by a standard indicating unit as described to the left).
Note: the RWF31 must be employed with a setting range insert type AZW61.2 for active signals.
When the RZM61.7 indicating unit is used, the power must be supplied by a 24V transformer.



Required connections for slave control when the RWF31 operates

Slave control of a second burner by means of a three position converter type SEZ61.3.
P1: 0-1000 Ω, P2. min. 0-135 Ω, max. 0-1000 Ω. For other connections refer to the data sheet of the corresponding burner control.

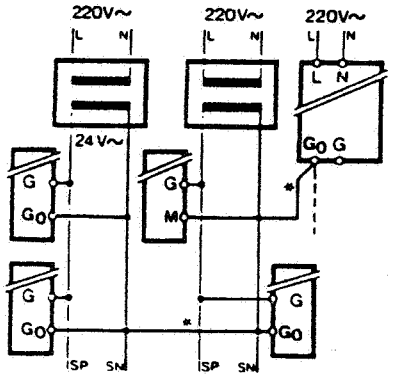
Required connections for slave control when the RWF31 operates as a PI- or PID-controller.
When the SEZ61.3 three-position converter is used, the power must be supplied by a 24V transformer. Required capacity of the transformer: total of the power consumption of all units required for the control.



Legend

A	Limit switch of the SA motor OPEN
AZY61.31	Submodule for the supervision of deviations from the desired value
LAL	Oil burner control
LFL	Gas burner control
LK	Air damper
M	Auxiliary changeover switch of the SA motor for the low-flame position
P	Remote setting unit or feedback potentiometer
QAE	Temperature detector
QBE	Pressure detector
RV	Fuel valve, continuously adjustable
RWF31	Universal controller
RZM61.6	Measuring amplifier
RZM61.7	Indicating unit
SA	Motor
SEZ61.1	On/off switch
SEZ61.3	Three position converter
SN, SP	System neutral, system potential
Z	Auxiliary changeover switch

If several 24 V transformers are required for one installation or if the RWF31 is connected to 220 V a.c. - whilst other units of the same installation are connected to 24V a.c. - terminal G0 or M of all units must be connected to the same voltage base, namely to SN, the system neutral. In applications of this kind the wires marked with an asterisk must therefore be used as additional wires.



Required connections for slave control when the RWF31 is set to 'P-control'

Explanations of the terminal designations and hints with respect to the eletrical connections

B, B1	Input for the measuring signal of the main detector (connection to terminals M and B or B1)
B2	Input for the measuring signal of the auxiliary detector, e.g. QAC21 (connection to terminals M and B2)
F	Terminals of the potential-free control switches of the AZY61.31 submodule
G, G0	System potential and neutral, 24 V a.c.
L, N	Phase and neutral, 220 V a.c.
M	Measuring neutral
Q	Voltage input for the potential-free control switches
Q2, Q3	Control outputs of the SEZ61.1 on/off switch
R	Input for setpoint, position or similar (connection of the remote setting unit to M and R)
R9	Voltage output for the generation of a 0-10 V d.c. signal, e.g. by a feedback potentiometer (connection to M and R9)
U	Output for the measuring signal 0-10 V d.c. from measuring or indicating units.
X	Auxiliary terminals
Y	With RWF31 controller: Output for the generation of a 0-10 V d.c. signal by means of 1000 Ω potentiometer (connected to G0 and Y)
Y1	Control signal OPEN
Y2	Control signal CLOSED
Z1	Input for reference signal +5V ±10 V d.c.

LANDIS & GYR - RWF32 UNIVERSAL CONTROLLER

The controller RWF32 has been designed specifically for the control of boiler temperature or steam pressure in oil or gas fired heat prodiction plants. To meet the requirements of this major field of application, the RWF32 comprises the following units and provides the following functions:

Digital PID controller, acting on modulating burners via its three-position output. Using an external operation selector switch, the RWF32 can be changed to a two-position controller for controlling a two-stage burner, providing oil firing of a dual fuel burner, for instance

Digital thermostat or pressurestat function during low flame operation (with adjustable reaction threshold with regard to switching over to high flame, i.e. low flame **priority)**

Shift controller for weather dependent shifting of the setpoint

Minimum limiter, e.g. for the boiler temperature (operative only in connection with setpoint shifting).

Design Features

The RWF32 is supplied as a plug-in unit with a terminal designation plate,

The front of the casings is protected by a transparent plastic cover which can be swung downward. The terminal base with its large connecting terminals is at the rear of the unit.

Using an appropriate **setting range insert,** the controller is adapted to the controlled value and the required setting range. This setting range insert forms part of the measuring bridge on the detector side. It also carries the setting scale. The setting unit itself is an integral part of the controller. It can be switched over to a remote setting unit.

All other setting controls are easily accessible and are located behind the unit's front plate, so the control parameters can be optimally set while the burner is in operation. All settings are analogue, i.e. they can be read off directly although the controller provides digital operation.

LED's indicate the following operational statuses:

Control ON/OFF

Control pulses OPENING and CLOSING given to the burner's air damper motor whith modulating burner control, or operation of stage I/stage II in the case of two-stage burner control

The digital display below the LED's gives the set value/actual value deviation as a percentage of the range insert's setting range. In the case of deviations exceeding +19%, symbol will be displayed in place of numerals; in the case of deviations of more than −19%, symbol will appear.
Measuring and displaying take place at 2-second intervals and in 1 per cent steps.

Function of Controller when used for Burner Control

Thermostat or pressurestat function

When controlling the burner, the RWF32 in the low fire range basically operates like a thermostat or pressurestat, i.e. it maintains the setpoint by switching the burner on and off. To accomplish this, the controller closes the start control loop at terminals Q13 and Q14 which, at the same time, causes signal lamp "O - I" to light up. The switching differential for this two-position operation can be adjusted within a wide range so that it is possible to choose the burner's switching ratio such that low wear operation will be assured.
If, during this on/off operation, the heating load slightly increases, causing the acutal value to occasionally drop below the switch on limit (SD on) of the selected switching differential, the controller does not immediately provide high flame operation, but it first checks and measures the dynamics of the control deviations and switches over to high flame only when an adjustable limit value, the reaction threshold "Q", is exceeded. "Q" is the integral of the magnitude of the control deviation(s) multiplied by the time. This adjustable reaction threshold is another facility offered by the RWF32 to reduce the burner's switching ratio if this is permitted by the control accuracy needed. The function diagrams on the next page give more details.
When "Q" is exceeded, thus requiring high flame operation, the presence or absence of mains voltage (phase!) at terminal "L9" is used to decide whether the RWF32 will continue to operate as a two-position controller, or — when there is no voltage present at terminal "L9" — as a modulating PID controller with three-position output.

Modulating control

With modulating control — in contrast to two-position control — 1/3 of the set switching differential "SD" lies below and 2/3 of it above the setpoint. However, if the same ratio as with two-position control is required (½ and ½), wire link "B2" on the printed circuit board must be cut. Also, in the case of modulating control, a non-adjustable neutral zone "NZ", which is 2% of the range insert's setting range, is operative. If control deviations exceed this neutral zone, the microprocessor ascertains not only the direction of the positioning pulses to the actuator for fuel/air compound control, but their optimum duration also, down to pulse durations of 1/10 s (indicated by the signal lights and). The RWF32 thus responds very accurately to any control deviation. P-band, derivative action time and integral action time are adjustable. Also, as with two-position control, the controller permanently indicates the **set value/actual value deviation** (in percent of the range insert's setting range) so that the operator of the plant always gets a clear picture of the accuracy and stability of the control. If, during modulating burner operation, the actual value exceeds the switch off limit of the set switching differential, the controller will switch the burner off (via relay "K") and resume control operation only when the actual value falls again below the switch on limit, starting with the thermostat or pressurestat function, i.e. low flame operation.

However, if — after a long off period, for example — the control deviation exceeds **twice** the amount of the set switching differential, modulating operation will start immediately. This, of course, also applies to the above described two-stage operation.

Function when used as a Universal Controller

To provide this function, i.e. when using any other detector/setting range insert combination of the POLYGYR control system, plug "J1" on the controller's printed circuit board must be removed. Potentiometer "Q", which is required for burner control, is put out of operation by the same action, i.e. over the entire control range the RWF32 now operates as a PID controller having a three-position output and a fixed neutral zone which is 2% of the setting range insert's range.
The correct variable is increased via terminal "Y1" and is decreased via terminal "Y1".
When using this function, relay "K3" becomes a limit value signalling device. Its contact closes (indication "0 — I" on), when the actual value falls below the switch on limit of the selected switching differential and reopens only when the actual value reaches the switch off limit. 1/3 of the set switching differential lies again below the setpoint and 2/3 above it. When the wire link "B2" is cut, the split is ½ — ½.

Shifting of Setpoint by Building Automation Systems of similar

This is achieved by feeding voltage signals to controller terminal "Z1". At +5 Vd.c. (measured across terminals "Z1" and "M"), the authority is 0%. A voltage increase of 1V raises the setpoint, the shift being 10% of the setting range insert's range; a voltage decrease of 1V lowers the setpoint by 10%. In the case of weather dependent setpoint shift, a reference signal at terminal "Z1" will not, however, change the compensation curve, but only the minimum limit value set with the slider of the setting range insert!

Weather dependent Shifting of Setpoint

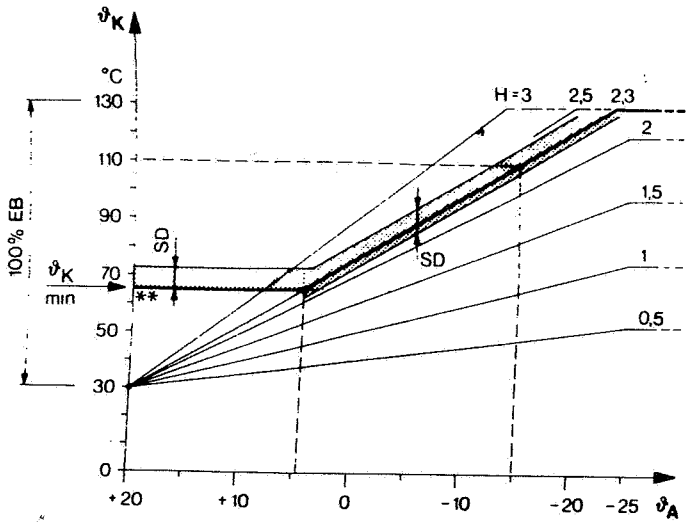
It becomes operative automatically as soon as the QAC21 outside detector is connected. The lower reference value is **not** adjustable. This fixed value represents the "pivot" for the adjustment of the heating curve with potentiometer "H", located behind the controller's front plate. In the case of weather dependent shifting, the slider of the setting range insert serves for setting the **minimum limitation of the controlled value**, e.g. the min. boiler temperature, whereby the set value represents the **switch on limit** of the selected switching differential.

ϑA Outdoor temperature
ϑK Boiler temperature (example)
ϑK_{min} Minimum boiler temperature

SD Switching differential set
H Slope of heating curve

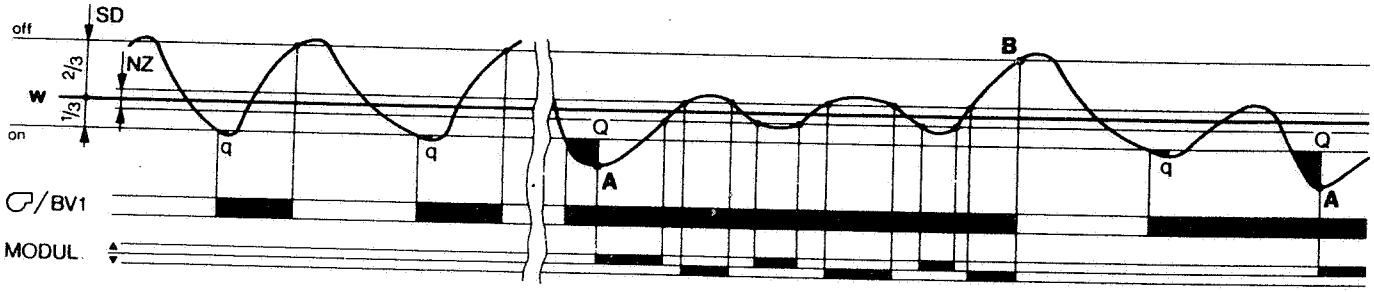
Setting of heating curve slopes in the case of weather dependent shifting of the boiler temperature's set value by the QAC21 outside detector in connection with AZW61.113-t30/130 setting range insert (example).

** Shifting curve when setting potentiometer «H» to 2,3 and with a minimum limitation of the boiler temperature to 65°C (using setting slider!)

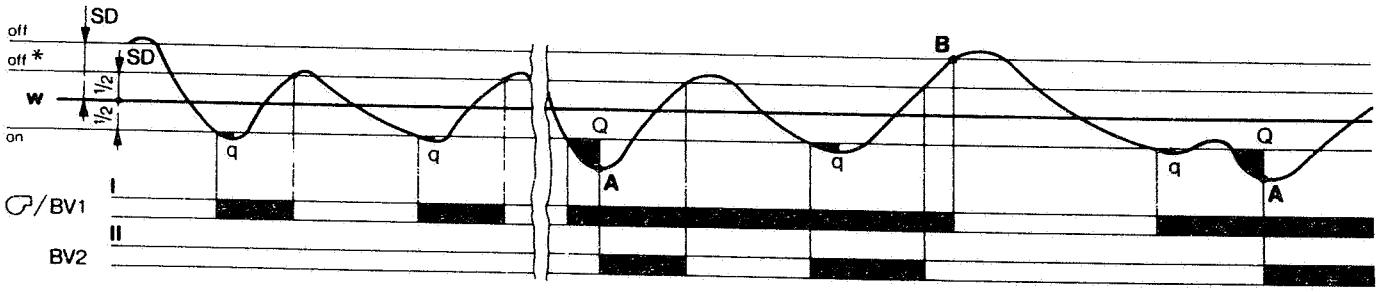


Function Diagrams

Continuous (PID) control, e.g. for modulating burners, with automatic on/off function during low flame operation



Two-stage on/off control, for two-stage oil burner, for example



The diagrams show the controller's thermostat/pressurestat function on the left (on/off operation).
Since the control deviations "q" remain under the reaction threshold "Q" set at the controller, switchover to high flame operation (two-stage or modulating) will not take place.

When the actual value falls repeatedly below the switch on threshold, the controller **adds up** the "q" deviations and switches over to high flame when the set "Q" value is reached. However, if the setpoint is reached with low flame operation, the counter will be reset to zero.
At "A", the set reaction threshold is exceeded and the controller immediately switches to high flame operation, i.e. it changes to continuous control (top) or two-stage burner control (bottom).

This continuous or two-stage burner control will remain operative Ontil the actual value exceeds the setpoint by the value of the set switching differential — independent of the extent of further control deviations. This means burner and control are switched off at point "B".
Automatic burner restart as soon as the actual value falls below the switching differential. Another change to continuous or two-stage burner control is made at "A". because reaction threshold "Q" is again exceeded.

SD Set switching differential
NZ Neutral zone with PID-controller
on Burner on
off* Low flame or high flame off
off Burner off
w Selected setpoint

Basic Wiring Diagram

For temperature or pressure control in connection with a dual fuel burner. Control and supervision of the burner are provided by an LAL... or LFL... unit (example).

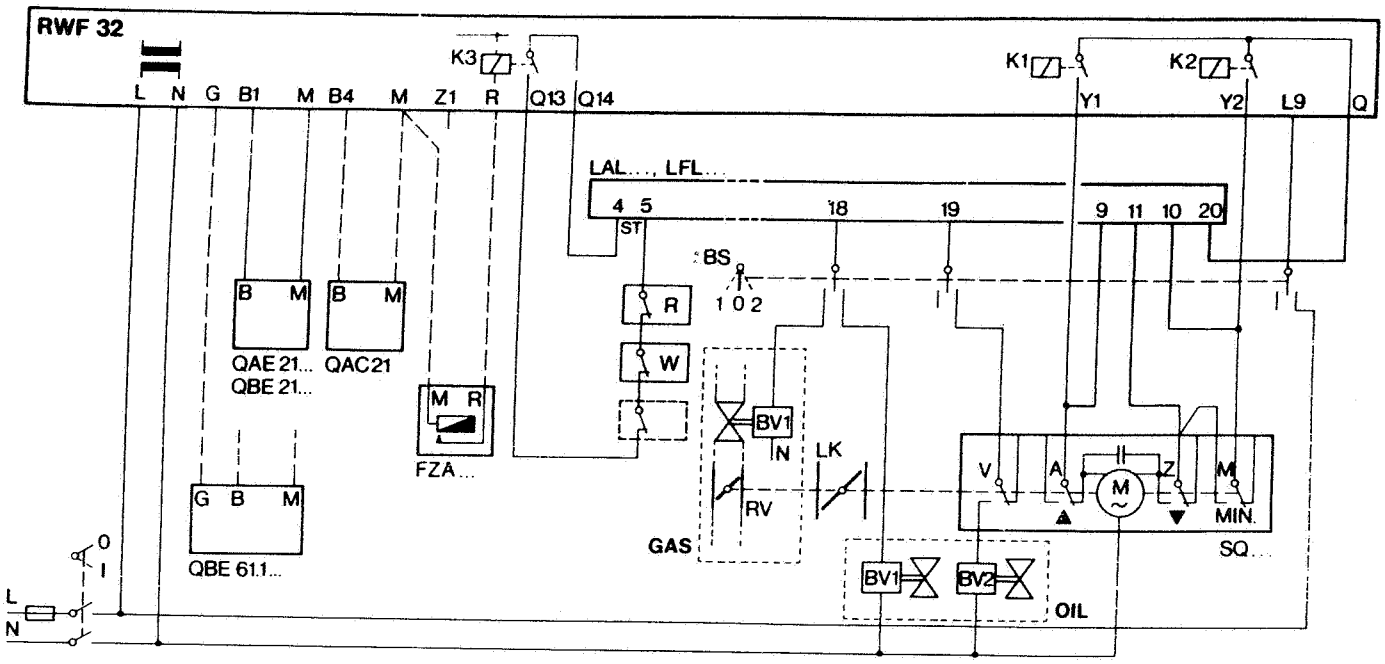
1 Gas, modulating
2 Oil, two-stage

Caution:

The voltage of 24Va.c. available at terminals "G" and "M" may only be used for supplying power to the pressure detector QBE61.1...!

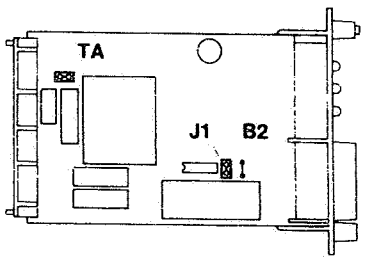
Electrical loads such as signal lamps, relays, hours run meters, etc., may **not** be connected to terminal "L9"!

The control voltage to terminal "L9" must be picked up at terminal "L" (same phase relation!).



Legend

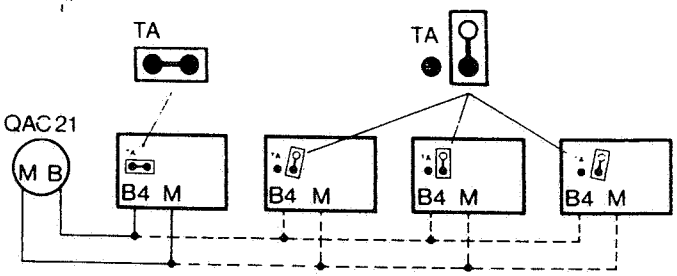
A Limit changeover switch for air damper position OPEN
BS Operation switch
1 = gas (modulating burner control)
2 = oil (2-stage burner control)
BV... Fuel valve
FZA... Remote setting unit (becomes operative when setting the built-in setting unit to "ext")
K1,K2 Output relays for the control loop's regulating unit (in this case: actuator of fuel/air compound control)
K3 Limit value signalling relay, potential-free
L... Burner control (e.g. LAL..., LFL1..., LGK16..., LOK16...)
LK Burner's air damper
L9 See "B"
M(MIN) Auxiliary changeover switch for the control of the low flame stage
QAC... Outside detector for weather dependent shifting of setpoint
QAE... Immersion temperature detector
QBE... Pressure detector
R Boiler thermostat or pressurestat
RV Gas regulating damper
SQ... Motor for burner air damper and gas control damper
ST Connections of burner control's start control loop
V Auxiliary changeover switch for the release of the second fuel valve depending on the position of the air damper
W Thermal (or manual) reset limit thermostat or pressure switch
Z Limit changeover switch for air damper position CLOSED
Z1 Input terminal for reference signal from building automation system or similar



Location of plugs "TA" and "J" and of wire link "B2" on controller's printed circuit board

The signal supplied by the QAC21 outside detector may be fed to a maximum of 4 RWF32 controllers (controller terminals "B4" and "M" connected in parallel).
In this case, plug "TA" may be plugged into **only** one **of the controllers!**

TA When connecting the QAC21 outside detector to several (max. 4) controllers in parallel, plug "TA" may be plugged into **only** one of the controllers.
J1 When using the RWF32 as a universal controller, plug "j1" must be removed, thus making potentiometer "Q" inoperative.
B+ Wire link for changing the position of the switching differential SD in relation to the setpoint in the case of PID control (B2 cut off = ½ — ½ in place of 1/3 — 2/3, refer to text).



RANGE OF UNITS

Universal Controller — POLYGYR RWF31

Control characteristics can be selected: PID, PI or P. with potential-free three position output for the control of reversible motors. Indication of the direction of travel by light emitting diodes. Operating voltage 220/240 V, 50/60 Hz, can be changed over to 24 V a.c. ±20%. Casing for panel or flush panel mounting (also available for rack mounting).
The adaptation of the controller to the controlled value and the setting range is achieved by setting range inserts:

- In connection with passive detectors type QAE21 (temperature) and QBE21 (pressure) — Type AZW61.1
- In connection with active detectors, measuring amplifiers as well as indicating units with inbuilt measuring amplifiers — Type AZW61.2

Immersion temperature detectors — QAE21

Passive detectors with measuring element 1000 Ω at 0°C. Head of the QAE21 made from plastic, heads of the other types made from die-cast aluminium. Permissible ambient temperature −15 - +60°C. Mounting position optional.

Range °C	Measuring element	Immersion length	Protection standard	Type designation
30 - 130	NI	100mm	IP42	QAE21
0 - 250	Pt	200 mm	IP42	QAE21.1
150 - 450				on request

For protection pockets refer to table 1
for detailed information refer to data sheet 3434

Electrical installation: The following cable runs and cross sections between detector and controller give a deviation of the measured value of 1°C.

	Type	0.6mm dia.	1 mm^2	1.5 mm^2	2.5mm^2
For longer cable runs refer to measuring amplifiers	QAE21	40	150	220	370 m
	QAE21.1	35	120	180	300 m

Pressure detectors **QBE21**

Passive detectors (bellows acting on potentiometer), permissible for water with a pH-value not exceeding 10, for steam as well as for other media according to data sheet 3460. With medium temperatures above 80°C it is necessary to install a water trap; ordering number Nr. 4 286 16520.
Housing made from plastic; protection standard IP42. Permissible ambient temperature −15 - +50°C. Pressure connection G½". Mounting position optional with the exception of the detector head hanging down. Attention: The QBE21 must not be exposed to vibrations.
Electrical installation: the following cable runs and cross sections between detector and controller give a deviation of the measured value of 1%:

For longer cable runs refer to measuring amplifiers	0.6mm dia	1 mm²	1.5 mm²	2.5 mm²
	80	300	450	750 m

Measuring ranges and ordering specification: see table 1
For detailed information refer to data sheet 3460

Remote setting units **FZA21**

If a remote setting unit is used, the slider on the controller for setting the desired value must be set to 'ext'.
Suitable for flush panel mounting; front plate measuring 48 x 48 mm. The setting knob can be locked or its setting range limited.
Electrical installation: The cable runs and cross sections between detector and controller shown below give an error of 1% of the setting range of the setting unit.

0.6 mm dia.	80 m
1 mm²	300 m
1.5 mm²	450 m
2.5mm²	750 m

Setting ranges and ordering specification see table 1
For detailed information refer to data sheet 3470

Measuring amplifiers **RZM61.6**

Measuring amplifiers are used to convert passive detector signals into active 0-10 V d.c. signals thus achieving
- multiple use of the measuring signal of a passive detector (can be used tenfold)
- distances of any length between the detector and the controller with no measuring error
- Indication of the actual value by means of standard indicating units for 0-10 V d.c. internal resistance 10kΩ/V, scale must be obtained on site.

Operating voltage 24V ±20%, 50/60 Hz. Power consumption 1VA. Housing suitable for panel mounting. Permissible ambient temperature −10 — +50°C.

Permissible length of cable run from the transformer of the installation to the measuring amplifier	0.6mm dia	30 m*
	1 mm²	115 m
	1.5 mm²	170 m
	2.5 mm²	285 m

* 1000 m if an additional transformer is used which supplies power to the measuring amplifier only.

Ordering specification see table 1
For detailed information refer to data sheet 3475

Indicating units **RZM61.7**

These units are used for the indication of the actual value. Normal version suitable for flush panel mounting. Also available with mounting frame ARG61.1 for 19" rack mounting (surcharge).
Types RZM61.71 for the indication of temperature and types RZM61.73 for the indication of pressure are provided with a measuring amplifier whose 0-10 V d.c. output signal can be used tenfold. The technical data, cable runs, etc. are the same as those of the measuring amplifiers type RZM61.6.
Ordering specification see table 1
For detailed nformation refer to data sheet 3477

Three position converter **SEZ61.3**

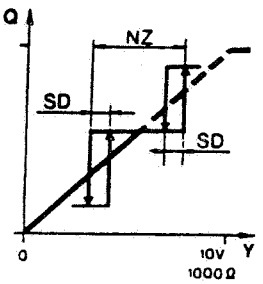
Depending on its connection, the SEZ61.3 converts the resistance value of a 0-1000 Ω setting unit or a continuous 0-10 V d.c. signal into a three position signal which is used for the contol of a reversible motor.
To achieve this, the motor must be provided with a feedback potentiometer having a resistance of min. 0-135 Ω and max. 0-1000 Ω (within these limits the three position converter can be adapted to the resistance range of a potentiometer).
In heat generating plants the three position converter is predominently used for slave control whereby one SEZ61.3 is required for each controlled motor.
Housing suitable for panel mounting. Power consumption 3 VA. Permissible ambient temperature −15 — +50°C.

Switching differential SD:
Approx. 0.1 V or 10 Ω or 1%

Neutral zone NZ:
Approx. 0.5 V or 50 Ω or 5%

Type of contact: potential-free normally open contacts

Switching capacity: 5(3)A, 24-250 V a.c.



Connection example see page 3
For more information refer to data sheet 3486

On/off switch **SEZ61.1**
(electronic auxiliary switch)

The SEZ61.1 converts a continuous 0-10 V d.c. signal into an on/off signal when the signal reaches the set value (YD). The setting scale is graduated from 0-100%. When the set value is reached and the selected switching differential 'SD' traversed, Q1-Q2 opens and Q1-Q3 closes.

Switching differential SD:
- Wire link across terminals X1-X2 fitted: 10% corresponding to approx. 1 V d.c.
- Wire link removed: 5% corresponding to approx. 0.5 V d.c.

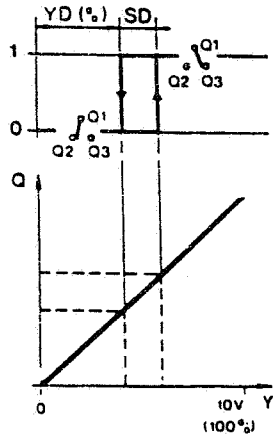
Type of contact: Potential-free changeover switch

Switching capacity: 5(3)A, 24-250 V a.c.

Housing: Suitable for panel mounting

Power consumption: 1 VA

Permissible ambient temperature: −15 - +50°C



Connection example see page 2
For more information refer to data sheet 3484

Submodule for RWF31 controller used for the signalling of deviations from the desired value **AZY61.31**

This submodule has been especially designed for use with the RWF31 controller to convert both positive and negative deviations from the desired value into on/off signals, for example:

- for the (remote) signalling when limit values are exceeded
- for the simulation of thermostat functions (see connection example), or
- for control functions with boiler sequence control, etc.

Response value	Adjustable between 0-25% of the setting range of the setting unit; the seleceted value signifies both positive and negative deviations from the desired value.
Switching differential	2% of the setting range of the setting unit, e.g. 2K with the setting unit for 30-130°C. If the adjusted response value is close to 0%, priority is given to deviations which cause the actual value to fall below the desired value.
Type of contact	Potential-free normally closed contacts for 24 V a.c., max. 0.5A (lamp current max. 0.1A).

The submodule is plugged into the controller; its potentiometer for the adjustment of the response value is accessible after the front plate of the controller has been removed.

Universal shift controllers **RZF61.10**

The universal shift controller isused to shift the setpoint of the controlled system according to any physical variable that can be detected by one of the POLYGYR detectors, for example in heat generating plants, where the setpoint is shifted according to a certain temperature, pressure, pressure difference or similar.
The RZF61.10 is supplied complete with housing - like the RWF31 controller. A setting range insert is used to adapt the shift controller to the reference value (depending on detector) and compensation range. Up to 40 control loops can be shifted by one shift controller.
For detailed information on the comprehensive shifting and limiting capabilities of the RZF61.10 refer to data sheet 3472.

Range of Units
(continuation of the short descriptions)

Submodule for shifting the setpoint according to the outside temperature (weather) **AZY61.9**
Outside detector **QAC21**

The AZY61.9 is for use in burner installations where winter compensation is required, i.e. the setpoint is continuously raised when the outside temperature drops. To achieve this, the following adjustments must be made:
Basic reference value: This is the outside temperature at which the authority of compensation of the submodule shall start. It is adjustable from from 5 to 35°C.
The appropriate sliding potentiometer is located behind the front plate of the controller.
Authority of compensation: It determines to what extent a change in outside temperature shall shift the setpoint and is adjustable from 0 to 165%. The setting potentiometer is accessible after the controller insert has been removed.

Mode of compensation:
Winter compensation = switch position 1,
Summer compensation = switch position 2.
The switch is located on the printed circuit board of the submodule.
Compensation range: With passive measuring signals from the main detector, the compensation range can be selected from −50 to +50°c. To do this, the shorting plug on the printed circuit board of the submodule must be set to P. For active signals -also with a measuring amplifier - the shorting plug must be set to A and the range is from −30 to +40°C.

Setting example

Type of compensation	weather compensation with boiler temperature control
Setting range of setting unit	30-130°C
Detector signal	passive
Setpoint at an outside temperature of	+20°C = 55°C −20°C = 100°C
Compensated control range	◀ W_R = 55 − 100°C = 45K
Compensation range	▲ F_R = +20 − −20°C = 40K
Range of setting unit	EB_R = 30 − 130°C = 100K

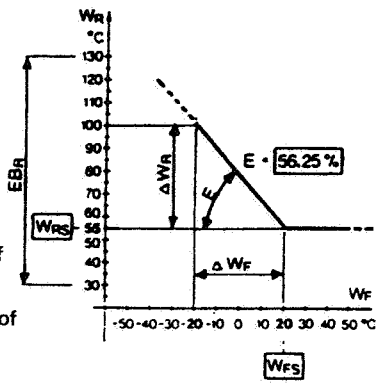
Calculation of the authority of compensation E:

$$E = \frac{W_R \cdot 50}{R_F \cdot EB_R} \cdot 100\%$$

$$E = \frac{45 \cdot 50}{40 \cdot 100} \cdot 100\%$$

$$E = 56.25\%$$

The follwing settings must therefore be made: Mode of compensation on 1, kind of signal on P, basic reference value W_{FS} on 20, authority of compensation E on 56 and setpoint at 55°C.



Outside detector QAC21: The detector is suitable for temperatures from −30 to +50°C. For permissible cable runs and cross sections of wires refer to immersion temperature detector QAE21.
Detailed technical information:

Submodule, data sheet	3429
QAC21, data sheet	3442

Feedback potentiometer/setting unit **ASZ**

For motor type	Angle of rotation	Resistance	Type designation
SQM10	90°	1000 Ohm	**ASZ12.50**
	130°	1000 Ohm	**ASZ12.53**

ADJUSTMENT OF THE CONTROLLER

With most installations the guide values according to the table shown below normally give good results, which must then be optimized by slightly correcting the control parameters.

With very fast controlled systems as well as with fast motors used for the control of the burner output, however, a sound knowledge of control engineering is a prerequisite for the correct adjustment of the control parameters.

The commissioning of the installation can be considerably simplified if, while the adjustments are made, the load conditions are kept nearly constant, so that the reaction of the controlled system to load or setpoint changes can be easily seen.

For every correction the following points must be observed:

- Make a note of the previous settings
- Change only one parameter at a time (i.e. do not change Xp, D and t_N at the same time)
- Change adjustments in small steps only
- Make a further correction only if the result of the previous correction is clearly noticeable.
- If the parameter Xp is increased, the controlled system tends to have more stability. At the same time, however, the corrective action after a load or setpoint change takes more time.
- If Xp is decreased, the controller reacts more quickly when a disturbance occurs. At the same time, however, the controlled system tends to become unstable.

Measures to be taken when the controlled system reacts too slowly

If the setpoint or the load changes, and the desired value is reached too slowly or not at all, the following corrective measures must be taken:

- Decrease Xp in steps of max. 5% (speeding up of correcting actions)
- If Xp = 5% does not give the expected result, Xp must not be decreased further but D-part a is to be reduced in steps of approx. 0.5. Fine adjustment is achieved by slowly adapting Xp
- Decrease integral action time t_N in steps of approx. 10 s only when a = 0. Fine adjustment is again achieved by slowly adapting Xp.

Measures to be taken when the controlled system is unstable.

If the setpoint or the load changes and the controlled system does not settle (oscillations), the following corrective measures must be taken:

- Increase Xp in steps of max. 5% (towards stability)
- If Xp = 100% does not give the expected result, D-part a is to be increased in steps of 0.5. Optimum control is achieved by slowly adapting Xp
- If the D-part value is 5 and the controlled system is still unstable, the integral action time t_N is to be increased in steps of approx. 10 s. Fine adjustment is again achieved by slowly adapting Xp.

Guide values for the adjustment of the control parameters

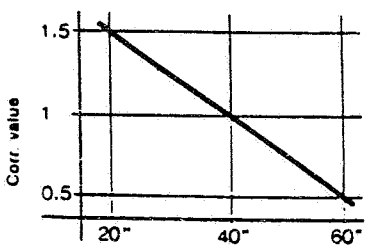
Type of installation	Speed of change of the controlled value, depending on boiler size and design, burner output, etc.	Control characteristic to be selected	Adjustments required at the controller			
			Switch position	Guide value for P-part Xp*	Guide value for D-part a	Guide value for integral action time t_N
High pressure steam	Fast	PID	PI	20%	2	60″
	Slow	PID	PI	10%	4	120″
	Very slow	PI**	PI	10%	0	120″
Low pressure steam	Fast	PID	PI	20%	2	60″
	Slow	PID	PI	15%	3	95″
	Very Slow	PI**	PI	15%	0	95″
Low pressure or high pressure hot water	Slow	PID	PI	10%	4	120″
	Very slow	PI**	PI	10%	0	120″

Note: When using motors with running times of more than 60 seconds, or motors with starting delay, the extension of the controller's control pulses by means of the aforementioned shorting plug is **imperative.**

Running time of motor

The running time of the motor for the range 'low flame position - nominal load position' must be at least 20 seconds. Ideally, the running time should be between 25 and 35 seconds. With longer running times it is recommended to prolong the control pulses given by the controller. This is achieved by using the **shorting plug 4 408 2936 0** which is plugged in the 3 pins located between the potentiometers 'E' and 'F', thus switching of the pulse limiting action of the controller (for 'E' and 'F' see photo on page 6).

* The guide value is valid for a motor runing time of approx. 40 s. For longer or shorter running times multiply the guide value by the correction value according to the chart shown to the right.



Running time (low flame position to nominal output position)

** For special applications P-control can be selected. In this case, the motor must be provided with a 0-1000 Ω potentiometer. Guide value for Xp: 0.5%: the potentiometers for setting the D-part and the integral action time with P-control are inoperative.

With P-control and unfavourable conditions the inherent control deviation might just be as great as the selected Xp-value. With Xp = 5%, for example, this would reperesent 5% of the range of the setting unit, i.e. with 1-250°C — 12.5°C, with 30-130°C —5°C, with 0-10 bar = 0.5 bar etc.

LANDIS & GYR AZW61 SETTING RANGE INSERTS

APPLICATION

The AZW61 is used to adapt the module controllers and shift controllers to the measured value and setting range.

A setting range insert is required with the following units:

— Universal controllers with	
one output	RWF61.10
two outputs	RWF61.20
three outputs	RWF61.30
— On/off controllers with	
two stages	RWF21.20
four stages	RWF21.40
— Economisers	RWF61.11
— Universal shift controllers	RZF61.10

FUNCTION

Within the controller the setting range insert is part of the measuring bridge. It determines the measured value for the detector input B1, adapts the measuring bridge to the detector signal and determines the setting range of the setting unit.

DESIGN FEATURES

The setting range insert is of plug in design and inserted at the front of the module unit. It consists of a plastic frame and a printed circuit board which carries the electronic components. The setting scale at the front of the insert has at its bottom the

— marking 'ext', being the slider position when remote setting of the desired value is used
— designation of the scale which is part of the type designation of the controller or shift controller

There are two basic types of setting range inserts available:

Setting range inserts for passive signals (AZW61.1, black scale) are used when

- a passive detector is connected direct to the controller. Passive detectors are detectors with a Ni 1000 Ω at 0°C or Pt 1000 Ω at 0°C measuring element or a 1000/2000 Ω signal
- a detector, which delivers a 0/4-20mA signal (outside purchase), is connected direct to the controller

Setting range inserts for active signals (AZW61.2, red scale) are used when

- an active detector is connected direct to the controller. Active detectors deliver a 0/-10 V signal
- A passive detector is used for several functions (e.g. control, indication, building automation system). In this case an amplifier type RZM61.6 or an indicating instrument type RZM61.7 must be connected between the detector and the controller. These two units convert a passive signal into an active 0/-10V signal.

Note: What applies to the controllers also applies to the RZF61.10 shift controllers.

LANDIS & GYR SQM AIR DAMPER MOTORS

APPLICATION AND DESIGN FEATURES

The reversible damper motors type SQM are suitable for 2-wire control with controllers or switching units with changeover contact.

The control section comprises 2 motor travel limit switches, 5 auxiliary switches and - on request - 1 potentiometer (as feedback potentiometer for P-control, as position indicator with slave control systems, or for remote position indication).

The operation of the limit and auxiliary switches is made by manually adjustable cams. Setting scales provided between the cam discs simplify the adjustment. The graduations of the scale between the changeover switches 6 and 7 are made such, that the two switches can be combined into a double-auxiliary switch with a switching interval of 6° travel. An additional scale on the end of the cam stack serves as position indicator.

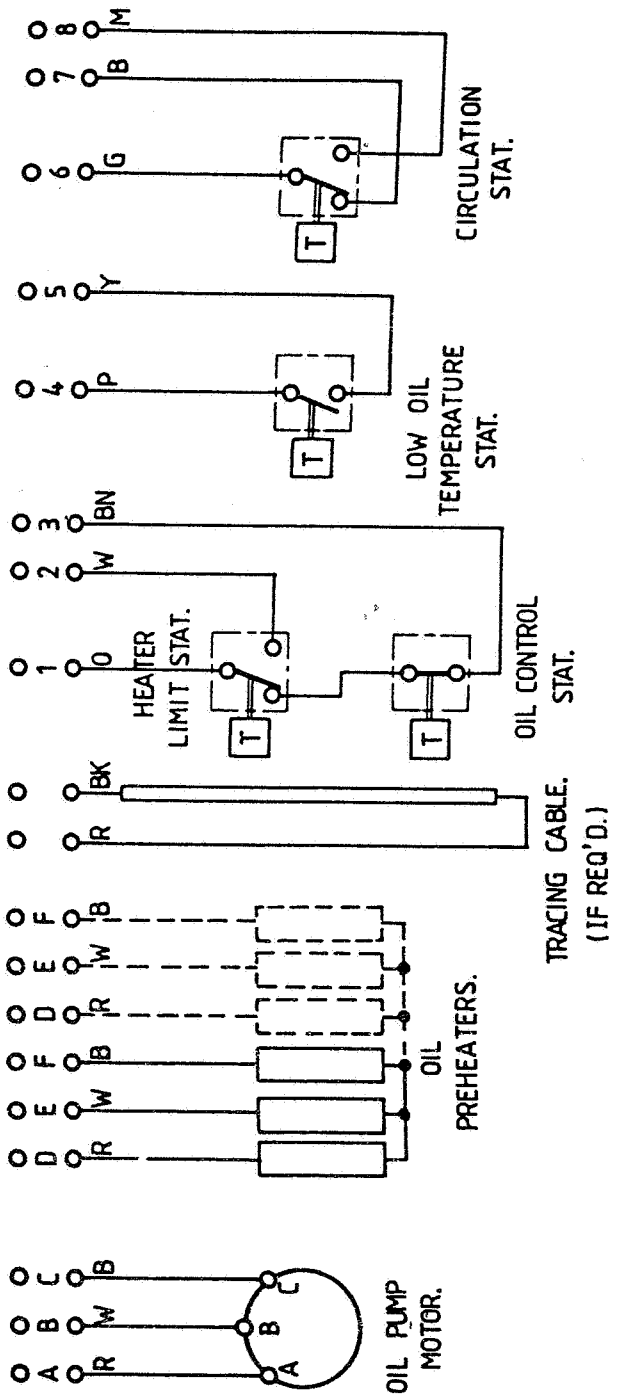
The reduction gearing is provided with self-lubricating sinter-bronze bearings and therefore requires no periodic maintenance. When mounting the motor and damper actuating rod, the gearing can be decoupled by means of a lever, so that the main drive spindle is easy to adjust in either direction of rotation.

The gear housing is of die-cast aluminium and painted silver-grey; the cover is in dark-grey, impact proof plastic. For the electrical installation are provided four entries threaded for glands Pg11 or BSP¾".

TECHNICAL DATA

Operating voltage*	220 V −15% 240 V +10% or 100 V −15% 110V +10%
Frequency	50/60 Hz
Switching capacity of the limit and auxiliary switches	250V 10(3) A
Power consumption	7 VA; asynchr. m. 12 VA
Angular rotation (scale)	160°
Direction of rotation with voltage to terminal 1, facing the spindle	Anti-clockwise
Mounting position	optional
Protection standard	IP54, DIN 40050
Permissible ambient temp.	
— during operation	−15°/+50°C
— during transportation and storage	−50°C
Cable entries	4 threaded entries for Pg11 resp. BSP¾"
Weight	approx. 1.7 kg

Before any adjustment to the motor or wiring is made the electrical supply to the control unit must be disconnected. All installation and repair work must only be carried out by a qualified person.

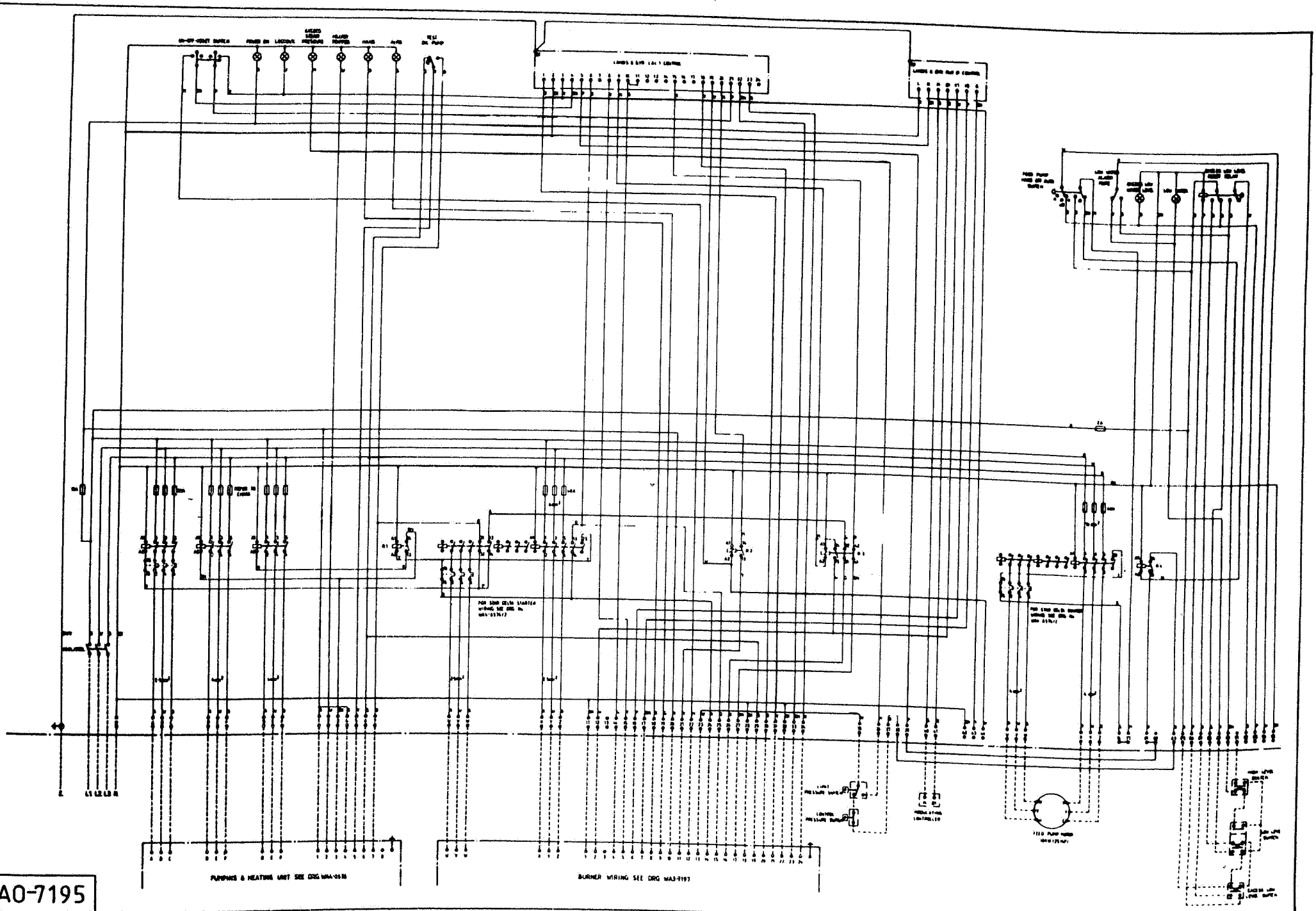


TITLE:

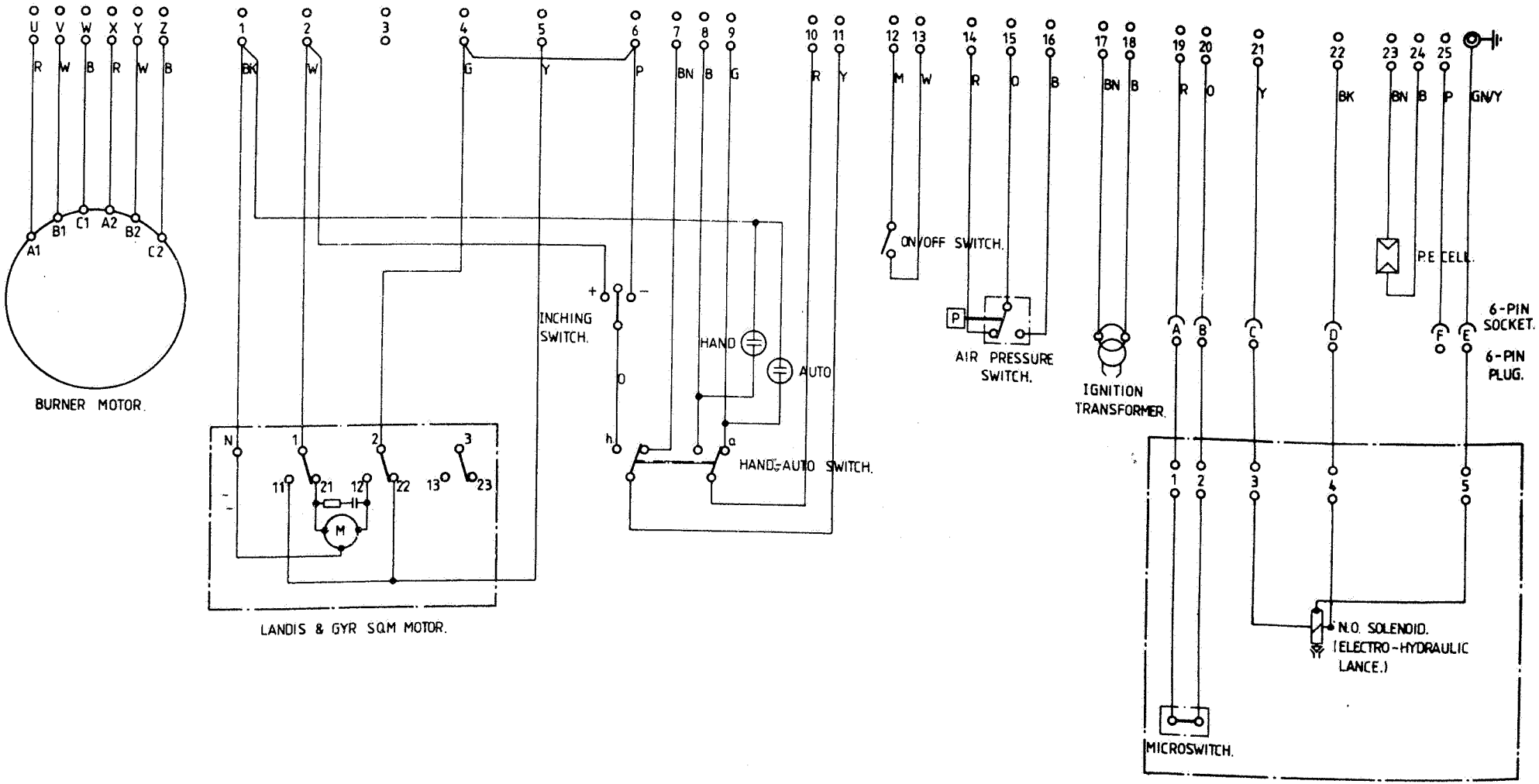
CONNECTIONS FOR PUMPING & HEATING UNIT.

DRAWING No.

WA4-6636


PUMPWAS & HEATING UNIT SEE DRG WAA-0536
BURNER WIRING SEE DRG WA3-9197

WAO-7195



BURNER WIRING FOR PF.4,5,6,7 & 8 MODULATING

DRG. No. WA3-7187/2

BURNER SETTING RECORD

1. Burner Type .....

2. Burner Specification .....

3. Nozzle Type and Size Reference .....

4. Pump Pressure - Bar .....

5. Low Flame Spill Pressure - Bar .....

6. High Flame Spill Pressure - Bar .....

7. Turn-Down Ratio .....

8. Oil Throughput Kg/H .....

9. % CO_2 High Flame .....

10. % CO_2 Low Flame .....

11. Smoke Number H/F .....

12. Smoke Number L/F .....

13. °C Oil Temperature (Pre-Heater) .....

14. Date of Commissioning .....

This form must be completed by the Commissioning Engineer

The following information should be completed and used in any communication concerning your Burner.

SERIAL NUMBER: .....

SPECIFICATION NUMBER: .....

European Boiler Efficiency Directive (B.E.D.)

All burners and boiler bodies supplied separately should comply with European Standard BS EN267 (oil burners) or BS EN676 (gas burners) and BE EN303/1 (boiler bodies).

Burner adjustments must be made to ensure that measurements of flue gas temperature, CO_2 and O_2 concentrations and average water temperature are in accordance with the boiler manufacturers instructions.

RJA/JC/8.6.98/AH

Nu-way policy is one of continuous improvement. The right to change prices and specifications without notice is reserved.

BOILERHOUSE INSTRUCTIONS
PF BURNERS

These instructions are provided for the benefit of the operator and are intended to be of assistance in making minor adjustments and providing the burner with proper maintenance, cleaning and lubrication. Additional information can be obtained through your installer or from the manufacturer.

BOILERHOUSE VENTILATION
It is most important that the boilerhouse has an adequate supply of fresh air for both ventilation and combustion purposes.

PUMP BLEEDING
If the fuel tank is allowed to drain completely it will be necessary to bleed the oil pump free of air by slackening the plug in the pressure gauge port allowing oil to run through until air free. (See pump instructions.)

OIL FILTRATION - SEDIMENT REMOVAL
There is an oil strainer inside the body of the fuel pump and a separate oil filter between the oil pipe from the tank and the oil burner. The oil strainer should be removed and cleaned with paraffin during the pre-season check-up. At the same time the oil filter cartridge should be replaced or cleaned, as appropriate for the type fitted. Bleed fuel pump free of air, as described above, to remove any trapped air.

Draw off any accumulation of water or sediment in the fuel tank by opening the sludge cock in the tank bottom, immediately before any new delivery of fuel. Do not run the burner while the tank is being refilled and, if possible, do not restart for one hour after refilling is concluded.

NOZZLE CLEANING
Nozzles cleaned as required see maintenance photographs. Replace after 5000 hours service.

STARTING AND STOPPING
Start the burner by setting the thermostat pointer to a figure which is higher than the room or water temperature. Stop the burner by setting the thermostat to a point below this temperature.

The burner may set itself in the 'Safety Lockout' position — this will occur if the burner stops for any reason other than the action of the thermostat — and must then be restarted by pressing the reset button on the flameguard/sequence control. Ask your installer to instruct you in the proper method of resetting. If frequent resetting becomes necessary, call the service engineer whose name and address should be inserted below.

Do not attempt to start the burner when the fire-box may be full of oil vapour. It is desirable to allow the furnace to cool for about 15 minutes before resetting the control to restart the burner from the 'Lock-out' position.

EMERGENCY STOP
The burner can be stopped in emergency by opening the wall switch provided on the line between the burner and the electric supply. The installer must identify this switch.

CHECKING BURNER OPERATION
Inspect burner flame periodically. If it becomes lopsided or smokey, call a service engineer.

When cleaning the room housing the heater unit, always switch off the burner to reduce the amount of dust and lint drawn in through the air inlet.

SUMMER CARE, AUTUMN RESTART
During the summer months, or whenever heat is not required over a considerable period, the wall switch may be opened. To restart the burner it is only necessary to close this switch.

At the close of the heating season have the furnace cleaned and flues swept. See that the complete burner plant, especially the electric ignition system, nozzle, oil filter etc., is checked over and cleaned by a competent service engineer.

PREVENTIVE MAINTENANCE
Consult your heating engineer for advice on regular preventive maintenance intervals. It is not possible to recommend a service interval for universal use since operating conditions vary widely from installation to installation.

CAUTION
Never burn rubbish or refuse in the heater fire-box. Never leave waste paper or rags lying around near the burner or the heater.

INSTALLER.....

NAME.....

ADDRESS .....

.....

FOR SERVICE TELEPHONE .....

NIGHTS, SUNDAYS OR HOLIDAYS .....

.....

TELEPHONE.....

NU-WAY

MODEL

PF

BURNER CODING

Example P F 5 X G 10

Burner type

Casing size

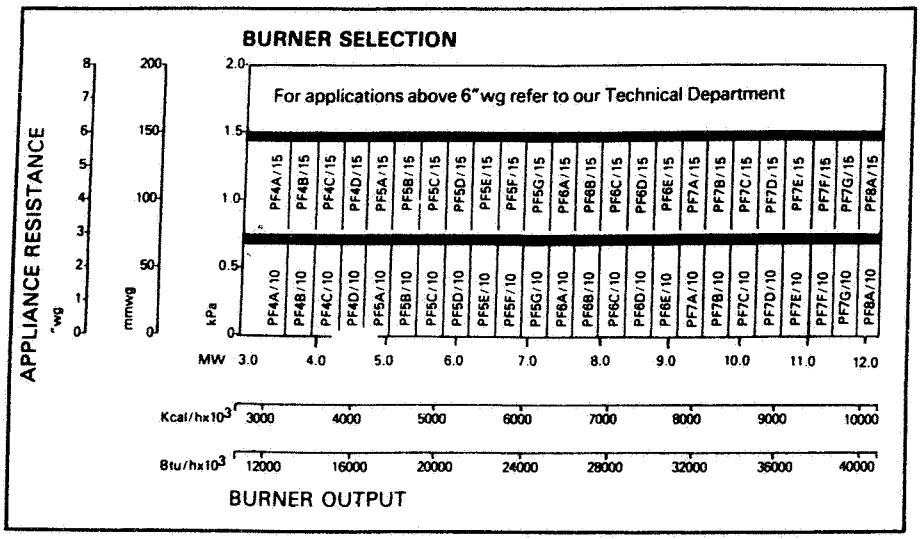
Oil type (residual extra heavy).

Throughput code

Fan pressure designation

This chart is a guide to burner selection only. For advice on individual applications please consult the Technical Department.

BURNER SELECTION



ELECTRICAL & TECHNICAL DATA

Burner Model	Standard Fan Motor /10 Model		Standard Fan Motor /15 Model		Standard Pump Motor Distillate Fuel		Standard Pump Motor Residual Fuel		Pr-heater Residual Fuel Fuel only kw	Required Oil Circulating Rate Distillate Oils litres/hr	Required Oil Circulating Rate Residual Oils litres/hr
	kw	hp	kw	hp	kw	hp	kw	hp			
PF4A	5.5	7.5	7.5	10	1.5	2.0	1.5	2.0	15	1000	600
PF4B	5.5	7.5	7.5	10	1.5	2.0	1.5	2.0	18	1000	600
PF4C	7.5	10	11	15	1.5	2.0	1.5	2.0	18	1000	600
PF4D	7.5	10	11	15	3.0	4.0	1.5	2.0	21	1300	600
PF5A	7.5	10	11	15	1.5	2.0	1.5	2.0	21	1300	1100
PF5B	11	15	11	15	1.5	2.0	1.5	2.0	24	1300	1100
PF5C	11	15	11	15	1.5	2.0	1.5	2.0	24	1950	1100
PF5D	11	15	11	15	1.5	2.0	1.5	2.0	27	1950	1100
PF5E	11	15	11	15	3.0	4.0	3.0	4.0	27	1950	1200
PF5F	11	15	11	15	3.0	4.0	3.0	4.0	30	1950	1200
PF5G	11	15	11	15	3.0	4.0	3.0	4.0	30	1950	1200
PF6A	11	15	11	15	3.0	4.0	3.0	4.0	33	1950	1200
PF6B	15	20	15	20	3.0	4.0	3.0	4.0	33	1950	1200
PF6C	15	20	15	20	3.0	4.0	3.0	4.0	36	1950	1200
PF6D	15	20	22	30	4.1	5.5	3.0	4.0	36	3000	1200
PF6E	15	20	22	30	4.1	5.5	3.0	4.0	42	3000	1200
PF7 F G											
PF7A	15	20	22	30	4.1	5.5	4.1	5.5	42	3000	1450
PF7B	15	20	22	30	4.1	5.5	4.1	5.5	42	3000	1450
PF7C	15	20	22	30	4.1	5.5	4.1	5.5	42	3000	1450
PF7D	15	20	22	30	4.1	5.5	4.1	5.5	48	3000	1450
PF7E	22	30	22	30	4.1	5.5	4.1	5.5	48	3000	1450
PF8A											

NU-WAY *Leaders in Burner Technology*

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ISO 9001
EN 29001

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Ann Harris

From: D.V.RAJASEKHAR. [r_danday@rediffmail.com]
Sent: 29 March 2010 17:37
To: Information
Subject: Enquiry from Nu-way Ltd web site

Date: 29 March 2010 17:36:49
Name: D.V.RAJASEKHAR.
Telephone: 04427482415
Email: r_danday@rediffmail.com
Address: No-12,rohini,DAETOWN SHIP,KALPAKKAM.TN.603102
Postcode: 603102
Enquiry:
Sir, i requst you that ple send nu-way.P.F.model burner assembly,mannuval and electrical and total technical data.with electrical dia gram.chart etc. thankyou

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