LIGNE PILOT

DOSSIER

TECHNIQUE

FREEZER

APV

MF 50

&

FREEZER

APV

MF 100

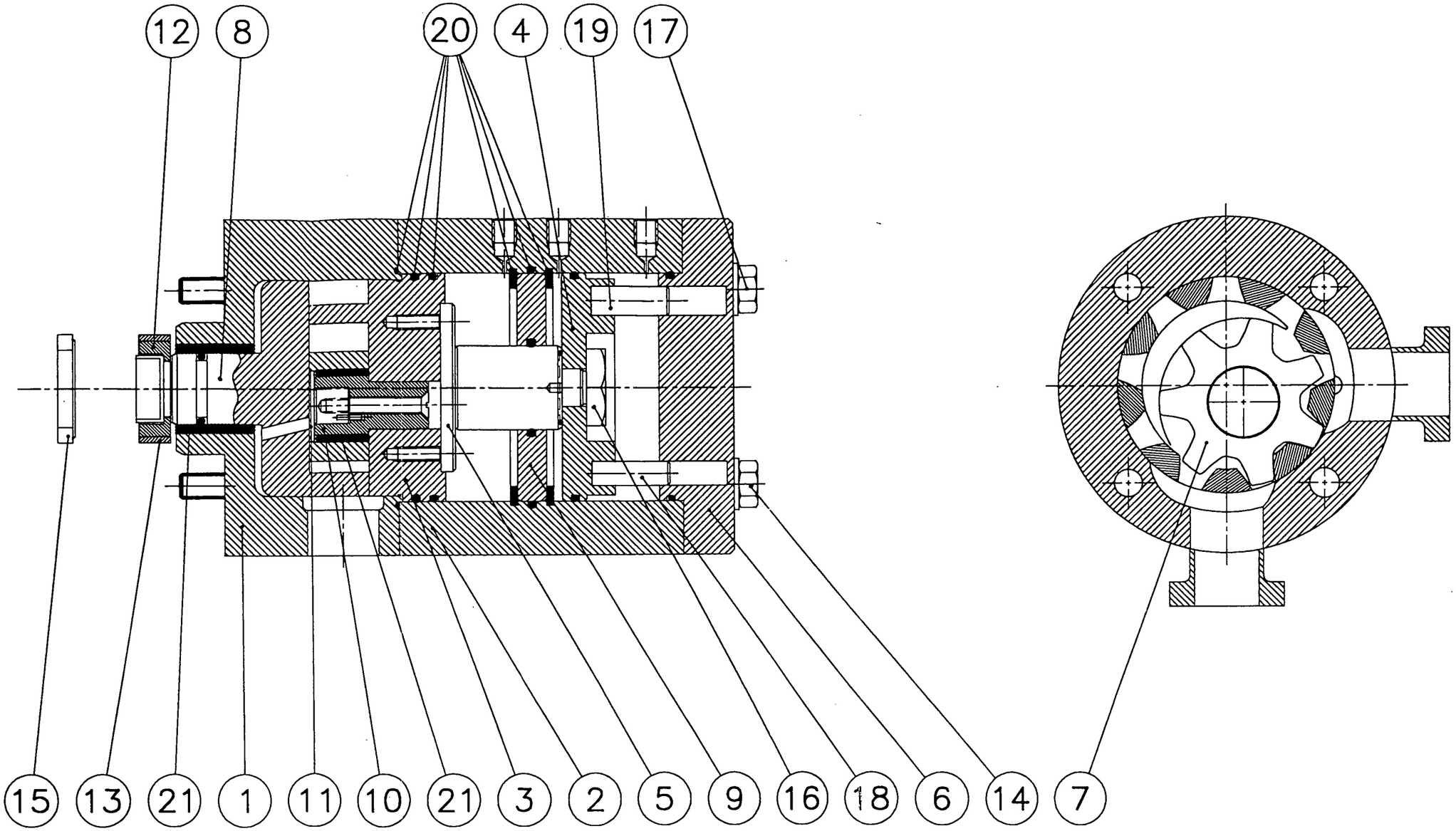
MAINTENANCE

D. STEPHAN

APV Technohoy

TP 1 PUMP C 21527

POS.NO.:	DESIGNATION:	NUMBER:
1.	Pump housing	1
2.	CIP-cylinder	1
3.	Crescent-shaped insertion	1
4.	Guide	1
5.	Impeller	1
6.	Piston	1
7.	End cover	1
8.	Star wheel	1
9.	Dividing plate	1
10.	Shaft	1
11.	Lock-nut	1
12.	Cup-shaped locking device - 1 set = 2 pcs.	1 set
13.	Fitted ring	1
14.	Bolt	3
15.	Clearance feeler	1
16.	Bolt - large	1
17.	Guide pin - ø10	1
18.	Guide pin - ø8	1
19.	Set of gaskets	1 set
	- Comprises: 9 O-rings	
	2 Seeger rings	
20.	Set of bearings	1 set
	- Comprises: 2 Carbon bearing bushes	
	1 Tool	



TECHNOHOY CARL HOYER A/S — AARHUS – DENMARK	Skala	Tegn.	JS
		Dato	24.11.92
Reservedelstg. pumpe TP2 Spare parts drawing for pumps TP2 Ersatzteilzeichnung uber Pumpen TP2 Plan des pieces detachees des pompes TP2		C 21528	

APV Technohoy

TP 2 PUMP C 21528

POS.NO.:	DESIGNATION:	NUMBER:
1.	Pump housing	1
2.	CIP-cylinder	1
3.	Crescent-shaped insertion	1
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10.	Shaft	1
11.	Lock-nut	1
12.	Cup-shaped locking device - 1 set = 2 pcs.	1 set
13.	Fitted ring	1
14.	Bolt	3
15.	Clearance feeler	1
16.	Nut	1
17.	Bolt - large	1
18.	Guide pin - ø10	1
19.	Guide pin - ø12	1
20.	Set of gaskets	1 set
	- Comprises: 9 O-rings	
	2 Seeger rings	
21.	Set of bearings	1 set
	- Comprises: 2 Carbon bearing bushes	
	1 Tool	

SPARE PARTS

When ordering spare parts for your Technohoy Continuous Ice Cream Freezer, please always state Machine Type, Machine Serial Number, Drawing Number and Figure Number.

EXAMPLE:

MF 50 Number 42, Drawing C 3100. Position Number 7.

Weight net.

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GENERAL INFORMATION

The TECHNOHOY Ice Cream Freezers MF 50, MF 75, MF 100, MF 100L, MF 200 and MF 300 are self-contained, units with built-in refrigerating systems. The MF 300 Twin-Freezer functions as two selfcontained MF 300 single freezers in one frame.

WORKING PRINCIPLE

The ice cream mix is metered into the freezing cylinder by a positive pump, and a constant flow of air is fed in together with the mix. During the passage through the cylinder the air is whipped into the mix by the action of a rotating mutator. Liquid Freon 502, evaporating in the cooling jacket, surrounding the freezing cylinder, supplies the refrigeration. Hardened scraper blades of the best quality, hinged to the mutator, scrapes off the ice cream, continuously as it freezes on to the inside cylinder wall. Whipping and freezing takes place under air pressure, which can be regulated to obtain the desired overrun. A second pump forwards the finished product from the outlet of the cylinder to the discharge piping. The flow of liquid Freon is regulated by an automatic thermovalve, and the evaporating pressure and temperature is regulated by an automatic back pressure regulator.

The smallest model, MF 50, which is designed primarily for laboratory purposes, has a variable speed drive for the mutator, allowing any speed between app. 400 and 1000 r.p.m.

The mutator in the MF 50 is of a special flat and solid design. The freezer has a flowmeter with flowcontroller, which makes it possible to check the constancy of the airflow.

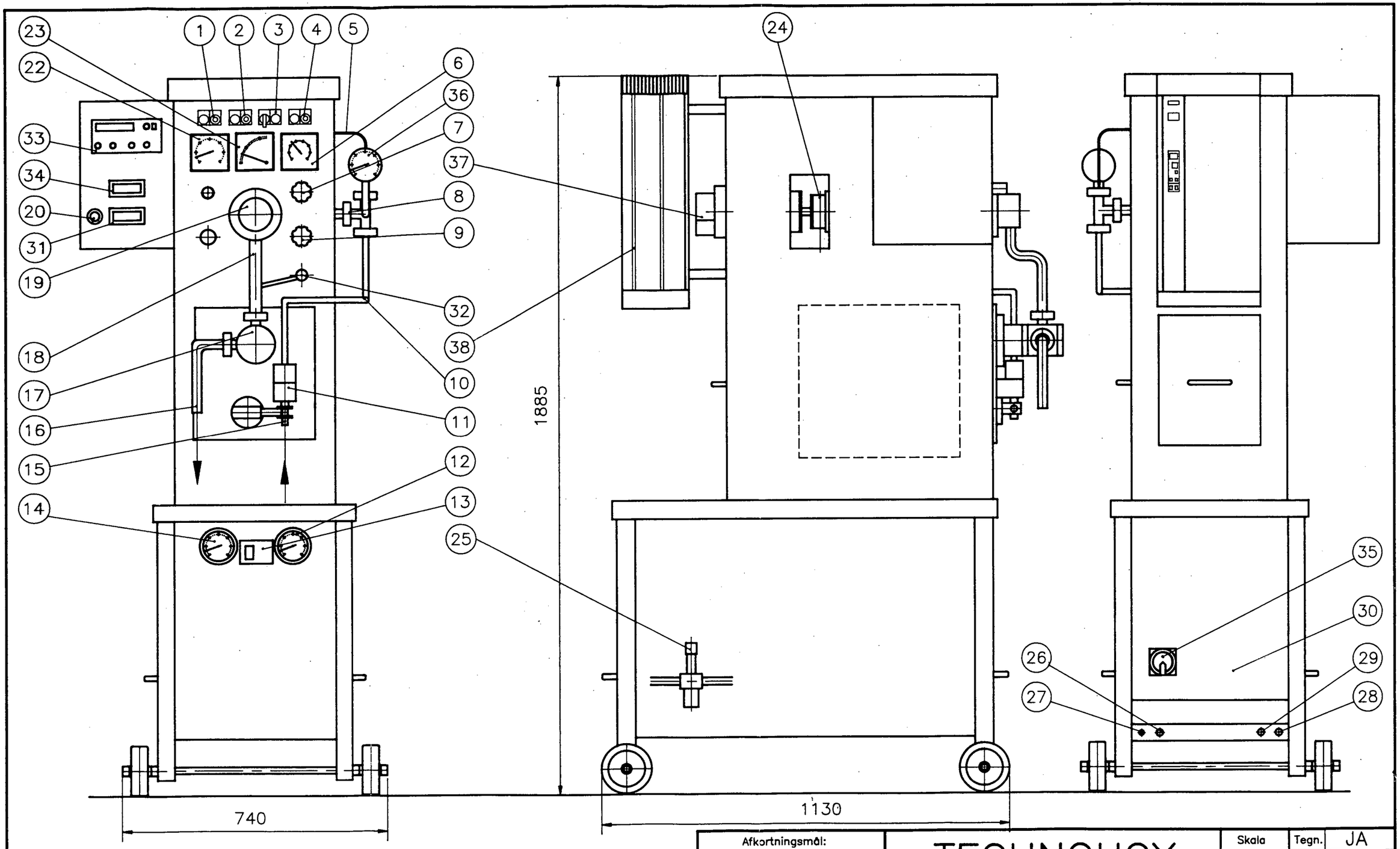
OPTIONAL EQUIPMENT

AS AN OPTIONAL, all MF Freezers can be delivered with a frequency converter for regulation of the mutator speed.

Technohoy product description

Technohoy
CARL HOYER A/S

April 1990. TECHNICAL DATA for standard models		MF 50 Laboratory freezer	MF 75 Spec. production f.limited output	MF 100 Production freezer	MF 100 L Production freezer	MF 200 Production freezer	MF 300 Production freezer
Nominal output	l/h	20 - 100	30 - 160	60 - 300	84 - 420	100 - 550	150 - 650
	Imp. Gall	4.5 - 22	7 - 35	13 - 66	19 - 92	22 - 121	33 - 154
	U.S. Gall	5.5 - 27	8 - 42	16 - 79	22 - 111	27 - 145	40 - 185
Evap./condensing temperature	°C	-25 / + 40	-25 / + 40	-25 / + 40	-25 / + 40	-25 / + 40	-25 / + 40
	°F	-13 / + 104	-13 / + 104	-13 / + 104	-13 / + 104	-13 / + 104	-13 / + 104
Refrigerating effect	W	6000	10700	13440	16000	16000	20600
	kcal/h	5160	9202	11558	13760	13760	17700
Surface freezing tube	cm^2	628	942	1885	2639	3769	4882
Compressor motor	kW	2.2	5.5	7.5	9.2	9.2	11.0
Electric main motor	kW	2.2	3.0	5.5	7.5	7.5	7.5
Electric pump motor	kW	0.37	0.37	0.55	0.55	0.55	0.75
Power connection (standard)		3 x 380V, 50 c/s	3 x 380V, 50 c/s	3 x 380V, 50 c/s	3 x 380V, 50 c/s	3 x 380V, 50 c/s	3 x 380V, 50 c/s
Mix - inlet piping	øi mm	10.0	10.0	16.0	16.0	16.0	25.0
Ice cream outlet piping	ø mm	25.0	25.0	38.0	38.0	38.0	38.0
Air connection	ø inch	3/8	3/8	3/8	3/8	3/8	3/8
Air consumption	l/h	50	80	150	210	275	350
Required air pressure	bar	7	7	7	7	7	7
Water req. app. (max. +25°C)	l/h	350	600	1100	1560	1725	1800
Required water pressure	bar	3 - 4	3 - 4	3 - 4	3 - 4	3 - 4	3 - 4
Water inlet connection	ø inch	1/2	1/2	3/4	3/4	3/4	3/4
Water outlet connection	ø inch	1/2	1/2	3/4	3/4	3/4	3/4
Mutator speed, 50 c/s	rpm	400 - 1000	600	430	430	300	300
OPTIONAL mutator speed	rpm		200 - 600	200 - 600	200 - 400	200 - 400	200 - 400
Standard mutator		Solid mutator	Solid mutator	Open type mutator	Open type mutator	Open type mutator	Open type mutator
OPTIONAL equipment			Open type mutator	Solid mutator	Solid mutator	Solid mutator	
Mix pump		Piston type	Piston type	Piston type	Piston type	Piston type	Positiv
Ice cream pump		Rotary piston type	Positiv	Positiv	Positiv	Positiv	Positiv



Afkortningsmål:	
Antal	Dimension

TECHNOHOY

CARL HOYER A/S AARHUS – DENMARK

MF 50

Materiale

Maskintype MF

Skala	Tegn.	JA
	Dato	30.10.90

~~C 10813~~

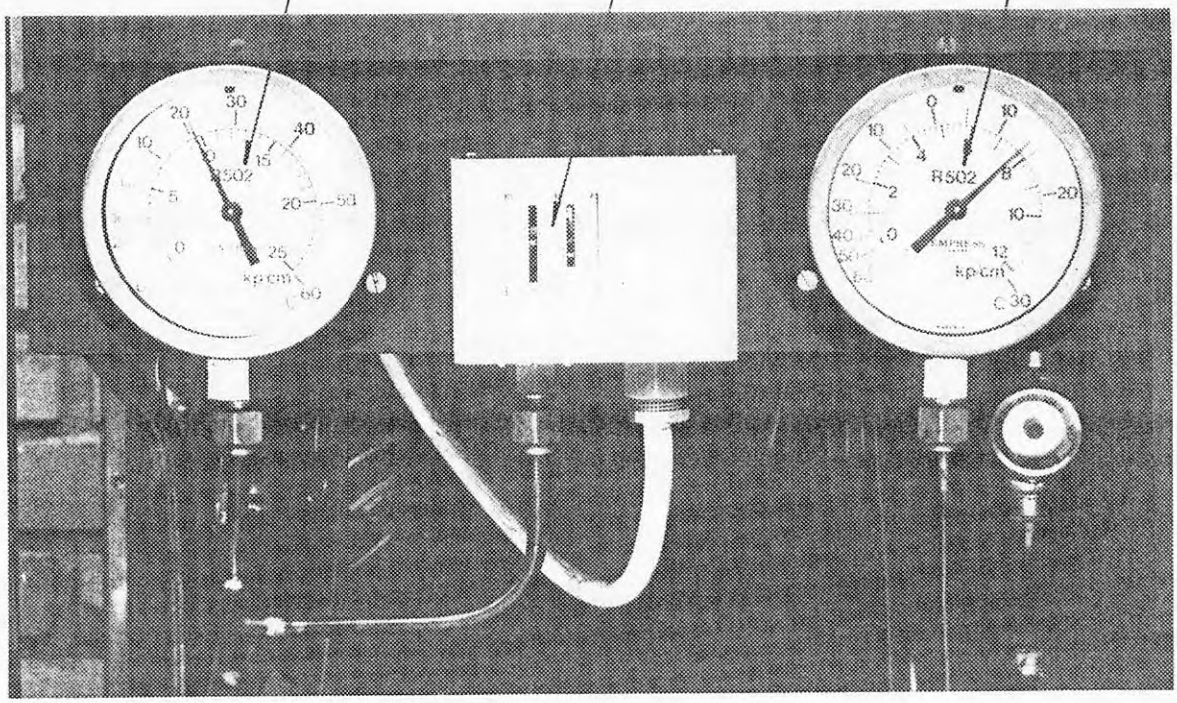
C 16440

DRAWING C 16440

1. Start and stop of pump motor
2. " " " " main driving motor
3. " " " " CIP or air compressor (IF ANY)
4. " " " " refr. compressor
5. Air connection to cylinder
6. Compound pressure and temperature gauge for Freon
7. Back pressure regulating valve
8. Tee in mix line with non-return valve
9. Pump speed regulator
10. Mix line
11. Mix inlet pump
12. Suction pressure gauge
13. Pressure control
14. Condensing pressure gauge
15. Mix connection
16. Ice cream outlet pipe
17. Ice cream outlet pump
18. Vertical ice cream pipe
19. Front cover of freezing cylinder
20. Speed regulation of mutator
21. Air pressure regulating valve (IF ANY)
22. Air pressure gauge
23. Amperemeter for main driving motor
24. Rear end cylinder cover with rotary shaft seal
25. Water regulating valve
26. Screwed connection for electrical cable
27. Air inlet
28. Water outlet
29. Water inlet
30. Main current cabinet
31. Digital thermometer
32. Sensor for digital thermometer
33. Flowmeter/Control and read out equipment
34. Tachometer

35. Main switch / Circuit interrupter
36. Pressure gauge for measuring the cylinder pressure
37. Encoder
38. VLT - Frequency converter for regulation of mutator

Del af _____ Type _____



	Technohøy CIVILINGENIØR O·G·HØYER AARHUS - DANMARK	Konstr. 09.12.1982. Tegn. C. Høyer Godk.
Målestok: Materiale:	Temperature gauges F-502	Tegning nr.: D 5431

Alle mål uden tolerance ± mm

H.M.(09) 162727

INSTALLATION

The freezer is completely self-contained and needs only connections for electricity, cooling water, compressed air and ice cream mix, to be ready for operation. To take full advantage of this system, the freezer is equipped with transport wheels and can easily be moved from one location to another in the factory.

ELECTRIC CONNECTION

The freezer - standard model is built with a three phase ac system for 380V, 50 c/s with earth connection, BUT NO O-CONDUCTOR. For safety reasons all control circuits are fed from a transformer to 24 volts.

AS AN OPTIONAL, all MF Freezers can be delivered with the required voltage and frequency.

A main current cabinet contains fuses and starters with overload protection. A flexible cable, with four cores of ample size to comply with local regulations, should be drawn through the screwed connection 26 on drawing C 16440, and from there to another screwed connection in the bottom of the cabinet. The three phases in the cable should be connected to the main switch / circuit interrupter L1, L2, L3 and ground terminals.

AIR CONNECTION

A supply of clean, dry air under a pressure of 7 bar should be provided. Normally the air is taken from an existing supply system but, as an alternative, the freezer can be supplied with an oil-free, built-in air compressor of the diaphragm type.

An air filter and a water filter can be supplied as optional extra.

WATER CONNECTIONS

The inlet and outlet for cooling water have adaptors for rubber water hoses. A water pressure of 3-4 bar is required.

CONNECTION FOR MIX

This connection must be made with utmost care to obtain trouble free operation. It is essential, that the mix is fed to the inlet of the mix pump under positive pressure. This can be obtained by placing the mix tank at a higher level than the inlet of the mix pump, so that the mix can flow to the pump by gravity alone. Should this not be possible, it is recommended to install a centrifugal booster pump, which then can be used for CIP-cleaning also. The important thing is to avoid sub-atmospheric pressure in the mix line AND THEREBY TO PREVENT THE INTAKE OF AIR THROUGH POSSIBLE LEAKS, which would make accurate control of the overrun impossible.

CONNECTION FOR ICE CREAM

It is important to keep the outlet piping as short as possible and to avoid to make reductions in diameter relative to the size of the outlet of the discharge pump. Never use insulated ice cream pipes.

Concerning the working conditions for the outlet pump, please see the enclosed pump manual.

THE BUILT-IN REFRIGERATING SYSTEM

Is charged with the proper amount of refrigerent, Freon, and compressor oil. Normally no adjustment are required before initial starting up. The Freon pressure gauges 12 and 14 should, by standstill, show a temperature close to the temperature of the surroundings.

If however the gauges show zero pressure, it is an indication, that the freezer has been damaged during transport with loss of the Freon charge as consequence.

If that is the case, a competent refrigerating engineer should be called to find and repair the leak, and recharge the system with Freon. **Freon type indication is stated in "Refrigeration components IV-07".**
NO OTHER REFRIGERANT MUST EVER BE USED.

PREPARATIONS BEFORE THE FIRST START

BEFORE ATTEMPTING TO START ANY OF THE ELECTRIC MOTORS THE FIRST TIME, THE MUTATOR SHOULD BE REMOVED FROM THE FREEZING TUBE. To do this, remove the connecting pipe, 18 on C 16440. Then turn the cylinder head 1/12 of a revolution anti-clock-wise, by hand. NEVER USE THE CONNECTING PIPE AS A HANDLE ! It could very easily be damaged, with leaking o-ring joints as consequence. The head of the freezing cylinder can now easily be removed and the mutator be pulled out.

Now start the pump motor. The direction of rotation according to the arrow on the pumpgear, should be checked. THE ROTATION SHOULD BE CLOCKWISE.

The direction of rotation can be changed by interchanging the cable connections at the terminals L1 and L2.
Please see enclosed Wiring Diagram

The main motor rotation can only be changed in the motor connecting box or in the output terminal in the VLT. The rotation of the main shaft must be ANTICLOCKWISE, when seen through the freezing cylinder.

Remove the piston from the mix pump by removing the pin and pushing back the yoke. Reinsert the pin in the next hole in the yoke. Remove the mix pipe between mix pump and tee, 10 on drawing C 16440. Unscrew the other two connections of the tee. The rear end cylinder cover with rotary shaft seal can now be removed.

Leave the non-return valve connected to the air hose and make a preliminary test of the air system by turning the knob CHANNEL-1 on the flowmeter clockwise, until the air pressure gauge responds. At about 0.5 - 1 bar, the non-return valve should start to blow. Clean all the parts and reinstall them.

An edible lubricating grease should be used for the shaft seal, the bearings and whereever parts move one against the other.
The spring should be able to move the seal ring on the shaft, after having been compressed. Also use this lubricant to keep the O-rings in place in their groves. It facilitates assembly and avoids damage to the O-rings.

ADJUSTING OF DIGITAL THERMOMETER

The digital thermometer is adjusted (by an adjusting screw, please see enclosed wiring diagramm) by comparing it to a reference thermometer of a known liability. This is done in an ice water solution at 0°C. The display must at this temperature show 0.0°C.

STARTING THE FREEZER

1. The VLT regulator should be placed more than 60% before starting the main motor in order to have sufficient torque.

2. Make sure that there is an adequate amount of mix in the mix supply tank.

3. Start the pumps and set the pump speed regulator at a low capacity.

4. Wait until mix comes out of the discharge pipe. Then start the main motor.

5. Start the refrigerating compressor and set the evaporating temperature at about -15o to -20o C. Wait for about 2 minutes to cool down the cylinder.

6. Raise the air pressure slowly from 0 to about 4 bar.

The freezer is now in operation. Wait until the product comes out in a constant flow before making further adjustments.

First considerations are overrun and stiffness.

Check the overrun by weighing a known volume, for instance 1.0 l. For ice cream of normal composition the liter weight should be around 550 g. The overrun is increased by increasing the air pressure, and vice versa. Stiffness is depending on the Freon evaporating temperature and the throughput of ice cream. The lower the evaporating temperature and the lower the throughput, the stiffer the product will be.

When stiffness is increased, the load on the main motor is also increased, which is reflected by a higher reading of the motor amperemeter.

When increasing stiffness, the motor amperemeter should therefore always be under careful observation to avoid overloading the motor, which eventually might result in so called freeze-up. See later.

Now increase pump speed to obtain higher output, if so desired. This will have a negative effect on stiffness, which must be compensated for by lowering the evaporating temperature. By repeating these alternating adjustments, the desired output and overrun can be reached within the capacity of the freezer. Overrun will vary simultaneously with variations in output and stiffness. Check the overrun and adjust the air pressure accordingly. Output cannot be increased beyond a certain point determined by mix recipe, and the capacity of the refrigerating compressor. This point has been reached, when the evaporating temperature cannot be driven further down. The back pressure regulating valve in the refrigerating system is then wide open. The Freon pressure gauges 6 and 12 on drawing C 16440 will then show nearly the same evaporating temperature.

Adjustments should always be made one at a time, and sufficient time should be allowed for observation of the effect, before the next adjustment is made.

When ice cream outlet temperature goes lower than -6o C to -7o C, be careful not to have a "freeze-up".

STOPPING THE FREEZER

To stop the freezer proceed as follows:

1. Stop the refrigerating compressor.

2. Turn the knob CHANNEL-1 on the flowmeter slowly until the air pressure gauge reads zero.

3. Wait until the product becomes liquid and the amperemeter shows no-load current.

4. Stop the main driving motor.

5. Stop the pumps.

IT IS IMPORTANT, THAT THIS SEQUENCE IS FOLLOWED CLOSELY

DAY TO DAY RUNNING OF THE FREEZER

The freezer should produce ice cream with uniform stiffness and overrun. It should be possible to obtain the desired values by using the controls on the freezer correctly. It is essential for close overrun control, that the pressure in the inlet of the mix pump is constant and positive. In this way intake of false air is avoided, through possible leaks in the mix line. See page II-05

The experienced operator always keeps a keen eye on his instruments, because they reflect the inner life of the freezer. The air pressure gauge response to adjustments of the air pressure must be immediate. If also the non-return valve is in good condition, one can be reasonably sure, that the air system is in order.

The amperemeter shows the load condition of the main driving motor. The motor load depends on, how hard freezing is, i.e. how low the Freon evaporating temperature is, and how high the throughput is. When adjusting the Freon temperature, or the throughput, downwards, follow the increase of the ampere reading. THERE IS ALWAYS A POTENTIAL RISK OF OVERLOADING THE MOTOR. Eventually the V-belts may slip or the thermal overload protection may stop the motor. In either case a "freeze-up" is a reality.

The amperemeter has one more important function. Besides the slow, smooth movement of the needle, caused by changes in the evaporating temperature, fluctuations of the mix temperature, varying throughput etc. the needle can also show quick and abrupt movements.

They are an indication, that the scraper blades do not function properly. They do not scrape to the bottom all the time, but slide over a thin film of ice cream, frozen to the cylinder wall, especially if the evaporating temperature is very low, until they suddenly cut through to the cylinder wall again, which causes a jump in the motor current. If these jumps get very pronounced, the scraper blades should be inspected and reconditioned. See later.

The third instrument is the compound gauge showing both the evaporating pressure and the evaporating temperature. For the operation of the freezer, only the evaporating temperature is of interest. It is not possible to say, what the evaporating temperature should be. The lower throughput, the stiffer the ice cream, the lower freezing point of the mix the lower the evaporating temperature has to be.

On the following two pages some typical questions and answers are tabulated.

Product too soft	Evaporating temperature too high	Back pressure reg. valve not opened enough	Open valve to lower evaporating temperature
		Compressor loaded to full capacity	Reduce pump capacity
		Setting of thermoexpansion valve incorrect	Readjust valve See valve instructions, included
		Compressor capacity diminished	See maintenance instruction for compressor, included
	Scraper blades worn		Recondition blades. See IV-14
	Mix temperature too high		Reduce mix temperature
	Freon charge insufficient		Replenish Freon charge **Freon type indication is stated in refrigeration components IV-07.** Freon charge: See label attached to the condenser
	Freezing point of mix too low		

Overrun too low	Air pressure too low		Adjust flowmeter
	Pump ratio not correct		Adjust pump ratio IV-05 or contact Technohoy
	Finished product too cold or too warm		Try with different product outlet temperatures
	Lack of correct overrun additives		
Overrun too high	Air pressure too high		Adjust flowmeter
	Air leaks in the mix line		See II-04
	Too much rework in the mix tank		Use only freshly prepared mix
Overrun unsteady	Air leaks in the mix line		
	Too much rework in the mix tank		Use only freshly prepared mix
Air slugs in the finished product	Too much rework in the mix tank		Use only freshly prepared mix
	Poor air holding ability of the mix		
	Entering mix too cold		
	Pump ratio not correct		Adjust pump ratio IV-05 or contact Technohoy

Stage	Approx. time min.	Approx. temp. oC
1. Pre-rinse with water. Outgoing water to drain.	7	10 - 15
2. Lye wash - 1% caustic soda solution with wetting agent and phosphate additives. Is returned to tank after use.	12	65 - 70
3. Hot water sterilisation. Water displaces lye and goes to drain after regenerative cooling.	12	90 - 95
4. Water goes to drain and graduate cooling.	--	---

The times mentioned above are normative and the programme is effective from a bacteriological point of view, but it does not prevent hard rinsing water from depositing lime salts.

These can be removed once or twice every season by means of acetic acid or citric acid (PH 3.5 - 4.5) according to the following procedure:

The freezer and the pumps are disassembled and the individual parts are washed in the above mentioned weak acid (max. 100 ppm), and are then immediately after carefully rinsed in clean, cold water and dried.

WARNING! Do not use acidiferous or chlorine-containing detergent apart from the exception referred to.

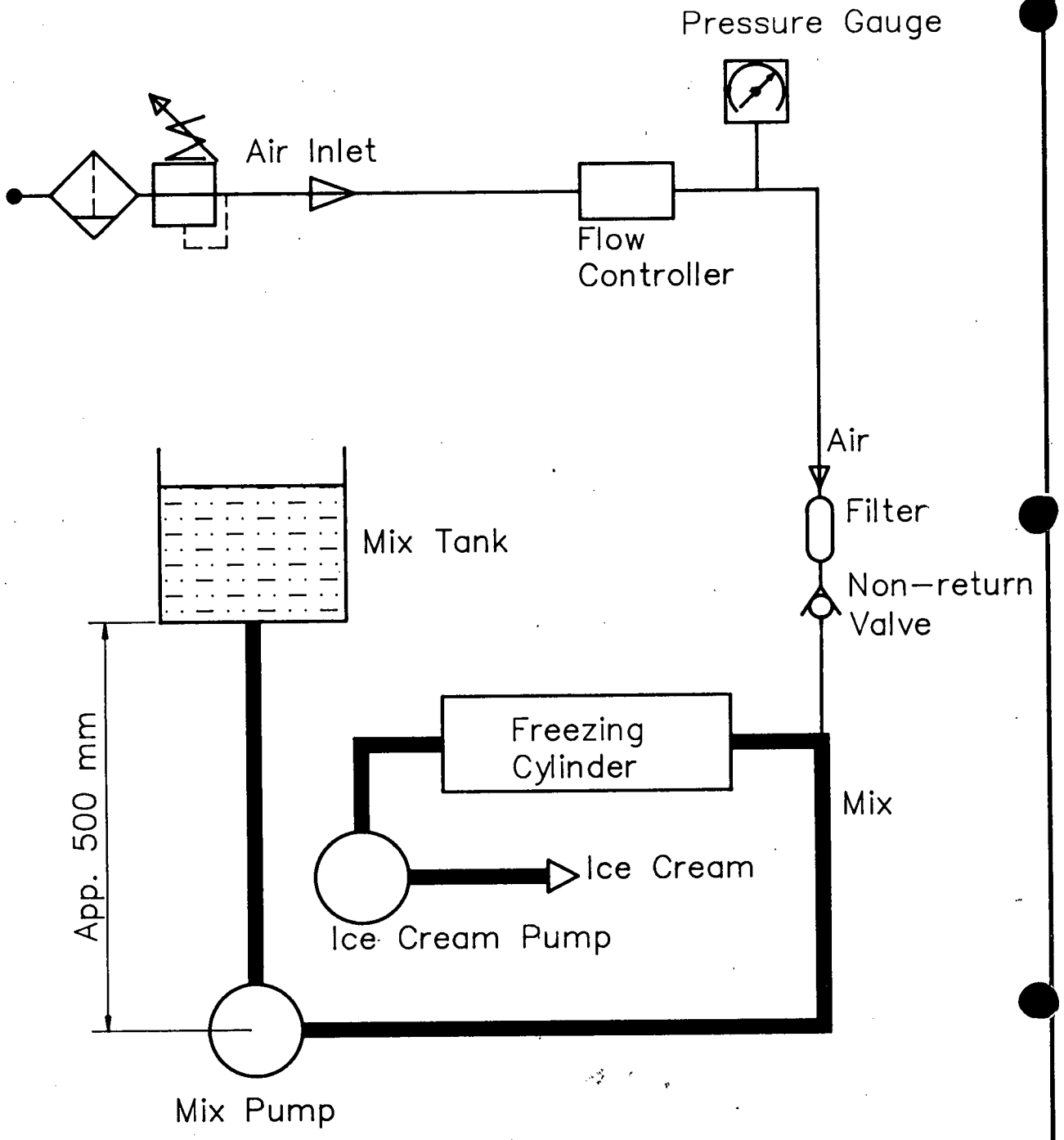
Chlorine pits and makes mutator and scraperblades rust and pits chrome.

Acid attacks chrome!

OVERRUN TABLE - Met. c

Weight in grams of Finished Product in various sized containers (x)			Overrun percent shown for various weights of Mix or Product Input (indicated in grams per liter) (x)			
1/4 Liter	1/2 Liter	1 Liter	1080 grams % overrun	1092 grams % overrun	1104 grams % overrun	1116 grams % overrun
120 gr	240 gr	480 gr	125 %	127 %	130 %	133 %
122 gr	243 gr	485 gr	122 %	125 %	127 %	130 %
123 gr	246 gr	492 gr	120 %	122 %	124 %	127 %
124 gr	249 gr	498 gr	117 %	119 %	121 %	124 %
126 gr	252 gr	504 gr	114 %	117%	119 %	121 %
128 gr	255 gr	510 gr	112 %	114 %	116 %	119 %
129 gr	258 gr	516 gr	110 %	112 %	114 %	116 %
130 gr	261 gr	522 gr	107 %	109 %	111 %	114 %
132 gr	264 gr	528 gr	105 %	106 %	109 %	111 %
134 gr	267 gr	534 gr	102 %	104 %	106 %	109 %
135 gr	270 gr	540 gr	100 %	102 %	104 %	107 %
136 gr	273 gr	546 gr	97 %	100 %	102 %	104 %
138 gr	276 gr	552 gr	96 %	98 %	100 %	102 %
139 gr	279 gr	558 gr	94 %	96 %	97 %	100 %
141 gr	282 gr	564 gr	91 %	94 %	95 %	98 %
143 gr	285 gr	570 gr	89 %	92 %	93 %	96 %
144 gr	288 gr	576 gr	88 %	90 %	91 %	94 %
146 gr	291 gr	582 gr	86 %	88 %	89 %	92 %
147 gr	294 gr	588 gr	84 %	86 %	87 %	90 %
148 gr	297 gr	594 gr	82 %	84 %	85 %	88 %
150 gr	300 gr	600 gr	80 %	82 %	84 %	86 %
151 gr	302 gr	604 gr	78 %	80 %	82 %	84 %
153 gr	306 gr	612 gr	76 %	78 %	80 %	82 %
154 gr	309 gr	618 gr	75 %	77 %	78 %	80 %
156 gr	312 gr	624 gr	73 %	75 %	76 %	79 %
157 gr	315 gr	630 gr	71 %	73 %	75 %	77 %
159 gr	318 gr	636 gr	70 %	72 %	73 %	75 %
160 gr	321 gr	642 gr	68 %	70 %	71 %	74 %
162 gr	324 gr	648 gr	67 %	68 %	70 %	72 %
164 gr	328 gr	654 gr	65 %	67 %	68 %	70 %
165 gr	330 gr	660 gr	64 %	65 %	67 %	69 %
166 gr	333 gr	666 gr	62 %	63 %	66 %	67 %

(x) Before calculating weights, make certain that weight of container is subtracted.



Tolerancer ifølge DS 2075, hvor intet andet er angivet.	Antal	Styklistenr.	Maskine	Evt. bem.

Afkortningsmål:					
Antal	Dimension				

TECHNOHOY
CARL HOYER A/S AARHUS – DENMARK

Skala 1:1

Tegn.	sc
Dato	90.11.08

Ice Cream/Air System

Materiale	Maskintype MF50

D16442

THE ICE CREAM- AND AIR SYSTEM

The TECHNOHOY freezers are continuous freezers, which means that they, unlike batch freezers, have two pumps to supply a continuous and constant flow of ice cream mix to the freezer and to meter the finished product out of the freezer. The air, necessary to obtain the desired overrun, is fed to the inlet end of the freezing cylinder, together with the ice cream mix.

D 16442 shows a schematic diagram of the ice cream- and airsystem. Mix from the supply tank is taken by the mix pump and is pumped to the inlet end of the freezing cylinder.

A build in flowmeter measures the flow of air mixed into the ice cream. An air pressure gauge shows the actual air pressure. The air passes a disposable filter and a non-return valve, and is mixed into the ice cream mix.

In the freezing cylinder air and mix are whipped thoroughly together by the action of the mutator, to form an emulsion with finely divided air bubbles. Simultaneously the mix is cooled down and partly frozen by the contact with the refrigerated cylinder wall. The mutator, which rotates in the cylinder, at a comparatively high speed, serves two purposes. First it performs the just mentioned whipping. Secondly it constantly scrapes off the ice cream, which freezes on to the cylinder wall. For this purpose the mutator is equipped with a set of two scraper blades, hinged in such a way that they can swing out and contact the cylinder wall under the influence of centrifugal force.

The freezing tube is hard chromium plated on the interior surface, to minimize wear of the scrapers.

The finished product passes to the ice cream pump and to the outlet.

Control of overrun is accomplished as an interplay between the capacities of these two pumps and the air pressure, as set by the flowmeter. It is obvious, that the ice cream pump must have a higher capacity than the mix pump. The difference in capacity is made up for by the air, the volume of which is reduced because of the prevailing pressure.

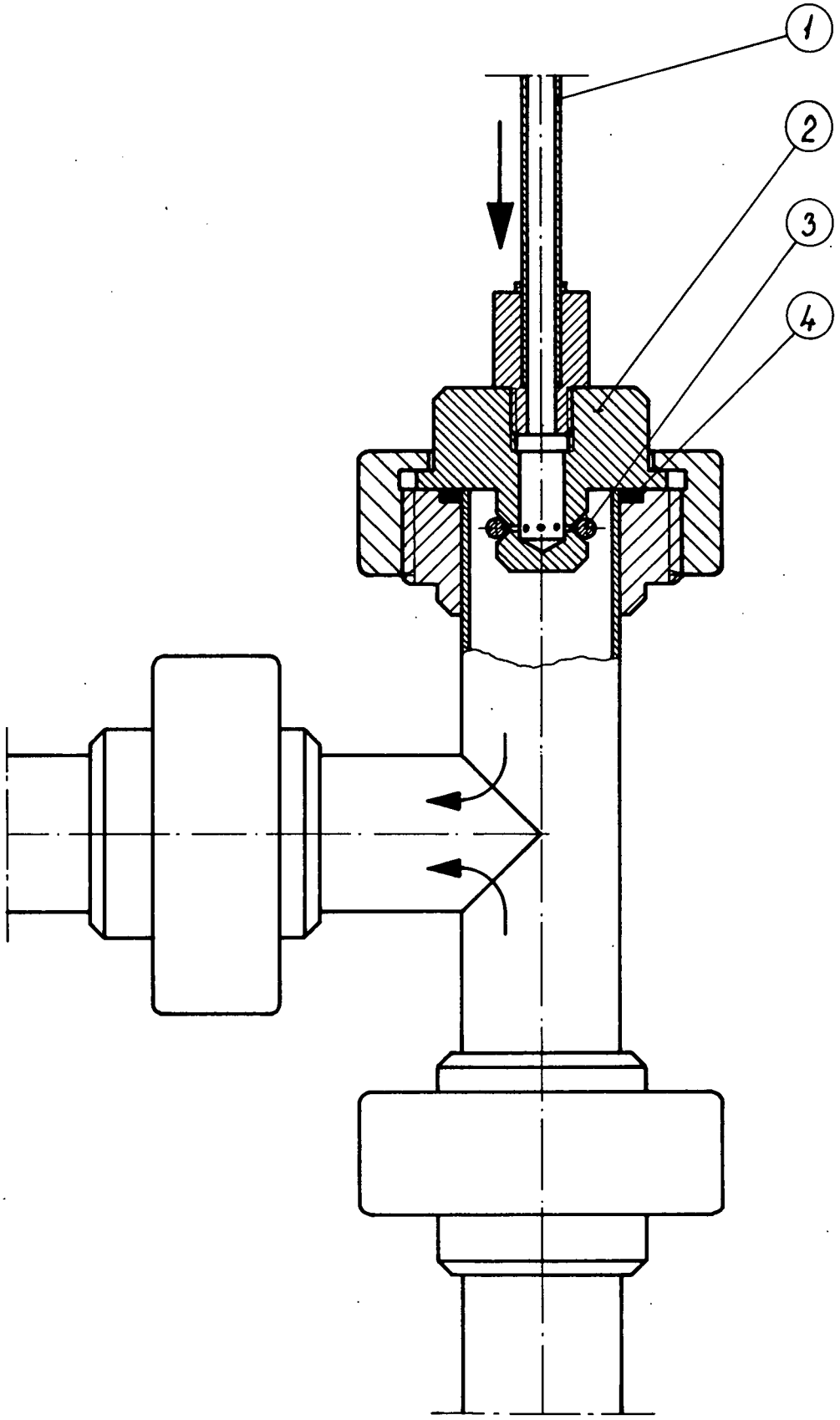
After passage of the second pump the air in the product re-expands to normal volume and gives the product the desired overrun, provided that the air pressure and the difference in pump capacities, pump ratio, were right. These are the two factors by which the overrun can be controlled.

Del af

Type

Firma:

Technology
CIVILINGENIØR O·G·HØYER
AARHUS - DANMARK



Alle mål uden tolerance ++ mm

	Materiale	Model nr.	Lager nr.	Målforhold	Tegn.	78.06.15.
				1:1	Kont.	
	Genstand: T-stykke m/kontraventil.			Tg. nr. D 3141		

HM (09) 16 27 27

NON-RETURN VALVE

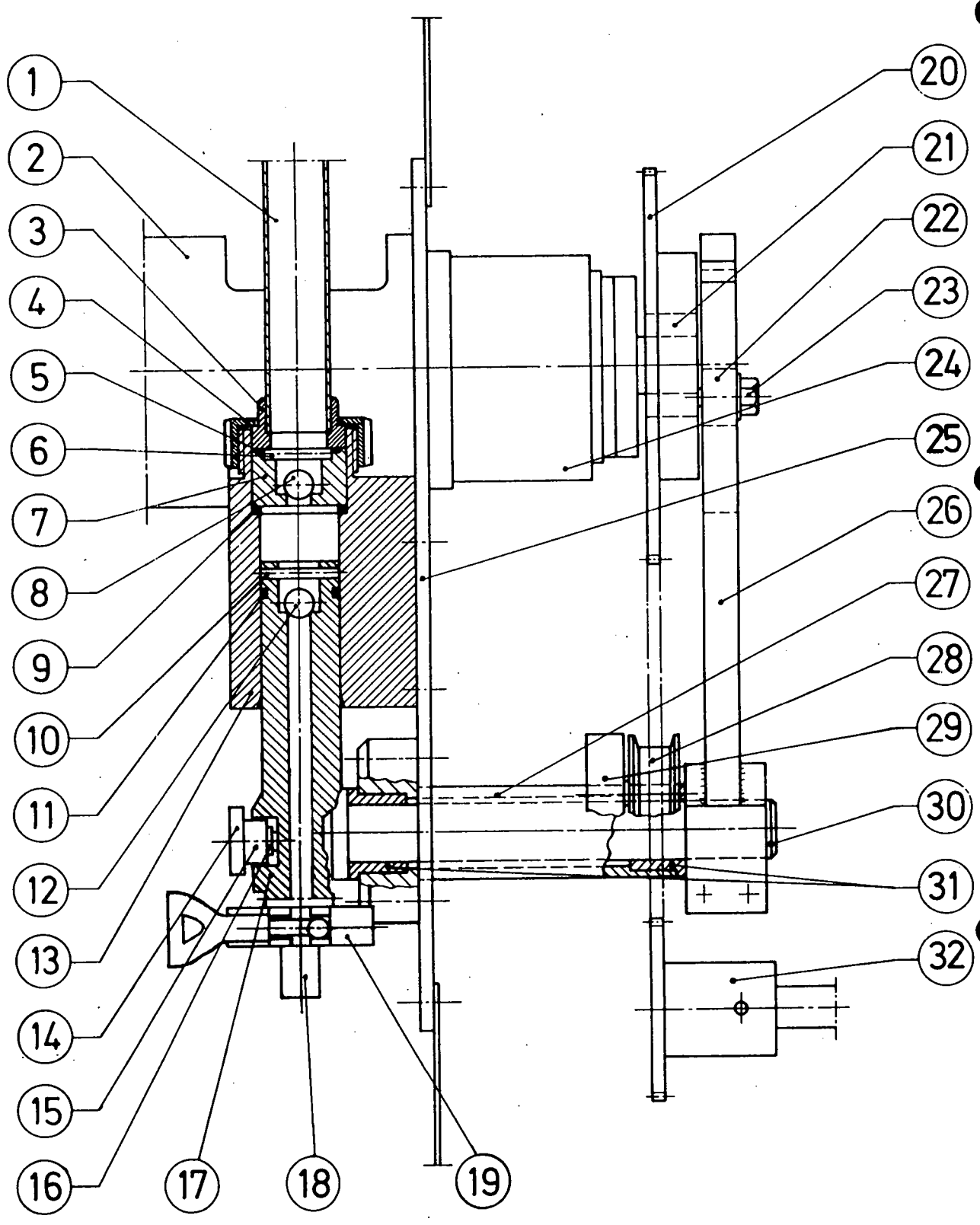
D 3141 shows a section through the non-return valve, which is placed in the top of the sanitary tee in the mix pipe from the mix pump.

Air under constant pressure enters the valve body 2 through the tube 1, the other end of which is connected to the air control system. The valve body 2 carries an O-ring 3 in a V-grove, the bottom of which is connected to the inlet port of the valve body through a number of radial holes. The valve body is sealed against the tee by means of an O-ring 4.

It takes about 1.2 to 1.5 bar air pressure to lift the O-ring 3 from the seat and thereby to open the valve. THE ACTUAL PRESSURE IN THE FREEZING CYLINDER IS THEREFORE 1,2 TO 1,5 BAR LOWER THAN THE VALUE SHOWN BY THE AIR PRESSURE GAUGE.

MAINTENANCE

IT IS VERY IMPORTANT, that the two O-rings 3 and 4 are in perfect condition to avoid counter flow through the valve. For the same reason the valve should be kept clean.



Tolerancer, der ikke angives ved spåntagende bearbejdn., klipning eller stansning		
Basismål		Tol.
(1)	6	±0,1
(6)	30	±0,2
(30)	120	±0,3
(120)	315	±0,5
(315)	1000	±0,8
(1000)	2000	±1,2
(2000)	4000	±2,0

Målestok 1 : 2,5

First angle projection ISO method E

TECHNOHOY

AARHUS DENMARK

Driving arrangements for pumps
Antrieb für Pumpen

T. Kort

Materiale

Maskintype MF

Rett.

Rett.

Rett.

Dato 13.01.87.

Tegn S.K.

Godk.

D 5984

D 9406

H.M.(09) 16 27 27

THE MIX PUMP AND DRIVING ARRANGEMENT. DRAWING D 9406

The function of this pump is straight forward. Power from the oscillating shaft 30 is transmitted to the piston 17 through the yoke 14. The two stainless steel balls 8 and 12 are acting as suction- and discharge valves. The inlet port for mix, is connected to the mix supply tank by means of a rubber or synthetic hose. The tank should be placed higher than the pump, in order to secure positive pressure at the inlet. The outlet port is connected to the sanitary tee 8 through the pipe 10 on C 16440.

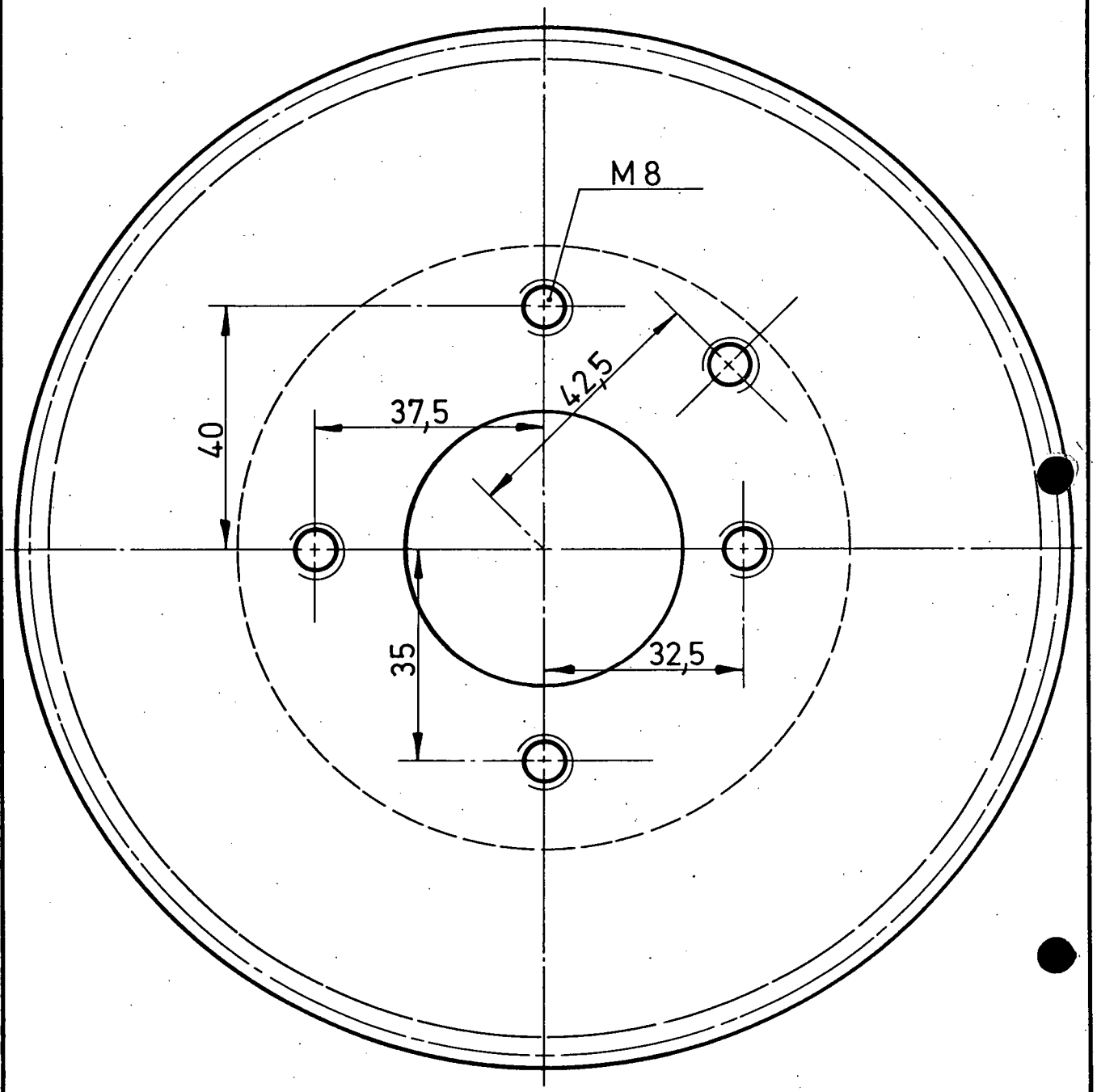
To take the pump apart, remove the pin. Push back the yoke 14 AND REINSERT THE PIN. THIS IS IMPORTANT, as the parts could be damaged, if the pump motor should be started accidentially. After the piston has been pulled out, the ball retaining pin 10 and the ball 12 can easily be removed. Then remove the union nut 4, which keeps the cylinder head 7 and the top flange 3 in place.
When reasembling the pump be sure, that both of the synthetic rollers 15 are in place.

The pump ratio is adjustable. See later.

The driving arrangement is of a solid design and straight forward.

The power is transmitted from the rotating chain wheel 32 to the chain wheel 20 attached on the ice cream pump.
The oscillating arm 26 transmits the power to the mix pump according to the preset pump ratio.

The chain is tightened by moving the arm 29.



Tolerancer, der ikke angives ved spåntagende bearbejdn., klipning eller stansning		
Basismål		Tol.
(1)	6	±0,1
(6)	30	±0,2
(30)	120	±0,3
(120)	315	±0,5
(315)	1000	±0,8
(1000)	2000	±1,2
(2000)	4000	±2,0

Målestok 1 : 1

First angle projection ISO method E

TECHNOHOY

AARHUS DENMARK

CHAIN WHEEL KETTENRAD

Dato 7.11.83.

Tegn. D.S.M.

Godk.

D

D 6004

T. Kort

Rett.

Rett.

Rett.

Materiale St. 37.

Maskintype MF

H. M. (09) 16 27 27

THE ICE CREAM PUMP

Please read the pump manual for the ice cream pump.

ADJUSTING THE PUMP RATIO, DRAWING D 6004

To get the required overrun of the finished product, there are two possibilities of adjustment. One is already mentioned : Adjusting the air pressure by the knob CHANNEL-1 on the flowmeter. The air pressure is shown on the gauge 22.

If the air pressure is too low or too high to get the required overrun, you can change the pump ratio by unscrewing the INA curve roller and remove it to one of the four other positions, see drawing D 6004.

In this way the pump ratio can be changed between 5 positions.

Equivalent to 42,5 mm distance is pump ratio app. 1:1,15

Equivalent to 40,0 mm distance is pump ratio app. 1:1,25

Equivalent to 37,5 mm distance is pump ratio app. 1:1,35

Equivalent to 35,0 mm distance is pump ratio app. 1:1,45

Equivalent to 32,5 mm distance is pump ratio app. 1:1,60

The accuraute value of the pump ratio is depending of the recipe of the mix, pressure in the freezing tube, conditions of the pumps, so within a range of 5 values the desired result can be found.

When the pump ratio is correctly adjusted, further adjustments are unnecessary.

In case of problems with the pump ratio - **please contact Technohoy.**

Technohoy
CARL HOYER A/S

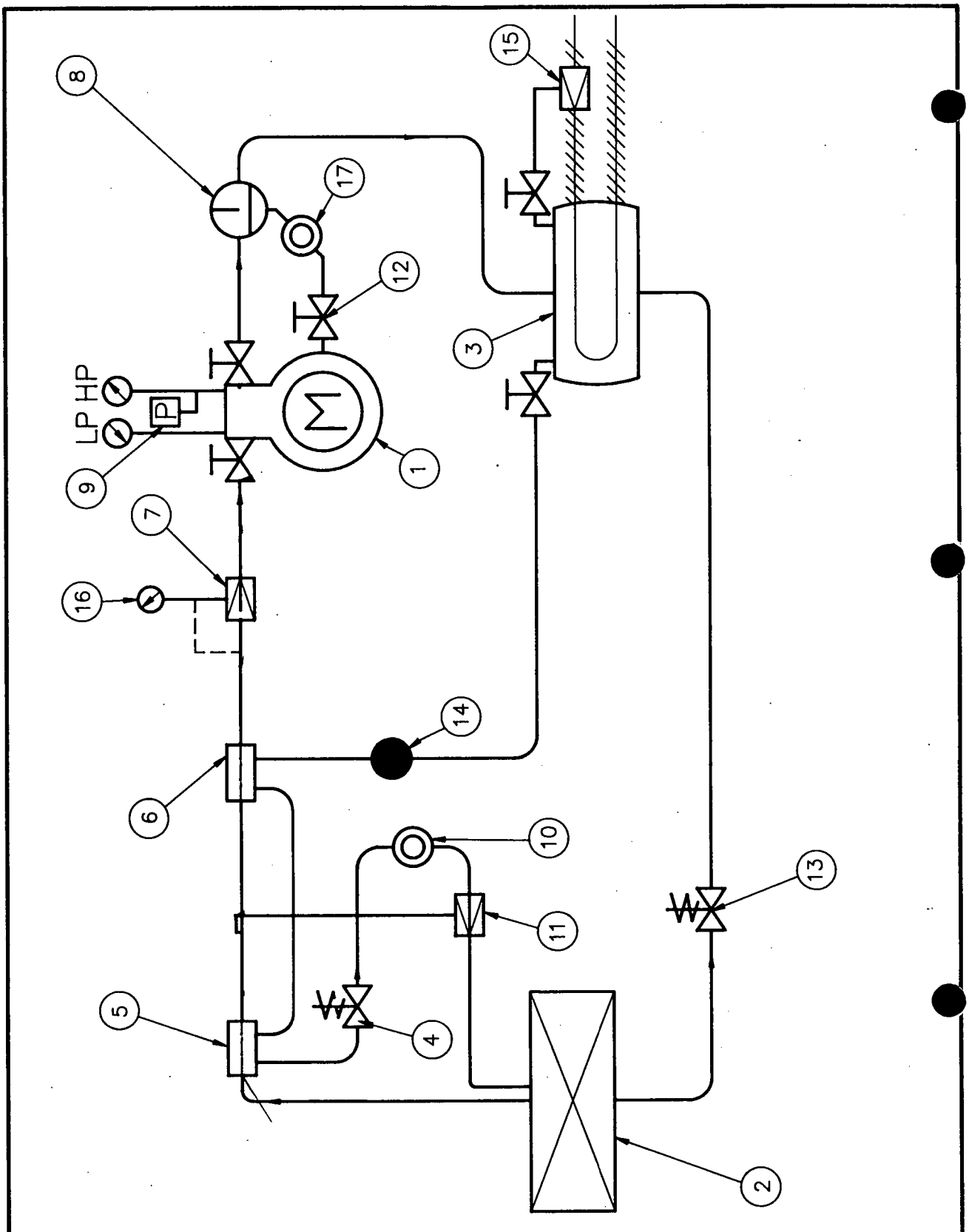
MF 50, no. 67

REFRIGERATION COMPONENTS for Diagram D 16441

1	Compressor	Pos.	1	Prestcold L 300/0062
1	Evaporator	Pos.	2	Technohoy
1	Condenser	Pos.	3	Roller B3
1	Solenoid Valve	Pos.	4	Danfoss EVR 6
1	Heat Exchanger	Pos.	5	Searle 120 XS
1	Heat Exchanger	Pos.	6	Searle 120 XS
1	Back press.reg.valve	Pos.	7	Danfoss KVP 22
1	Oil Separator	Pos.	8	Danfoss OUB 4
1	Pressure control	Pos.	9	Danfoss KP 5
1	Sight glass	Pos.	10	Danfoss SGI 10
1	Thermovalve	Pos.	11	Danfoss TY 2 No.3
1	Closing valve (Freon)	Pos.	12	Danfoss BML 10
1	Solenoid Valve	Pos.	13	Lucifer 121 K 03
1	Filter	Pos.	14	Danfoss DX 165
1	Water regulat. valve	Pos.	15	Danfoss WVFX 15
1	Pressure gauge	Pos.	16	Tempress Ref.No. R 11700
1	Sight glass	Pos.	17	Danfoss SGI 6
1	Pressure gauge HP	Pos.	HP	Tempress Ref.No. R 14168
1	Pressure gauge LP	Pos.	LP	Tempress Ref.No. R 14364

Refrigerant: Freon R 502

The Condenser Pos. 3 carries a label indicating the Freon charge.



Tolerancer ifølge DS 2075, hvor intet andet er angivet.	Antal	Styklistenr.	Maskine	Evt. bem.

Afkortningsmål:	
Antal	Dimension

TECHNOHOY

CARL HOYER A/S AARHUS – DENMARK

R–502 Diagram

Skala	1:1
Tegn.	sc
Dato	90.10.25

Materiale	Maskintype MF50

D16441

THE REFRIGERATING SYSTEM
DRAWING D 16441

The suction side of the refrigerating compressor 1 is connected to the top of the freezing jacket 2 surrounding the freezing cylinder. The suction line passes through two heat exchangers 5 and 6 and the back pressure regulator 7. The oil separator 8 brings back the oil from the discharge line to the compressor, where it belongs. The sight glass 17 gives a clear visual indication of the function of this system. In this way the jacket 2 is kept practically free of oil, which is of utmost importance to maintain best possible freezing capacity.

The discharge side of the compressor is connected to a condenser 3. In the condenser the condensing heat is transferred to the cooling water, the amount of which is controlled by the automatic water regulating valve 15. From the condenser the now liquified Freon flows through the liquid line with a filter 14, through both of the heat exchangers 6 and 5, in counter flow to the Freon gas in the suction line, through the solenoid valve 4, a sight glass 10, to the thermovalve 11, the bulb of which is clamped to the suction line between the two heat exchangers. The suction line between 2 and 5 will carry a mixture of Freon gas and liquid. In the liquid will be dissolved some oil, originating from the compressor, from which it has been carried to the evaporator through condenser and liquid line.

In the heat exchanger 5 the liquid part of the Freon is evaporated by means of heat from the counterflowing warm liquid.
The purpose of the second heat exchanger 6 is to afterevaporate traces of liquid Freon after the first heat exchanger.

The purpose of the automatic but adjustable valve 7 is to keep a constant pressure, and thereby also a constant temperature in the jacket 2. This pressure which is shown by the square pressure gauge 16, must by necessity, be higher than the pressure in the suction port of the compressor, which is shown by the pressure gauge LP. The pressure difference is created by the throlling action of the valve 7. When the freezer is working at low capacity the valve 7 is adjusted to keep a relatively high pressure in the jacket 2, while at the same time the compressor is able to pull the pressure after the valve 7 down to a relatively low value. The pressure difference between 16 and LP is then large. If now the refrigerating load is increased by increasing the throughput and the stiffnes of the product, the back pressure regulating valve 7 must be adjusted to keep a lower pressure and temperature in the jacket 2. The throttling action is reduced and the pressure at LP rises. The pressure difference between 16 and LP is then low.

By further increasing and refrigerating load, the pressure differrence reaches a minimum. The valve 7 is then wide open, and the limit of the compressor capacity has been reached. It is evident, that the mentioned pressure difference is a good measure for the load of the refrigerating system.

HP is a pressure gauge showing the condensing pressure and temperature. In principle this pressure should be kept as low as possible to obtain highest possible refrigerating capacity, lowest possible consumption of electricity and lowest possible discharge temperature of the compressor. This advantage must be paid for by a high consumption of cooling water however. 15 is an automatic water regulating valve, placed in the water inlet to the condenser. It has a pressure sensitive element which is connected to the discharge port of the compressor. The element has the function to open the valve, when pressure is build up and let so much water flow through the condenser as necessary to keep the condensing pressure at the value which is preset by the adjustment knob of the water valve. When making adjustments of the water flow, the effect should be followed on the gauge HP. From the factory the valve is set to keep the condensing temperature at about 30° C. It depends very much on local conditions however, to which condensing temperature the water valve should be set. If water is plentiful, cheap and perhaps warm, much water should be used and vice versa.

THE FREEZING CYLINDER ASSEMBLY AND MAIN DRIVE DRAWING U 5437

The freezing tube 7, made of stainless steel and hard chromium plated on the interior surface, is surrounded by the eccentrically placed jacket 8 with heads 8a and 8b. The annular space so formed is the evaporator for Freon, which cools the freezing tube. Tightness between the heads and the freezing tube is obtained by O-rings 5 and 28. End covers 1 and 6 are attached to the ends of the freezing tube by bayonet style locks. 31 is the inlet connection for ice cream mix with air, and 19 is the outlet connection for the finished product. Centrally placed in the cylinder is the solid mutator 20 suspended between the anchor plate 21 and the driving stud 14. The torque from the main shaft is transmitted to the mutator shaft 27 through the driving stud 14. The right end of the mutator, the shaft 27 is sealed against the cover 6 by means of the rotary shaft seal 9 and engaged with the main shaft 39. The V-belt pulley 42,, is secured to the main shaft by the taper lock bushing 43. The main shaft is suspended in two ball bearings 11 and 15. The first mentioned, being the heavier, is designed to take the axial thrust from the internal pressure in the freezing tube.

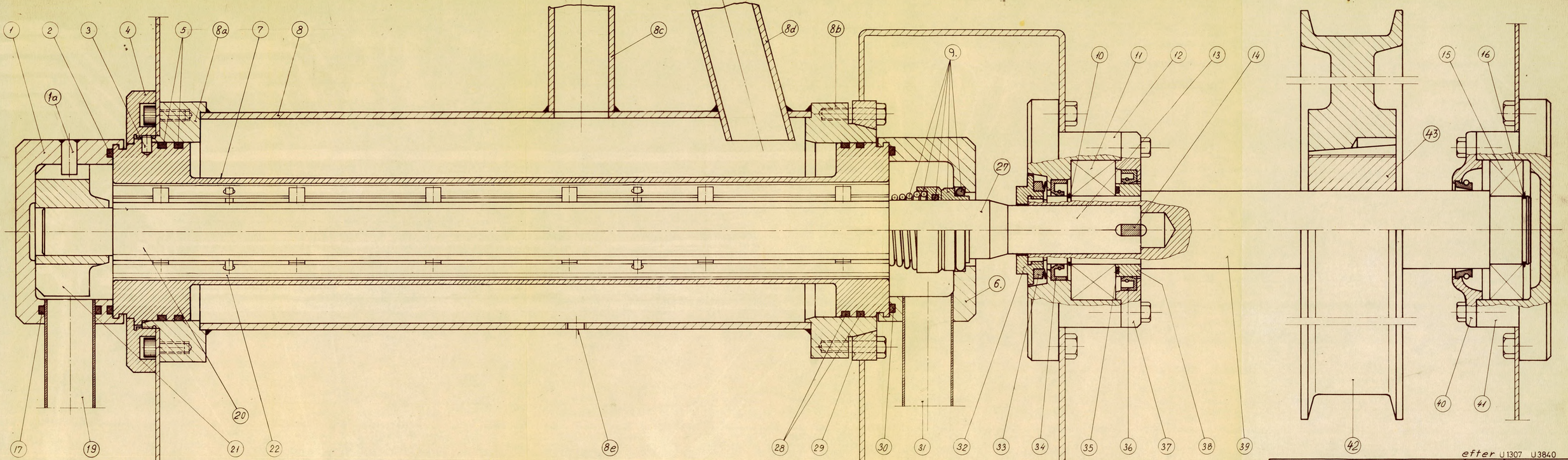
MAINTENANCE U 5437

The freezing tube 7 is removable. If the tube needs to be replaced, or for other reasons taken out of the freezer, the low side of the refrigerating system must be pumped down. This should be done by a competent refrigerating service engineer, NEVER by an unexperienced person. Remove both of the covers 1 and 6 and the mutator assembly, by hand. Remove the union nut 4 with a tool delivered with the freezer. The freezing tube can then be pulled out. When reinstalling the tube make sure, that everything is clean, and that the O-rings are of proper quality for use in connection with Freon, and that they are properly oiled with refrigerating compressor oil and that the dowel pin 3 is exactly opposite its slot. Loosen the expansion ring 29, if necessary. Then drive home the tube with a wooden block and a bench hammer. Tighten the union nut 4 firmly. Tighten the screws evenly but not too firmly. Check for leaks with a halide leak detector, electric type.

If, after considerable use, the shaft seal 9 gets leaky inspect the running surfaces of the seal rings. Also inspect the two O-rings. It is important, that the spring is able to push the rotating seal ring on the shaft, if compressed. The shaft should therefor be lubricated occasionally with an edible lubricant. If any part of the shaft seal gets scored, the entire shaft seal must be replaced with a new one.

Power from the main motor is transmitted to the main shaft through a V-belt. If it ever becomes necessary to replace the V-belt, proceed as follows : Remove the V-belt from its groove. Remove the screws holding 40 and 41. Remove the ball bearing house 41. The old belt can now be slipped over the end of the shaft and out, and the new belt can be inserted the same way.

If it, for some reason, is necessary to remove the main shaft 39 and the nose 32, which is fastened to the shaft with right hand thread. Loosen the taper lock in the main V-belt pulley. Remove the ball bearing 15. The cover 40 and the taper lock can now be taken out, and the shaft can be moved to the right. Now lift the left end of the shaft up and take the shaft out of the machine. It is now possible to renew the ball bearing 11 and the seal rings 33, 34, 35 and 36.



efter U 1307 U3840

Technohoj
CIVILINGENIØR O·G·HØYER
AARHUS - DANMARK

Mål: 1:1

Tegn 30.10.79

Maskine Type MF 50

erstatter U 1307 U 5437

Frysecylinder med hovedtræk

SPEED ADJUSTING OF THE PUMPS C 2954

The dial 19, with figures from 0 to 10, is driven from the spindel 6 through gear trains 20, 21 and 23. The sprocket 7 is connected to the STRÖTER gear head motor through a 3/8" roller chain, running over the take up pulley 18.

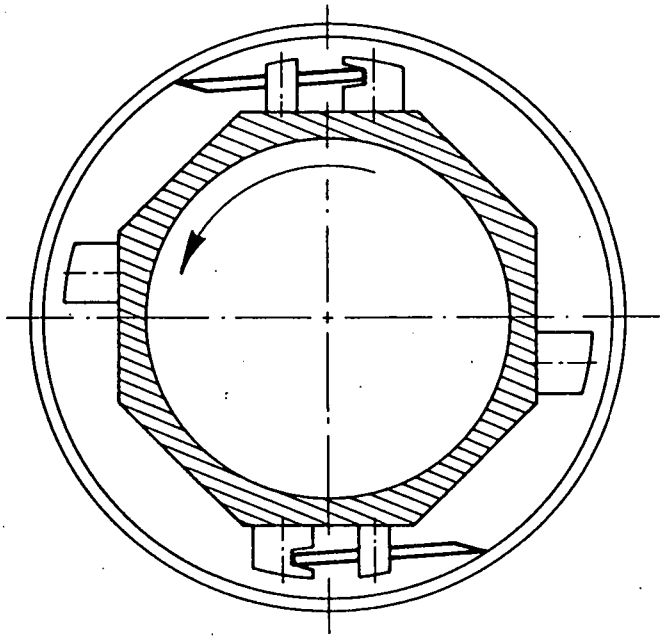
The dial 19 makes one turn when the pump capacity is adjusted from max. to min.

The figures 0 to 10 are reference figures only.

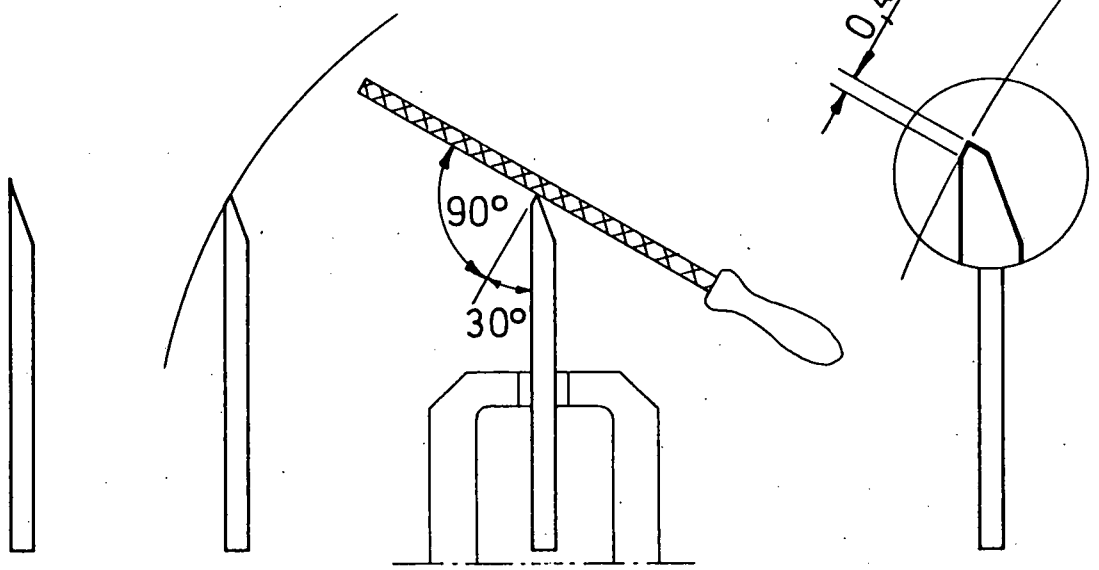
Del af _____ Type _____

Firma:

Technology
CIVILINGENIØR O·G·HØYER
AARHUS · DANMARK



A

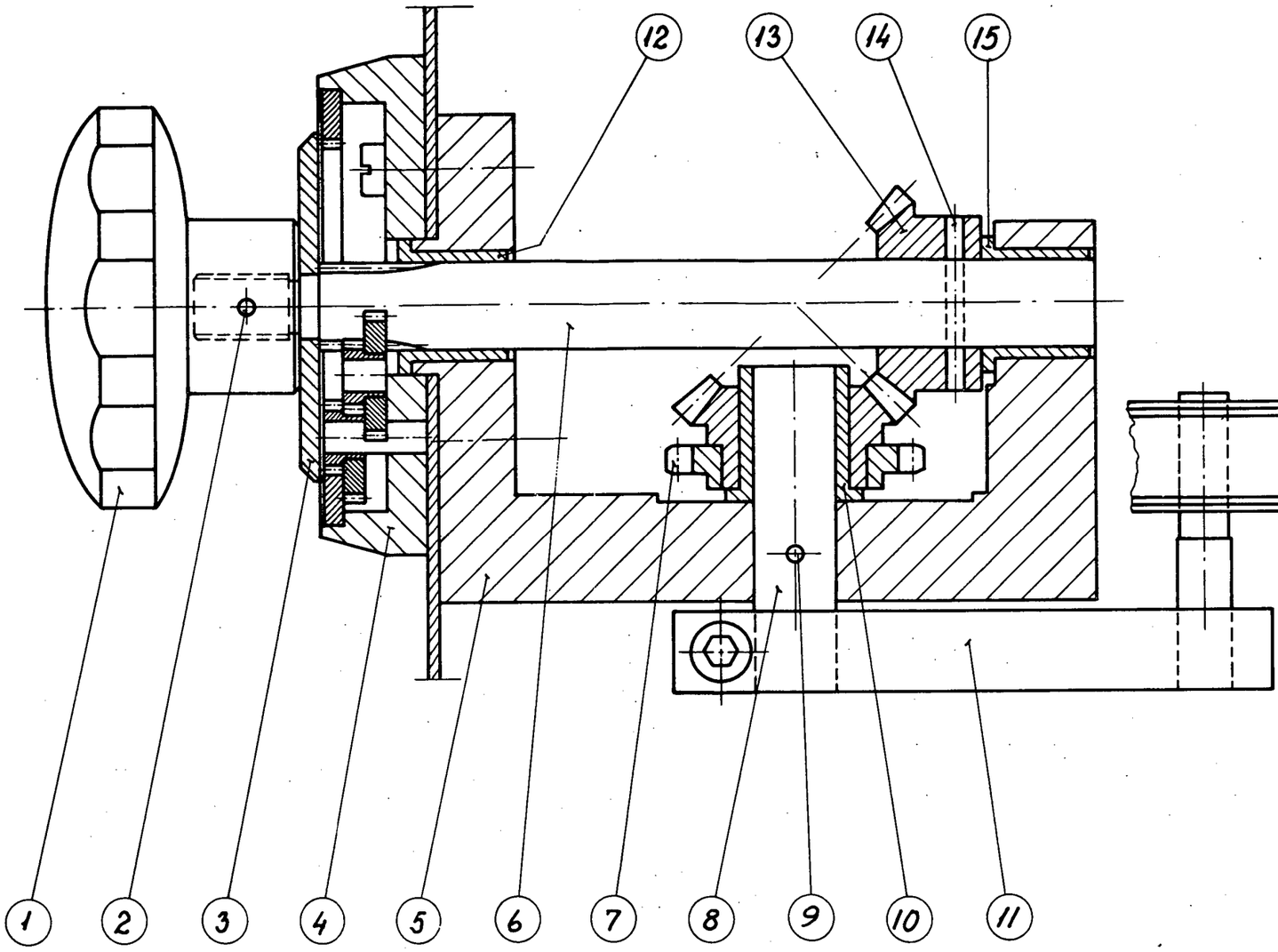


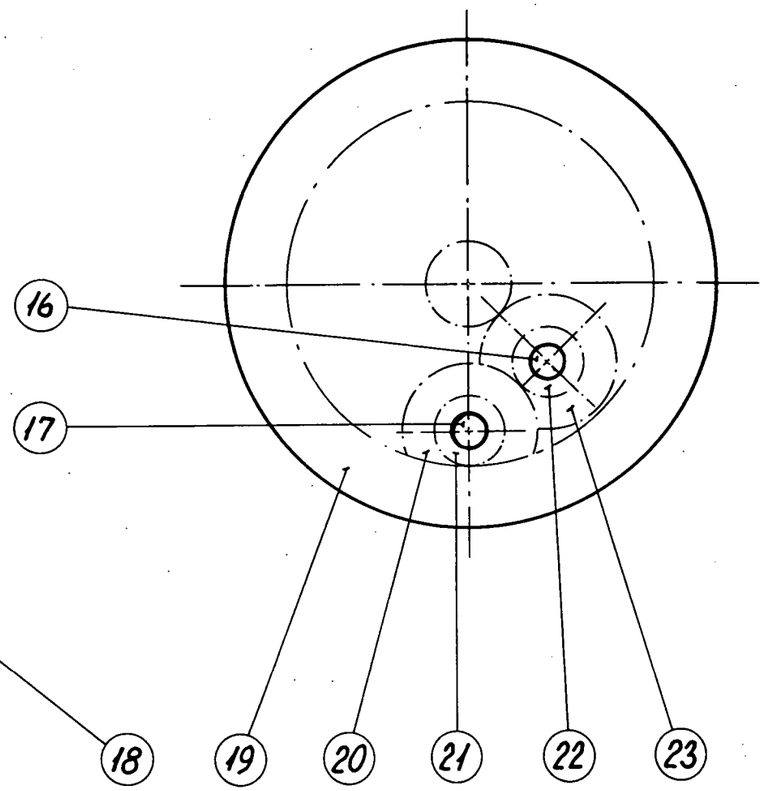
NEW WORN-IN RECONDITIONING READY FOR USE

erst. af D4058	Materiale	Model nr.	Lager nr.	Målforhold	Tegn.	18.06.08.
					Kont.	AR
	Genstand: RECONDITIONING WORN SCRAPER BLADES				Tg. nr.	D 3140

Alle mål uden tolerance ++ mm

HM (09) 16 27 27





Stk.	Genstand	Mrk. nr.	Tegn. nr.	Materiale	Model nr. Lager nr.	Vægt
	Dato / Rettelse	Dato	Rettelse			

Technohøy
CIVILINGENIØR O·G·HØYER
AARHUS · DANMARK

Målforhold	Tegn.	30.1.78
1:1	Kont.	R
	Normpr.	

(Erstatning for:) C 2954

(Erstattet af:)

Hast. regulering af pumper.

HM (09) 16 27 27

RECONDITIONING OF WORN SCRAPER BLADES

Drawing D 3140 shows, at A, a section through the freezing cylinder, with mutator and scraper blades. The mutator turns anti-clockwise, when seen from the front of the freezer. The leading edge of the blades must be in contact with the refrigerated cylinder wall, by centrifugal force, and when in proper condition, they scrape off the thin layer of ice cream which freezes on to the cylinder wall between passages of the scrapers. It is evident, that the blades must be kept in good condition in order to scrape off efficiently, which is of so deciding importance for the performance of the freezer.

At 1 is shown a new and unused blade. It has a rather sharp cutting edge. 2 shows the blade after some use. The blade is "worn-in" against the cylinder surface. A narrow contact area has developed over the entire lenght of the blade. After considerable use this contact face gets so wide, say 1,5 mm, that reconditioning becomes necessary, in order to maintain scraping efficiency. At 3 is shown how to proceed. Put the blade in a vise and use a saw mill file to remove material from the edge as shown. The file should be held at approximately 90° to the contact face. Continue filling till the width of the face has been reduced to between 0.4 and 0.6 mm. Such a small portion should be left over to insure good contact between blade and cylinder wall. NEVER remove the face completely.

THE ELECTRICAL INSTALLATION

The drawing is made in accordance with international standard and practise.

The wirings for the pump motor and the main driving motor are straight forward.

The compressor motor is equipped with a local protection system against overload and burn out. Thermistor temperature sensors are placed in the motor windings.
SEE WIRING DIAGRAM

If the allowed temperature of the windings is exeeded, the electrical resistance in the sensors rises abruptly, which causes a relay in the control box to break the connection, where by the compressor motor is stopped through the motor contactor. A new start can normally be made after 5-6 minutes.

The heating element, if any, is located in the crank case of the compressor, immersed in the oil. Electrically it is connected in such a way, that it is on, when the motor is off and vice versa. This is done to avoid absorption of Freon in the oil during stand still periods of the compressor. Even during long periods of standstill, there is no danger of superheating of the oil because of the small heating capacity. A consequence of the above is, that the main switch on the wall should NEVER be pulled and that the freezer should be switched on app. 3-8 hours before production.

PRESTCOLD

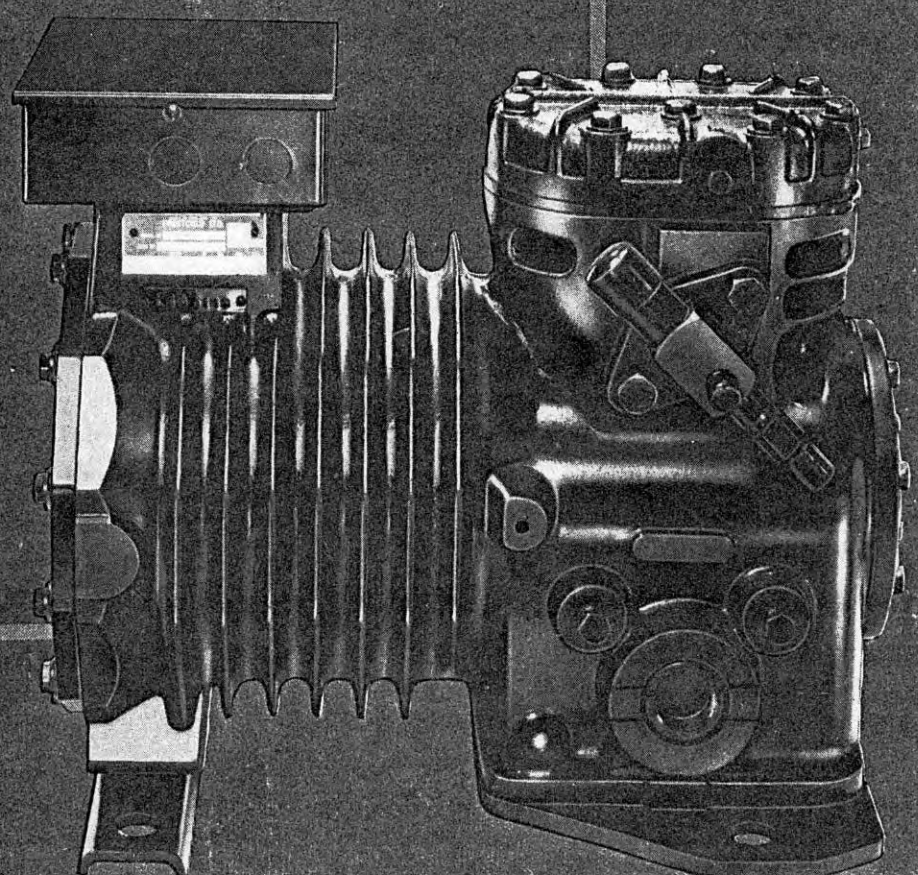
BY APPOINTMENT TO HER MAJESTY THE QUEEN
MANUFACTURERS OF REFRIGERATION MACHINERY
PRESTCOLD LIMITED THEALE BERKS

L

Semi-hermetic Compressors
Compresseurs Semi-hermétiques
Halbhermetische Kompressoren

50Hz

2 - 4
hp/ch/PS



L

GENERAL SPECIFICATION

Type: Semi-hermetic, twin cylinder, externally cooled, reciprocating compressor.

Operating Speed: 1450 rpm (except L200/0028 — 960 rpm)

Application: R12, 22, 502 and 13B1.

CARACTERISTIQUES GENERALES

Type: Compresseur alternatif à deux cylindres de type semi-hermétique à refroidissement externe.

Vitesse de fonctionnement: 1450 tr/min (sauf L200/0028 — 960 tr/min).

Utilisation: R12, 22, 502 et 13B1.

AUSFÜHRUNG

Typ: fremdgekühlter, halbhermetischer Zweizylinderkolbenkompressor.

Drehzahlen: 1450 U/min (ausser dem L200/0028 — 960 U/min).

Anwendung: R12, 22, 502 und 13B1.

DESIGN FEATURES

Crankshaft: cast iron, with oilways lubricating all bearing surfaces.

Pistons: High grade cast iron pistons, oil grooved and precision finished. Case-hardened steel gudgeon pins fitted with brass end pads to protect the cylinder walls.

Connecting Rods: light alloy.

Lubrication: Splash lubrication is used on all models except the L400/0062 which is fitted with a reversible oil pump.

Oil Charge: 2.3 litres.

Sight Glass: Standard on all compressors.

SPECIFICATIONS TECHNIQUES

Vilebrequin: en fonte avec canalisations d'huile pour lubrification des pièces mobiles.

Pistons: en font de haute qualité à rainures d'huile et parachevés avec soin. Les axes de piston d'acier cémenté sont munis en bout de pièces de laiton pour protéger les parois du cylindre.

Bielles: en alliage léger.

Lubrification: Tous les compresseurs ont un système de graissage par barbotage, à l'exception du L400/0062 qui est muni d'une pompe à huile réversible.

Charge d'huile: 2.3 litres.

Voyant de niveau d'huile: Standard.

KONSTRUKTIONSMERKMALE

Kurbelwelle: aus hochwertigem Gußeisen, mit Ölkanälen.

Kolben: aus hochwertigem Gußeisen, mit Schmiernuten versehen und fein bearbeitet. Die Kolbenbolzen aus schalenhartem Stahl haben zum Schutz der Zylinderwände Endpolster aus Messing.

Pleuelstangen: aus Leichtlegierung.

Schmierung: Alle Kompressoren ausser dem L400/0062, der mit einer drehrichtungsunabhängigen Ölpumpe ausgerüstet ist, haben Schleuderschmierung.

Ölfüllung: 2.3 liter.

Schauglas: Standardmäßig.

MODEL DESIGNATION

L 300 / 0050

- L body compressor, externally cooled
- Nominal motor output in % of 1 hp
- Compressor displacement in m^3/s

The new range of compressors incorporates a change of model designation. The designations in brackets on the individual performance curves indicate the nearest equivalent 'S' compressor model.

DESIGNATION

L 300 / 0050

- Compresseur corps L, refroidissement externe
- Puissance nominale du moteur en % de 1 ch.
- Volume balayé du compresseur en m^3/s

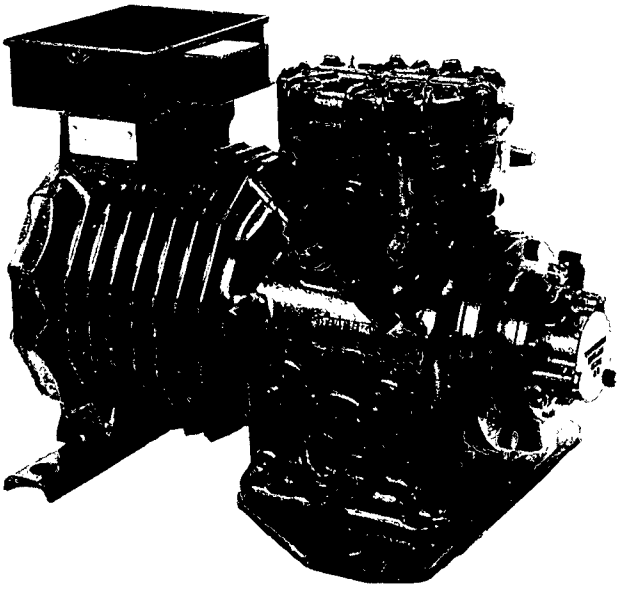
Un nouveau système de désignation des compresseurs de la nouvelle série L a été introduit. Les modèles indiqués entre parenthèses sur les courbes de puissances individuelles sont des équivalents approximatifs de l'ancienne série 'S'.

MODELLBEZEICHNUNG

L 300 / 0500

- Kompressor, Körpergrösse L, fremdgekühlt
- Motornennleistung in % von 1 PS
- Volumenstrom in m^3/s

Die neue Typenreihe L beinhaltet eine neue Modellbezeichnung. Die auf den einzelnen Leistungskurven in Klammern aufgezeichneten Typen beschreiben die gleichwertigen Typen der 'S'-Serie.



L400/0062

Technical Data Caractéristiques Techniques Technische Daten

Model Modèle Modell		L200/0028	L200/0037	L300/0037	L200/0042
Displacement at 960 rpm Volume balayé à 960 tr/min Volumenstrom bei 960 U/min	m^3/s m^3/h	0.0028 10.0			
Displacement at 1450 rpm Volume balayé à 1450 tr/min Volumenstrom bei 1450 U/min	m^3/s m^3/h		0.0037 13.3	0.0037 13.3	0.0042 15.0
Nominal motor power Puissance nominale du moteur Motornennleistung	kW	1.5	1.5	2.2	1.5
Refrigerant and application range Réfrigérant et plage d'application Kältemittel und Anwendungsbereich	R12 R22 R502 R13B1	ML ML	HML L L XL	HML L	ML L
No. of cylinders No. de cylindres Zylinderanzahl		2	2	2	2
Bore Alésage Bohrung	mm	50.8	47.5	47.5	50.8
Stroke Course Hub	mm	43	43	43	43
Suction valve Vanne d'aspiration Sauganschluss	O.D. ø ø	7/8" (22 mm) SW	7/8" (22 mm) SW	7/8" (22 mm) SW	7/8" (22 mm) SW
Discharge valve Vanne de refoulement Druckanschluss	O.D. ø ø	5/8" (15 mm) FL	5/8" (15 mm) FL	5/8" (15 mm) FL	5/8" (15 mm) FL
Oil charge Charge d'huile Ölfüllmenge	Litres	2.3	2.3	2.3	2.3
Net weight Poids net Nettogewicht	kg	82	82	86	82

NOTES

Connections:
SW = Sweat connection
FL = Flare connection

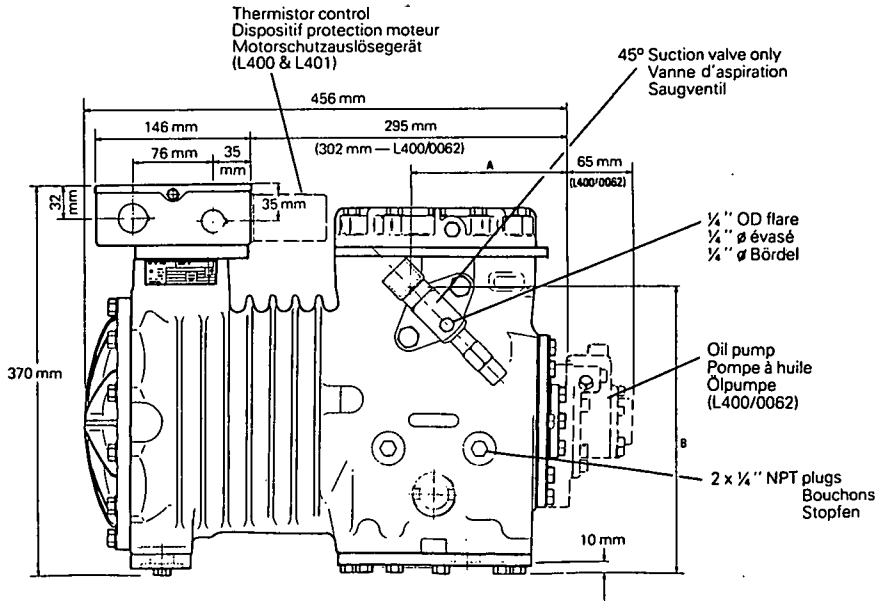
Application range
H = t_0 = −10°C to +15°C
M = t_0 = −20°C to 0°C
L = t_0 = −40°C to −10°C
XL = t_0 = −60°C to −35°C

NOTA

Raccords:
SW = Raccord à braser
FL = Raccord évasé

DIMENSIONS
DIMENSIONS
ABMESSUNGEN

Model Modele Modell	Suction Side Côté Aspiration Saugseite		Discharge Side Côté Refoulement Druckseite	
	A	B	A	B
L200/0028 L200/0037 L300/0037 L200/0042 L300/0042 L300/0050 L400/0050	156 mm	276 mm	175 mm	259 mm
L300/0062 L401/0062 L400/0062	150 mm	270 mm		



	L300/0042	L200/0050	L300/0050	L400/0050	L300/0062	L401/0062	L400/0062
	0.0042 15.0	0.0050 18.1	0.0050 18.1	0.0050 18.1	0.0062 22.4	0.0062 22.4	0.0062 22.4
	2.2	1.5	2.2	3.0	2.2	3.0	3.0
	HML ML L	L	HML L L XL	ML L	HML L	HML L XL	HML L XL
	2	2	2	2	2	2	2
	50.8	55.6	55.6	55.6	62	62	62
	43	43	43	43	43	43	43
	7/8" (22 mm) SW	7/8" (22 mm) SW	7/8" (22 mm) SW	7/8" (22 mm) SW	1 1/8" (28 mm) SW	1 1/8" (28 mm) SW	1 1/8" (28 mm) SW
	5/8" (15 mm) FL	5/8" (15 mm) FL	5/8" (15 mm) FL	5/8" (15 mm) FL	5/8" (15 mm) FL	5/8" (15 mm) FL	5/8" (15 mm) FL
	2.3	2.3	2.3	2.3	2.3	2.3	2.3
	86	82	86	89	86	89	91

Plage d'application

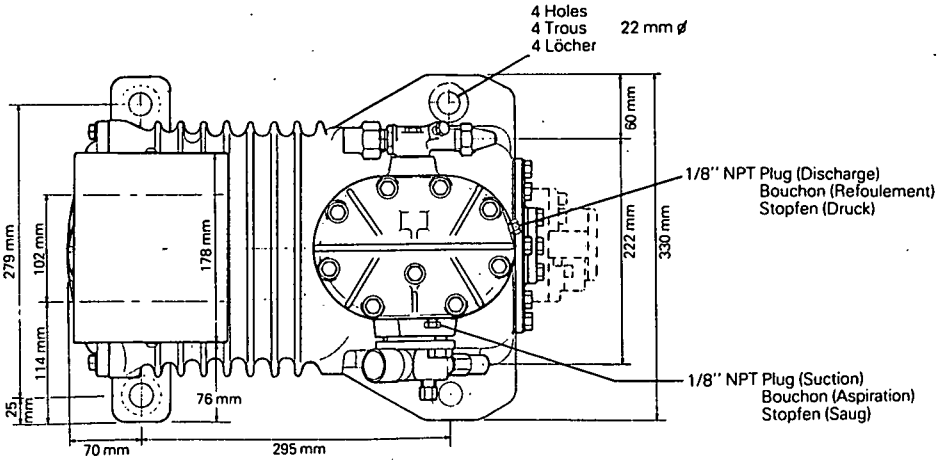
H = t_0 = −10°C à +15°C
M = t_0 = −20°C à 0°C
L = t_0 = −40°C à −10°C
XL = t_0 = −60°C à −35°C

ANMERKUNGEN

Anschlüsse:
SW = Lötanschluss
FL = Bördelanschluss

Anwendungsbereiche

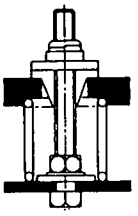
H = t_0 = −10°C bis +15°C
M = t_0 = −20°C bis 0°C
L = t_0 = −40°C bis −10°C
XL = t_0 = −60°C bis −35°C



Flexible mountings: Set no. 97120/0163 (optional) overall height increased by 28 mm.

Fixations souples: Jeu référence 97120/0163 (sur option) ajouter 28 mm à la hauteur totale.

Montagefedern: Satz 97120/0163 (wahlweise) vergrössern die Höhe um 28 mm.



L APPLICATION NOTES
CONSEILS D'UTILISATION
ANWENDUNGSHINWEISE

Design – Compressors are suitable for use with refrigerants 12, 22, 502 and 13B1 within the limits indicated on the individual data sheets to cover a wide variety of applications in the 2 to 4 nominal horsepower range.

Performance curves – These are based on the following conditions:

a) Liquid at saturation temperature corresponding to the discharge pressure with no sub-cooling. For each 1°C of liquid sub-cooling at the condenser outlet, 1% may be added to the extraction rate.

b) The suction gas entering the compressor being usefully heated to the maximum permitted temperature stated on the performance data.

c) A compressor speed of 960 rpm for model L200/0028 and 1450 rpm for all other models.

d) A maximum ambient temperature of 43°C.

Due to variations resulting from manufacturing tolerances, actual performance may differ from published figures by up to 5%.

It should be noted that the effective extraction rating of a given installation may be much lower than the compressor performance due to system losses caused by pressure drops, non-useful heat pick-up in the suction line, expansion valve losses, etc. This is particularly so on low temperature applications.

To minimise system losses, the following factors must be given careful consideration in the design of each installation:

a) Sizing of pipework and evaporator to give minimum pressure drop whilst maintaining a velocity high enough to ensure good oil return.

b) The use of insulation on the suction line to prevent heat pick-up from its surroundings.

c) Whether a suction to liquid line heat exchanger of suitable size should be used.

d) Selection of the correct size and type of expansion valve.

e) Whether compressor cooling is adequate, especially at low suction pressure.

Operational limits – In all cases the compressor motor is matched to the displacement, the refrigerant and the range of application and care must be taken to ensure that compressors operating on low suction pressures are not allowed to operate continuously at suction pressures exceeding the permitted limits. The performance data provides heat extraction figures within prescribed operating parameters and the compressors should not be applied outside these limits if motor overloading is to be avoided.

A short interval of operation above the limiting suction pressure, during a quick pull down, can be tolerated but when the evaporating pressure is liable, for any reason, to exceed these limits for any length of time, means of restricting the suction pressure must be applied. A pressure limiting expansion valve is most suitable, or alternatively, some form of throttling device must be used in the suction line.

Gas temperature – To avoid excessive

Construction – Les compresseurs type 'L' s'utilisent avec les réfrigérants 12, 22, 502 ou 13B1 dans les limites spécifiées dans leurs fiches techniques individuelles et conviennent de ce fait à une grande variété d'usages dans une gamme de puissance nominale de 2 à 4 ch.

Courbes de puissance – Les courbes de puissance s'entendent pour les conditions suivantes:

a) Liquide à la température de saturation qui correspond à la pression de refoulement sans sous-refroidissement. Pour chaque °C de sous-refroidissement de liquide à la sortie du condenseur, ajouter 1% à la puissance indiquée.

b) Les gaz aspirés à l'entrée du compresseur avec surchauffe utile jusqu'à la température maximum permise comme indiquée sur les courbes de puissance.

c) Vitesse de rotation 1450 tr/min, sauf le modèle L200/0028 – 960 tr/min;

d) Une température ambiante maximale de 43°C;

En raison des tolérances de fabrication, les puissances indiquées peuvent varier de ±5%.

Noter que la puissance "réelle" d'une installation peut être nettement inférieure à la puissance du compresseur en raison de pertes de puissance occasionnées par chutes de pression, apport de chaleur non-utile dans la conduite d'aspiration etc, surtout pour les installations à basse température.

Afin de réduire ces pertes au minimum, il faut tenir compte des points suivants:

a) Etudier la tuyauterie et l'évaporateur de façon à assurer une chute de pression minimum ainsi qu'une vitesse d'écoulement suffisante à assurer un bon retour d'huile;

b) Déterminer si la conduite d'aspiration devrait être isolée sur toute sa longeur afin d'éviter un apport de chaleur de l'ambiance.

c) Considérer l'utilisation d'un échangeur de chaleur "aspiration/refoulement".

d) Choisir avec soin un détendeur qui convient au système.

e) Assurer le refroidissement efficace du compresseur, surtout aux pressions d'aspirations basses.

Limites d'application – Dans tous les cas, le choix du moteur du compresseur est fait en fonction de son volume balayé, le frigorigène utilisé et sa plage d'application. Il importe d'éviter l'utilisation continue des compresseurs aux températures de gaz aspirés supérieures aux conditions limites indiquées. Les courbes de puissance frigorifique des compresseurs donnent leur capacité en dedans de leur plage d'application, les limites de laquelle doivent être respectées afin d'éviter le surcharge éventuel du moteur.

Une brève période d'utilisation du compresseur en dessus de la limite indiquée de pression des gaz aspirés pendant la mise en régime est permise, mais lorsque la pression des gaz aspirés est susceptible de dépasser cette limite pendant un certain temps, il faut que la pression des gaz aspirés soit limitée. Ceci peut se faire à moyen d'un détendeur limiteur de pression 'MOP' ou autre dispositif d'étranglement monté sur la

Anwendung – Die Kompressoren eignen sich zum Gebrauch mit den Kältemitteln R12, R22, R502 und R13B1 innerhalb der auf den individuellen Datenblättern angegebenen Grenzen für eine Vielfalt von Anwendungen im Nennleistungsbereich von 2 bis 4 PS.

Leistungskurven – Diese basieren auf den folgenden Annahmen:

a) Flüssigkeit auf Sättigungstemperatur entsprechend dem Austrittsdruck ohne Unterkühlung. Für je 1°C Unterkühlung der Flüssigkeit am Verflüssigeraustritt kann 1% zur Kälteleistung zugeschlagen werden.

b) Das in den Kompressor eintretende Sauggas durch Wärmeaustauscher auf die in den Leistungsdaten angegebene höchstzulässige Temperatur vorgewärmt.

c) Kompressor-Drehzahl 1450 U/min für alle Modelle, ausser dem L200/0028 — 960 U/min.

d) Maximale Umgebungstemperatur 43°C.

Die Leistungsdaten können durch Fertigungstoleranzen um 5% abweichen.

Es ist zu beachten, daß die effektive Leistung einer speziellen Anlage erheblich geringer sein kann als die Kompressorleistung, entsprechend der Verluste, die durch Erwärmung der Saugleitung, Druckverluste, Expansionsventile und sonst Drosselorgane entstehen. Dies gilt besonders für den Tieftemperaturbereich. Um diese Verluste so gering wie möglich zu halten, sind bei Festlegung einer Installation folgende Punkte zu beachten:

a) Rohrleitung und Verdampfer müssen so dimensioniert sein, daß ein möglichst geringer Druckabfall einerseits, jedoch eine ausreichende Geschwindigkeit andererseits möglich ist, um eine gute Ölrückführung zu erreichen.

b) Eine Isolierung der Saugleitung auf ihrer Gesamtlänge verhindert die Wärmeaufnahme aus der Umgebung.

c) Es ist zu entscheiden, ob ein passender Wärmeaustauscher eingesetzt wird.

d) Die richtige Expansionsventil-Größe und-Type ist sorgfältig auszuwählen.

e) Sicherstellen, daß ausreichend Kühlung für den Kompressor vorhanden ist, speziell für den Tieftemperaturbereich.

Anwendungsgrenzen – In allen Fällen ist der Kompressormotor an das Hubvolumen, das Kältemittel und den Anwendungsbereich angepaßt, und es ist sorgfältig darauf zu achten, daß mit niedrigen Ansaugdrücken arbeitende Kompressoren nicht ununterbrochen bei Ansaugdrücken betrieben werden, die die zulässigen Grenzen überschreiten. Die Leistungsdaten lassen Kälteleistungen in den Grenzen vorgeschriebener Betriebsparameter zu, und die Kompressoren dürfen nicht außerhalb dieser Grenzen betrieben werden, um Motorüberlastung zu vermeiden.

Kurzzeitiger Betrieb oberhalb des Grenz-Ansaugdrucks während eines schnellen Abkühlvorgangs ist zulässig; wenn aber der Verdampfungsdruck aus irgendeinem Grunde für längere Zeit die Grenzen überschreiten kann, müssen Mittel zur Beschränkung des Ansaugdrucks vorgesehen werden. Besonders geeignet ist hierzu ein druckbegrenzendes Expansionsventil; andererseits kann aber auch eine

discharge temperatures, which are detrimental to lubricating oil, refrigerant and motor winding insulation, the compressor must not operate below the suction pressures which correspond to the saturated vapour temperature limit on the performance graphs. The limits vary according to the refrigerants used, the condensing temperatures, and the degree of suction gas superheat.

If, due to reduction in plant duty, the use of throttling devices in the suction line, or any other cause, the compressors operate below limiting suction pressures, provision must be made for a corresponding reduction in suction vapour superheat.

The methods available for minimizing suction vapour superheating at the compressor are omitting the heat exchanger and insulating the entire length of the suction pipe to prevent heat pick-up from the atmosphere. In extreme cases liquid refrigerant injection into the suction line may be necessary.

Compressor cooling – It is necessary at all times to provide cooling for the electric motor. This can be accomplished by directing air on to the discharge side of the compressor housing either by positioning the compressor in the wake of the condenser fan or providing an independent fan to produce a minimum air flow of 152 m/min (500 ft/min). Alternatively, the compressor can be cooled by passing water through a cooling coil of copper pipe formed around the motor housing.

Lubricating system – Positive lubrication is provided via a twin blade oil propeller, (except on the L400/0062 which is fitted with a reversible positive displacement oil pump). This propeller rotates with the compressor shaft to lift oil into a reservoir located above the shaft centre line, from which a constant supply of oil is drawn through the shaft oilways to feed the bearings and pistons.

Lubricating oil – The compressors are charged with a full working charge of lubricating oil necessary for the proper lubrication of the bearings and moving parts.

Additional oil at the approximate rate of 0.5 litres for each 4.5 kg of system refrigerant charge should be introduced into the crankcase to allow for the amount of oil which will remain continuously in the system.

Care must be taken to ensure that the additional oil is clean, deaerated, and moisture free, and it should only be taken from a sealed can.

The following lubricating oils are compatible and approved for use in 'L' compressors:

Texaco Capella Oil 32
Suniso 3GS
Mobil Gargoyle Arctic 155
Duckhams Zeroflow 4
BP Energol LPT65
Burmah Castrol Icematic 266
Virginia 150 (Blue Cap)
Total Lunaria 20
Shell Clavus 32

Oil separators – Depending on the system design, the use of an oil separator may be necessary. This applies particularly to the use of R502, and all systems using R22 when evaporating below –12°C and R12 when evaporating below –35°C. In these cases an oil separator of sufficient capacity to retain the entire crankcase charge of lubricating oil

conduite d'aspiration.

Température des gaz – Afin d'éviter des températures excessives des gaz de refoulement qui nuisent à l'huile de lubrification, fluide frigorigène et isolation de bobinage, ne jamais utiliser le compresseur aux pressions des gaz aspirés inférieures à celles qui correspondent à la limite de température de vapeur saturée indiquée sur les courbes de puissance. Cette limite varie selon le frigorigène utilisé, la température de condensation et la quantité de surchauffe des gaz aspirés.

Si, à la suite d'une diminution de la capacité demandée par l'installation, ou de l'utilisation d'un dispositif d'étranglement dans la conduite d'aspiration ou de toute autre raison, le compresseur est utilisé aux pressions des gaz aspirés en dessous de la condition limite, il faut prévoir une diminution pareille de la surchauffe des gaz aspirés.

On peut réduire au minimum la surchaffe de la vapeur d'aspiration dans le compresseur en supprimant l'échangeur thermique et en isolant la conduite d'aspiration sur toute sa longeur afin d'éviter qu'elle n'absorbe de la chaleur ambiante. Dans des cas extrêmes, l'injection de réfrigérant liquide dans la conduite d'aspiration peut être nécessaire.

Refroidissement du compresseur – Il faut toujours que le moteur soit suffisamment refroidi. Ceci peut se faire en dirigeant un jet d'air sur le côté refoulement du compresseur, soit en le plaçant dans le courant d'air du ventilateur de condenseur, soit en équipant le compresseur d'un ventilateur séparé capable d'assurer une vitesse d'air minimum de 152 m/min. Autrement le compresseur peut être refroidi par un serpentin d'eau monté autour de la section moteur du compresseur.

Lubrification – La lubrification est assurée par une hélice à deux ailettes (sauf dans le modèle L400/0062 qui est équipé d'une pompe à huile réversible) qui tourne sur l'arbre du compresseur et refoule l'huile dans un réservoir situé en surplomb, réservoir d'où l'huile s'écoule par les galeries de l'arbre pour lubrifier les paliers et pistons.

Huile de lubrification – Les compresseurs reçoivent, en usine, une charge d'huile suffisante à assurer la bonne lubrification du compresseur. Pour tenir compte de la quantité d'huile qui restera dans la tuyauterie de l'installation, de l'huile supplémentaire sera introduite dans le carter du compresseur au régime de 0,5 litre par 4,5 kg de fluide frigorigène utilisé dans le système.

Il faut assurer que cette huile soit propre, déaërée, sans humidité et prise dans un bidon étanche.

Nous conseillons l'utilisation des huiles suivantes:

Texaco Capella Oil 32
Suniso 3GS
Mobile Gargoyle Arctic 155
Duckhams Zeroflow 4
BP Energol LPT65
Burmah Castrol Icematic 266
Virginia 150 (Blue Cap)
Total Lunaria 20
Shell Clavus 32

Séparateurs d'huile– Selon la conception de l'installation, l'emploi d'un séparateur d'huile peut être nécessaire. Ceci est surtout le cas pour les installations au R502 et celles utilisant le R22 aux températures

zweckmässige Drosselvorrichtung in die Saugleitung eingebaut werden.

Gastemperatur – Zur Vermeidung übermäßig hoher Drucktemperaturen, die für Schmieröl, Kältemittel und Motorwicklungs-Isolierung schädlich sind, darf der Kompressor nicht unterhalb der Ansaugdrücke arbeiten, die den Sättigungsdampf-Temperaturgrenzen in den Leistungskurven entsprechen. Diese Grenzen variieren je nach dem benutzen Kältemittel, den Verflüssigungstemperaturen und dem Überhitzungsgrad des Ansauggases.

Wenn wegen Herabsetzung der Anlageleistung, Anwendung von Drosseleinrichtungen oder aus irgendeinem anderen Grunde die Kompressoren unterhalb der unteren Grenze für den Ansaugdruck arbeiten, muß dafür gesorgt werden, daß die Überhitzung des Ansaugsdampfes entsprechend verringert wird.

Methoden zur Herabsetzung der Überhitzung des Ansaugdampfes sind Weglassen des Wärmeaustauschers und Isolieren der gesamten Saugleitung zwecks Verhütung von Wärmeaufnahme aus der Umgebungsluft. In extremen Fällen kann Einspritzen von flüssigem Kältemittel in die Saugleitung erforderlich sein.

Kompressorkühlung – Der Elektromotor muß dauernd gekühlt werden. Dies kann durch einen Luftstrom auf die Druckseite des Kompressorgehäuses geschehen, indem man entweder den Kompressor im Abstrom des Verflüssiger-Ventilators anbringt oder einen weiteren Ventilator mit einem Mindest-Luftstrom von 152 m/min vorsieht. Wahlweise kann der Kompressor mittels einer um das Motorgehäuse gewickelten, wasserdurchflossenen Kupferrohrschlange gekühlt werden.

Schmiersystem – Die zwangslaüfige Schmierung erfolgt durch eine doppelflügelige Ölschleuder (außer beim L400/0062, der mit einer drehrichtungsunabhängigen Ölpumpe ausgestattet ist). Die Schleuder rotiert mit der Kompressorwelle und fördert das Öl in einen oberhalb der Mittellinie der Welle angebrachten Behälter, aus dem es durch die Bohrungen in der Welle zu den Lagern und Kolben gelangt.

Schmieröl – Die Kompressoren sind mit einer für die einwandfreie Schmierung der Wellen und beweglichen Teile ausreichenden vollen Betriebsfüllung versehen. Zur Aufrechterhaltung des Ölstandes im System ist eventuell zusätzliches Öl in einer Menge von etwa 0,5 Liter je 4,5 kg Kältemittelfüllung in das Kurbelgehäuse einzufüllen.

Es ist sorgfältig darauf zu achten, daß hierfür nur sauberes, luft-und feuchtigkeitsfreies Öl verwendet wird, das einer versiegelten Dose zu entnehmen ist.

Die folgenden Schmieröle sind kompatibel und zugelassen:

Texaco Capella Oil 32
Suniso 3GS
Mobil Gargoyle Arctic 155
Duckhams Zeroflow 4
BP Energol LPT 65
Burmah Castrol Icematic 266
Virginia 150 (Blue Cap)
Total Lunaria 20
Shell Clavus 32

Ölabscheider – Je nach Systemauslegung kann der Einsatz eines Ölabscheiders erforderlich werden. Dies ist besonders der

should be fitted. In addition, an oil separator should be used when the design of the system is such that long off-cycles are anticipated without pump down facilities or when the total refrigerant charge in kilogrammes exceeds six times the standard oil charge of the compressor in litres.

In all cases the returning oil must be taken directly into the crankcase through an oil filling plug and provision made to prevent condensed refrigerant entering the sump from the oil separator during the off-cycle.

Oil return – The pipework of the entire system must be so designed and installed as to ensure that lubricating oil returns readily to the compressor. Reference to the relevant chapter in the Application section of the ASHRAE Date Book is strongly recommended as a guide to good pipework design and practice.

Oil pressure safety switch – An oil pump is fitted to the L400/0062, which ensures a liberal flow of oil to all bearings even under extreme operating conditions.

The design of the compressor is such that the lubricating system functions with a relatively low oil pressure. The pressure is sufficient to produce the necessary flow of oil but is lower than the minimum setting of commercially available oil pressure differential safety switches.

Crankcase and oil separator heaters – Heaters must be fitted to the crankcase and oil separator on all applications when the compressor or oil separator is liable at any time to become as cold as the evaporator, condenser or receiver. Crankcase heaters are not necessary when a full pump-down cycle is employed but a heater for the oil separator may still be required.

Suitable 100 W heaters for the compressor crankcase are available as optional extras. The heaters should be wired to be energised during the compressor off-cycle and they may be conveniently fed from a normally closed contact on the starter or contactor.

Starting – In order to protect the life of the compressor, it is recommended that the maximum number of starts per hour is limited to twenty. If, due to the application, a greater number of starts per hour is anticipated, some external form of capacity control should be used to avoid short-cycling.

Electric motors – All motor windings have Class 'B' insulation and are generously rated to permit compressors to be used over a wide range of operating conditions.

All motors are suitable for direct-on-line starting. L400 and L401 compressors can also be supplied with motors suitable for star/delta starting.

Electrical connections – The stator leads are brought out through hermetic terminals of the "Glasmetic" type to an electrical box mounted on top of the motor housing, in which terminals are provided for power supply connection and control circuits.

Motor protection – Single phase compressors are fitted with a temperature sensitive self-resetting overload cut-out. External current sensitive protection having approved quick-trip characteristics must be provided and a suitable starter is available as

d'évaporation inférieures à –12°C, ou le R12 aux temperatures d'évaporation inférieures à –35°C. Il faut prévoir un séparateur d'huile d'une capacité suffisante à contenir la charge d'huile entière du carter. On utilisera également un séparateur d'huile dans le cas où l'installation est telle que le compresseur ne tournera pas pendant de longues périodes et qu'il n'existe pas de possibilité d'evacuation, ou que la charge totale en frigorigène en kilogrammes est supérieure à six fois la charge normale d'huile du compresseur en litres.

Dans tous les cas, l'huile doit rentrer directement au carter du compresseur et il faut éviter que le frigorigène condensé puisse quitter le séparateur pour rentrer dans le carter en période de non-fonctionnement du compresseur.

Retour d'huile – La tuyauterie du système doit être conçue et installée de façon à assurer un abondant retour d'huile au compresseur. Nous conseillons fortement que l'installation soit étudiée et installée suivant les recommandations du "ASHRAE data book".

Pressostat différentiel d'huile – La pompe à huile dont est équipé le compresseur L400/0062 garantit une ample alimentation d'huile à tous les paliers, même dans les conditions d'utilisation les plus défavorables.

La conception du compresseur garantit le fonctionnement normal du circuit de lubrification par pression d'huile relativement faible. La pression est suffisante à assurer le débit d'huile requis mais est inférieure au point de réglage minimum des pressostats d'huile d'usage courant.

Résistances de carter et de séparateur d'huile – Si la température du carter du compresseur ou du séparateur d'huile peut descendre en dessous de celle d'un des constituants de l'installation (évaporateur, condenseur ou réservoir de liquide), il est conseillé de prévoir des résistances chauffantes.

Une résistance de carter n'est pas obligatoire lorsqu'il y a un système d'évacuation complète de frigorigène, mais un chauffage sera éventuellement nécessaire pour le séparateur d'huile.

Des résistances de carter 100W convenables sont fournies sur demande. Ces résistances seront branchées de manière à être mises en marche lorsque le compresseur est à l'arrêt, ce qui peut facilement être réalisé au moyen d'un relais normalement fermé sur le contacteur ou le démarreur du moteur.

Démarrage – Afin de ménager la durée de service du compresseur, on limitera à 20 le nombre de démarrages par heure. Si les circonstances d'exploitation donnent à prévoir la possibilité d'un nombre de démarrages supérieur à ce chiffre, il conviendra de prévoir un système extérieur de régulation de puissance pour éviter le court-cyclage du compresseur.

Moteurs électriques – Tous les bobinages de moteur sont isolés selon la norme B et leur homologation autorise l'emploi des compresseurs dans des conditions très

Fall bei allen Systemen mit Kältemittel R502, bei Systemen mit R22 bei Verdampfungstemperaturen unter –12°C, und bei Systemen mit R12 bei Verdampfungstemperaturen unter –35°C.

In solchen Fällen ist ein Ölabscheider vorzusehen, welcher ausreichende Kapazität hat, die gesamte Standardölfüllung des Kompressors aufzunehmen.

Ferner ist ein Ölabscheider zu empfehlen, wenn lange Standzeiten zu erwarten sind und keine Abpumpschaltung möglich ist, oder wenn die gesamte Kältemittelfüllung mehr als das Sechsfache der Standardölfüllung des Kompressors beträgt.

Auf alle Fälle muss das Öl direkt zum Kurbelgehäuse z.B. über ein Ölfüllnippel zurückgeführt werden. Es muss sichergestellt sein, daß während der Stillstandzeiten kein kondensiertes Kältemittel in das Kurbelgehäuse gelangt.

Ölrücklauf – Das Leitungssystem für die Gesamtanlage ist so zu konstruieren und zu verlegen, daß das Schmieröl ungehindert zum Kompressor zurücklaufen kann. Wertvolle Hinweise für gute Rohrleitungspraxis finden sich im Anwendungsteil des ASHRAE – Datenbuches.

Öldruck-Sicherheitsschalter – Der L400/0062 ist mit einer Ölpumpe ausgerüstet, die alle Lager reichlich mit Öl versorgt, selbst unter extremen Betriebsbedingungen, z. B. auf Schiffen bei schwerem Seegang.

Der Kompressor ist so konstruiert, daß das Schmiersystem mit einem relativ niedrigen Öldruck arbeitet. Der Druck reicht zur Erzeugung des erforderlichen Ölflusses aus, er ist jedoch kleiner als die niedrigste Einstellung handelsüblicher Öldruck-Differenzschalter.

Kurbelwannen- und Ölabscheiderheizung – In allen Anwendungsfällen müssen Kurbelgehäuse und Ölabscheider mit einer Heizung versehen werden, wenn sie zeitweilig so kalt werden können wie der Verdampfer, der Verflüssiger oder der Sammler, so daß die Gefahr einer Kältemittel-Abwanderung besteht. Bei Einsatz mit Abpumpschaltung darf die Kurbelwannenheizung entfallen. Eine Beheizung des Ölabscheiders ist aber in solchen Fällen eventuell vorzusehen.

Eine 100 W-Kurbelwannenheizung (wahlweise lieferbar) ist an einen Ruhekontakt im Anlasser bzw. Schütz anzuschließen, um Energiezufuhr während der Abschaltzeiten des Kompressors sicherzustellen.

Anlassen – Zur Schonung des Kompressors empfiehlt es sich, die Zahl der Anlaßvorgänge auf ein Maximum von zwanzig in der Stunde zu beschränken. Wenn der Anwendungszweck eine großere Schalthäufigkeit erwarten läßt, ist externe Leistungsregelung in irgendeiner Form vorzusehen, um ein Pendeln zu vermeiden.

Elektromotoren – Alle Motorwicklungen haben Isolation der Klasse B und sind so reichlich bemessen, daß die Kompressoren in einem weiten Bereich von Betriebsbedingungen benutzt werden können.

Direktanlauf ist bei allen Kompressoren möglich. Bei dem L400 und dem L401 ist Sterndreieckanlauf wahlweise erhältlich.

Elektrische Anschlüsse – Die Ständer-

an optional extra.

All dual-voltage models up to and including model L300 are fitted with a temperature sensitive self-resetting overload cut-out. External current sensitive protection having approved quick-trip characteristics must be provided and a suitable starter is available as a optional extra.

Single voltage band three phase compressors up to and including L300 are fitted with a temperature and current sensitive self-resetting overload cut-out connected at the star point of the motor windings. A suitable contactor, without overloads, can be supplied as an optional extra.

Inherent motor protection is available on request for dual voltage band three phase compressors and is supplied as standard for all L400 and L401 compressors. This is ensured by thermistors implanted in each phase winding continuously to monitor the temperature up to a predetermined level. At this point they cause the motor contactor (which can be supplied as an optional extra) to disconnect the supply from the motor and to restore it only when the temperature of the windings falls to a safe level. A transistorised low-voltage circuit actuates a miniaturised relay (included) which forms a switch in the main control circuit.

In cases where the electrical supply network is such that occasional loss of supply phase can occur, additional single-phasing protection devices should be fitted. Either external overloads with quick trip characteristics or separate phase-loss protectors, both with manual reset, are preferable.

variées. Tous les compresseurs type 'L' sont équipés de moteurs qui conviennent au démarrage direct. Les moteurs des compresseurs L400 et L401 peuvent également être fournis en version démarrage. étoile-triangle.

Branchements électriques – Les fils du stator sont raccordés par des bornes étanches de type Glasmetic à une boîte à bornes au dessus du moteur comprenant des bornes de raccordement de l'alimentation et des circuits de régulation et commande.

Protection moteur – Les compresseurs monophasés de la série 'L' sont équipés d'un disjoncteur de sécurité à auto-réenclenchement, sensible à la température. Il faut prévoir un relais extérieur à déclenchement instantané de protection contre les surcharges. Un démarreur convenable peut être fourni sur demande.

Tous les compresseurs à 220/380 V / 3 ph / 50 Hz jusq' au modèle L300 sont équipés d'un disjoncteur de sécurité à auto-réenclenchement, sensible à la température. Il faut prévoir un relais extérieur à déclenchement instantané de protection contre les surcharges. Un démarreur convenable peut être fourni sur demande.

Les compresseurs à 380 V / 3 ph / 50 Hz jusqu'au modèle L300 sont équipés d'un disjoncteur de sécurité à auto-réenclenchement, sensible à la température et au courant et coûplé à l'étoile des enroulements du moteur. Un contacteur approuvé peut être fourni sur demande.

Tous les compresseurs à 220 / 380 V / 3ph / 50 Hz peuvent être équipés, sur demande, d'une protection moteur intégrale par thermistances. Tous les compresseurs L400 et L401 sont équipés d'une protection moteur intégrale par thermistances incorporées aux bobinages des trois phases qui contrôlent la température jusqu'à une limite déterminée. Une fois ce niveau dépassé, les thermistances coupent l'alimentation du moteur par moyen du contacteur et ne permettent son rétablissement que lorsque la température des bobinages est retombée en dessous de cette limite. Un circuit basse tension transistorisé commande un relais miniaturisé monté sur le compresseur.

Quand le réseau d'alimentation admet la possibilité de pertes de phases, il convient d'installer des dispositifs de protection supplémentaires. Dans ce cas, l'emploi de disjoncteurs extérieurs à déclenchement instantané ou de dispositifs de protection contre perte de phase, avec réenclenchement manuel dans les deux cas, est préconisé.

leitungen werden über hermetische Durchführungen vom "Glasmetic"-Typ zu einem auf dem Motorgehäuse angebrachten Kasten geführt, der Klemmen zum Anschließen der Stromversorgung und der Regelkreise enthält.

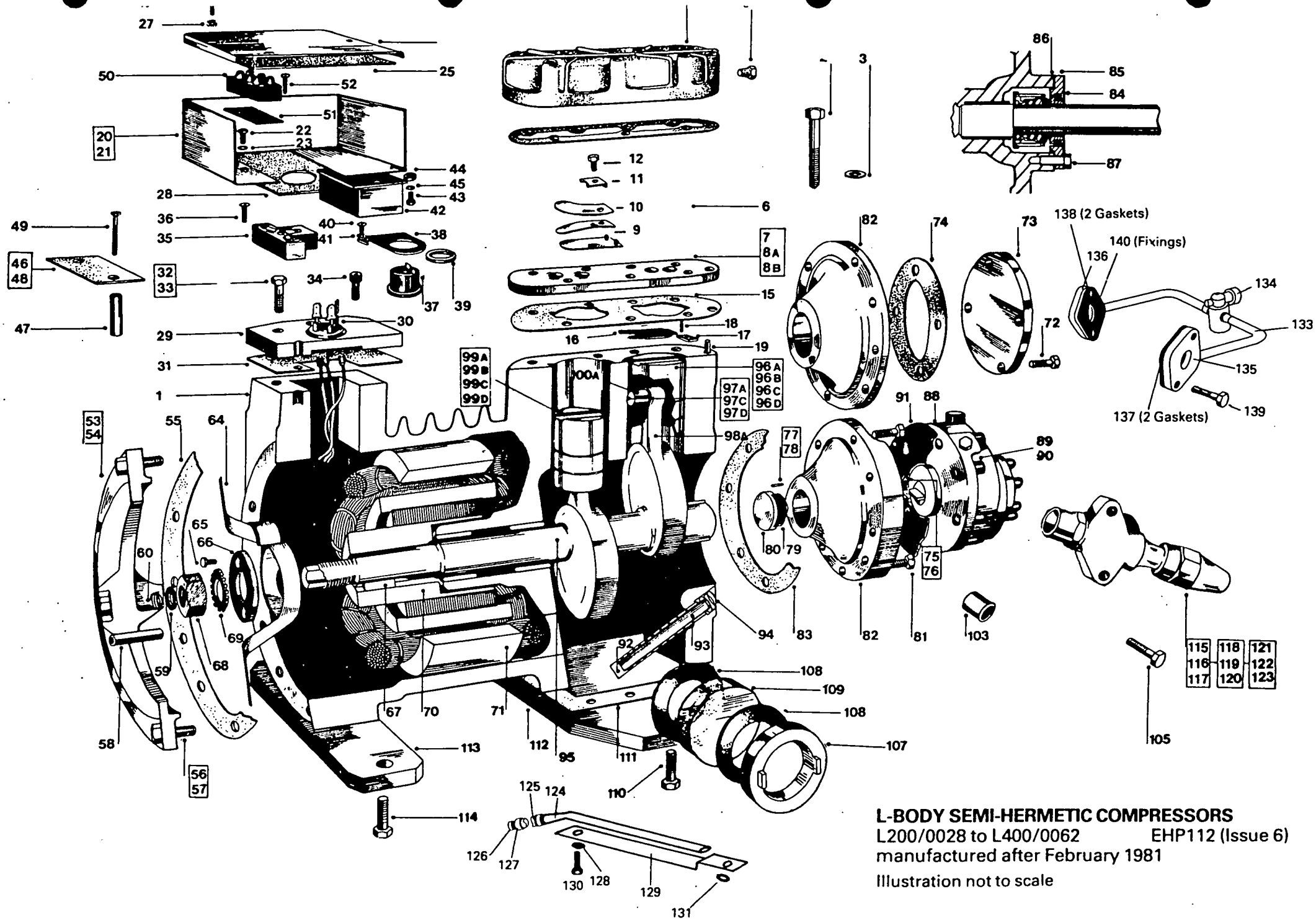
Motorschutz – Einphasen-Kompressoren der L-Serie sind mit einem temperaturempfindlichen, selbstrückstellenden Thermoschutzschalter versehen. Ein externer stromempfindlicher Überstromauslöser mit genehmigter Schnellauslösecharakteristik ist vorzusehen. Ein passender Anlasser ist als wahlweise Sonderausstattung lieferbar.

Alle Typen Doppelspannung (220 V/380 V) bis Modell L300 einschließlich haben einen temperaturempfindlichen, selbstrückstellenden Thermoschutzschalter. Ein externer stromempfindlicher Überstromauslöser mit genehmigter Schnellauslösecharakteristik is vorzusehen; ein passender Anlasser ist als wahlweise Sonderausstattung lieferbar. Als Alternative kann Thermistorvollschutz geliefert werden, wobei ein externer Überstromauslöser nicht erforderlich ist.

Dreiphasen-Kompressoren für nur einen Spannungsbereich sind mit einem temperatur- und stromempfindlichen Thermoschutzschalter versehen, der im Sternpunkt der Motorwicklungen angeschlossen ist. Ein passendes Schaltzschütz ohne Überlastungsschutz kann als wahlweise Sonderausstattung geliefert werden.

Für den Schutz der Kompressoren L400 und L401 sorgen Thermistoren, die in jede einzelne Phasenwicklung eingebaut sind und laufend die Temperatur bis zu einer vorgegebenen Höhe überwachen. Bei diesem Wert veranlassen sie das als wahlweise Sonderausstattung lieferbare Motorschütz zur Abschaltung der Motorspeisespannung, die erst wieder zugeschaltet wird, wenn die Wicklungstemperatur auf einen sicheren Wert gefallen ist. Eine transistorisierte Niederspannungsschaltung betätigt ein eingebautes Kleinrelais, das als Schalter im Hauptregelkreis wirkt.

Wenn wegen besonderen Eigenschaften der Netzes mit gelegentlichen Phasenausfall zu rechnen ist, sind zusätzliche Einphasen-Schutzvorrichtungen vorzusehen, vorzugsweise externe Schnellauslöser oder separate Phasenausfallsicherungen, beide mit Handrückstellung.



L-BODY SEMI-HERMETIC COMPRESSORS

L200/0028 to L400/0062 EHP112 (Issue 6)

manufactured after February 1981

Illustration not to scale

ISSUED MARCH 1983

L-body Semi-hermetic Compressors

PARTS LIST

L200/0028 to L400/0062

manufactured after February 1981

50 Hz

EHP112 (Issue 6)

Compressor Part No.	Model	Voltage	Phase	Hz	Stator Part No.	Rotor Part No.	Klixon Part No.
7170/1248	L200/0028	210/240–360/420	3	50	27170/7227	27170/7228	TP
57170/6398	L200/0037	220/240	1	50	27170/7899	27170/7919	27110/0016
57170/6399	L200/0037	200/220	1	50	27170/7900	27170/7919	27110/0016
57170/0160	L200/0037	480	1	50	27170/7901	27170/7919	27110/0016
57170/7803	L200/0037	360/420	3	50	27170/7893	27170/7916	27110/0093
57170/6401	L200/0037	210/240–360/420	3	50	27170/7893	27170/7916	27110/0016
57170/6489	L200/0042	220/240	1	50	27170/7899	27170/7919	27110/0016
57170/6488	L200/0042	200/220	1	50	27170/7900	27170/7919	27110/0016
57170/0161	L200/0042	480	1	50	27170/7901	27170/7919	27110/0016
57170/7804	L200/0042	360/420	3	50	27170/7893	27170/7916	27110/0093
57170/6491	L200/0042	210/240–360/420	3	50	27170/7893	27170/7916	27110/0016
57170/6402	L200/0050	220/240	1	50	27170/7899	27170/7919	27110/0016
57170/6403	L200/0050	200/220	1	50	27170/7900	27170/7919	27110/0016
57170/0176	L200/0050	480	1	50	27170/7901	27170/7919	27110/0016
57170/7805	L200/0050	360/420	3	50	27170/7893	27170/7916	27110/0093
57170/6405	L200/0050	210/240–360/420	3	50	27170/7893	27170/7916	27110/0016
57170/0186	L300/0037	220/240	1	50	27170/7904	27170/7920	27110/0016
57170/0187	L300/0037	200/220	1	50	27170/7905	27170/7920	27110/0016
57170/0190	L300/0037	480	1	50	27170/7906	27170/7920	27110/0016
57170/7417	L300/0037	360/420	3	50	27170/7910	27170/7917	27110/0073
				50	27173/7952	27173/7955	
57170/0189	L300/0037	210/240–360/420	3	50	27170/7910	27170/7917	27110/0016
				50	27173/7952	27173/7955	
57170/1245	L300/0042	220/240	1	50	27170/7904	27170/7920	27110/0016
57170/1244	L300/0042	200/220	1	50	27170/7905	27170/7920	27110/0016
57170/7984	L300/0042	480	1	50	27170/7906	27170/7920	27110/0016
57170/8210	L300/0042	360/420	3	50	27170/7910	27170/7917	27110/0073
				50	27173/7952	27173/7955	
57170/7983	L300/0042	210/240–360/420	3	50	27170/7910	27170/7917	27110/0016
				50	27173/7852	27173/7955	
57170/6406	L300/0050	220/240	1	50	27170/7904	27170/720	27110/0016
57170/6407	L300/0050	200/220	1	50	27170/7905	27170/7920	27110/0016
57170/0162	L300/0050	480	1	50	27170/7906	27170/7920	27110/0016
57170/7416	L300/0050	360/420	3	50	27170/7910	27170/7917	27110/0073
				50	27173/7952	27173/7955	
57170/6409	L300/0050	210/240–360/420	3	50	27170/7910	27170/7917	27110/0016
				50	27173/7952	27173/7955	
57170/6410	L300/0062	220/240	1	50	27170/7904	27170/7920	27110/0016
57170/6411	L300/0062	200/220	1	50	27170/7905	27170/7920	27110/0016
57170/0177	L300/0062	480	1	50	27170/7906	27170/7920	27110/0016
57170/7419	L300/0062	360/420	3	50	27170/7910	27170/791?	27110/0073
				50	27173/7952	27173/7955	

57170/0092	L300/0062	210/240–360/420	3	50	27170/7910	27170/7917	27110/0016
				50	27173/7952	27173/7955	
57170/1246	L400/0050	360/420	3	50	27170/7221	27170/7223	TP
57170/1247	L400/0050	210/240–360/420	3	50	27170/7222	27170/7223	TP
57170/1246	L400/0050	360/420–SD	3	50	27170/7221	27170/7223	TP
57170/1247	L400/0050	210/240–SD	3	50	27170/7222	27170/7223	TP
57170/7224	L400/0062	360/420	3	50	27170/7221	27170/7223	TP
57170/6756	L400/0062	210/240–360/420	3	50	27170/7222	27170/7223	TP
57170/7224	L400/0062	360/420 SD	3	50	27170/7221	27170/7223	TP
57170/6756	L400/0062	210/240 SD	3	50	27170/7222	27170/7223	TP
57170/8305	L401/0062	360/420	3	50	27170/7221	27170/7223	TP
57170/8304	L401/0062	210/240–360/420	3	50	27170/7222	27170/7223	TP
57170/8305	L401/0062	360/420 SD	3	50	27170/7221	27170/7223	TP
57170/8304	L401/0062	210/240 SD	3	50	27170/7222	27170/7223	TP

EXCEPT WHERE STATED ALL PARTS ARE COMMON

Item No.	Part No.	Description	Qty.
1	37170/6309	Body & Bearing Assy 1.7/8" Bore — L200/0037, L300/0037,	1
	37170/6310	Body & Bearing Assy 2" Bore — L200/0028, ES200/0042, L200/0042, L300/0042	1
	37170/6311	Body & Bearing Assy 2.3/16" Bore — L200/0050, L300/0050, L400/0050	1
	37170/6312	Body & Bearing Assy 2.7/16" Bore — L300/0062, L401/0062	1
	37170/7394	Body & Bearing Assy 1.7/8" Bore — L(SB) 200/0037	1
	37170/7395	Body & Bearing Assy 2" Bore — L(SB) 200/0042	1
	37170/7396	Body & Bearing Assy 2.3/16" Bore — L(SB) 200/0050, L(SB) 300/0050	1
	37170/7397	Body & Bearing Assy 2.7/16" Bore — L(SB) 300/0062, L400/0062	1
		CYLINDER HEAD AND VALUE PLATE TO BODY ASSEMBLY	
2	27170/6449	Screw Hex Hd 3/8" 24 UNF 2A x 2.1/4" } Securing Cylinder Head	9
3	WA110060	Washer Plain 3/8" } Securing Cylinder Head	9
4	17170/8247	Cylinder Head	1
5	27170/6453	1/8" Briggs Plug — Cylinder Head	2
6	27170/8248	Gasket — Cylinder Head	1
7	37170/8245	Valve Plate Assy (Large) — L300/0062, L400/0062, L401/0062 L200/0050, L300/0050, L400/0050	1
	37170/8249	Valve Plate Assy (Small) — L200/0037, L300/0037, L200/0042	1
8A	17170/8237	Valve Plate — Small	1
8B	17170/8238	Valve Plate — Large	1
9	27170/4189 or 27170/4190	Discharge Valve Reed / Discharge Reed (Flexed)	4 for 8A, 8 for 8B / 2 for 8A, 4 for 8B
10	27170/7760	Discharge Valve Reed Retainer	2 for 8A, 4 for 8B
11	27170/6244	Bolt Lock Washer	2 for 8A, 4 for 8B
12	27170/8250	Bolt	2 for 8A, 4 for 8B
15	27170/8239	Gasket Valve Plate — 0037 Models	1
	27170/8240	Gasket Valve Plate — 0028, 0042 models	1
	27170/8279	Gasket Valve Plate — 0050 Models	1
	27170/8278	Gasket Valve Plate — 0062	1
16	27170/6169	Reed Suction Valve — 0028 — 0037 — 0042 Models	1
	27170/4195	Reed Suction Valve — 0050 — 0062 Models	1
17	27170/6239	Suction Valve Pad	2
18	27170/6227	Suction Valve Locating Pin	4
19	27170/6228	Dowel Pin Valve Plate to Body	2
		TERMINAL AND OVERLOAD ASSEMBLY	
20	57170/9743	Terminal Box Assy — Klixon Protected Models	1
21	27170/9744	Terminal Box Assy — Thermistor Protected Models	1
22	UMA101PR05	M/C Screw 10 — 32 UNF 2A x 5/16" } Fixing Terminal Box	4
23	UWS021	Washer Shakeproof 10 UNF } Fixing Terminal Box	4
24	57170/6477	Terminal Box Cover	1
25	27170/6482	Insulation — Terminal Box Cover	1
26	SA101PR06	M/C Screw 10 — 32 UNF x 5/16" } Fixing Terminal Box Cover	2
27	WE702101	Washer Shakeproof 10 UNF } Fixing Terminal Box Cover	2
28	27170/7883	Insulating Gasket — Terminal Plate — all voltages except 480 volts	1
	27170/9826	Insulating Gasket — Terminal Plate — 480 volts only	1

29	37170/7878	Terminal Mounting Plate Assy (3 Term) 200/220/1/50 & 220/240/1/50		1
	37170/7879	Terminal Mounting Plate Assy (6 Term) 480 V.Single Phase, Std Three Phase & Three Phase Dual Voltage		1
	37170/7880	Terminal Mounting Plate Assy (5 term) Three Phase Dual Voltage (SB)		1
	37170/7881	Terminal Mounting Plate Assy (6 Term) 200/220/3/60 & 550/600/3/60		1
	37170/7882	Terminal Mounting Plate Assy (6 Term) Thermistor Protected Models		1
30	27170/6718	Fusite Terminal — Thermistor Protected Models		2
31	27170/6141	Gasket — Terminal Plate		1
32	27170/6442	M/C Screw 5/16" 24 UNF 2A x 1.1/8"	Fixing Terminal Mounting Plate	4
33	27170/6443	M/C Screw 5/16" 24 UNF 2A x 1.3/8"		1
34	27170/6456	Screw Socket Hd. 5/16" 24 UNF 2A x 3/4"		2
35	27170/6241	Terminal Connector		1
36	UMA109PR05	Screw Pan Recess Hd 10 — 32 UNF 2A x 5/16" — Terminal Connector		3
37	See front sheets	Motor Protector (Klixon)	Klixon Protected Models	1
37A	27170/7877	Klixon Mounting Plate		1
38	57170/6148	Retaining Plate — Motor Protector 3/4"		1
	57170/7095	Retaining Plate — Motor Protector 1"		1
39	27170/6149	Insulating Sleeve — Motor Protector 3/4"		1
	27170/7097	Insulating Sleeve — Motor Protector 1"		1
40	UMA101PR08	M/Screw 10 — 32 UNF — 2A x 1/2" — Fixing Retaining Plate		2
40A	UMA101CR08	M/Screw C/sk Hd 10 — 32 UNF - 2A x 1/2"		2
41	UWS121	Washer — Shakeproof — Fixing Retaining Plate		2
42	27170/4386	Thermistor Control Unit —	Thermistor Protected Models	1
42A	27080/0686	Spare Fuse 2 amp		1
43	UMC061PR08	M/C Screw 6 — 32 UNC x 1/2"	Fixing Thermistor Control Unit	2
44	UNC061H	Nut Hex 6 — 32 UNC		2
45	WS091	Washer Shakeproof No. 6		2
46	27170/6457	Terminal Board	DV Models	1
47	27170/6463	Terminal Board Spacer		2
48	27170/6464	Terminal Board Bush		2
49	UMA101P32	M/C Screw 10 — 32 UNF 2A x 2" — Fixing Board		2
50	27150/0135	Terminal Block — 6 Way — 20 Amp — Thermistor Protected Models		1
51	27170/7376	Insulation — Terminal Block		1
52	SA041PR12	S/M Screw Type 'A' No 4 x 3/4" — Fixing Terminal Block		2

MOTOR END

53	17172/6041	Motor End Cover (Cast Aluminium)		1
54	17170/6652	Splasher Baffle		1
55	27170/6114	Gasket Motor End Cover Plate		1
56	27170/6447	M/C Screw 3/8" 24 UNF 2A x 1.1/8"	Fixing Motor End Cover Plate	12
57	WA110060	Washer Plain 3/8"		12
58	27170/6222	Oil Tube (Not Pump Lubricated Models)		1
59	27170/6190	Rotor Thrust Washer (Not Extended Shaft & Pump Lubricated Models)		1
60	27170/6193	Rotor Thrust Spring (Not Extended Shaft & Pump Lubricated Models)		1
61	27170/6234	Thrust Washer (Extended Shaft & Pump Lubricated Models)		1
62	27170/6235	Tension Pin (Extended Shaft & Pump Lubricated Models)		1
63	17170/7382	Insert (Pump Lubricated Models)		1
64	37170/6328	Oil Splasher	Non-pump Lubricated Models	1
65	UMC161C08	M/C Screw 1/4" 20 UNC 2A x 1/2" — Fixing Oil Splasher		2
66	17170/9738	Washer Eccentric Shaft to Rotor		1
67	17170/6226	Crankshaft Key		1
68	27170/6257	Nut 7/8" 14 UNF 2A	Retaining Rotor	1
69	17170/9737	Washer Shakeproof 7/8"		1
70	see front sheets	Rotor		1
71	see front sheets	Stator		1

THRUST END AND CRANKCASE

72	27170/6439	M/C Screw 5/16" 24 UNF 2A x 3/4"	4
73	17170/6052	Thrust Plate } Not Extended Shaft	1
74	27170/6139	Gasket — Thrust Plate } and Pump Lubricated Models	1
76	17170/7364	End Thrust Plug — (Pump Lubricated Models)	1
77	27170/6250	Pin Spring — End Thrust Plug — (Not Extended Shaft & Pump Lubricated Models)	1
78	27170/6235	Pin Spring — Oil Pump — (Pump Lubricated Models)	2
79	27170/7366	End Thrust Crimp Spring (Not Extended Shaft Models)	1
80	27170/7365	Thrust Plug — Retainer	1
81	27170/6447	M/C Screw 3/8" UNF x 1.1/8" — Fixing Housing Cover & Bearing	8
82	37170/6759	Housing Cover & Bearing — Not Extended Shaft & Pump Lubricated Models	1
	37170/6324	Housing Cover & Bearing — Extended Shaft Models	1
	37170/6760	Housing Cover & Bearing — Pump Lubricated Models	1
83	27170/6117	Gasket Housing Cover	1
84	27170/6433	Shaft Seal Assy	1
85	17170/6076	Seal Retaining Plate } Extended Shaft Models	1
86	27170/6140	Gasket Seal Retaining Plate	1
87	27170/6438	M/C Screw 1/4" 28 UNF x 3/4" — Fixing Retaining Plate	6
88	17170/4397	Oil Pump — Pump Lubricated Models	1
89	27170/4097	M/C Screw 5/16" 18 UNC 2A x 3/4" } Fixing Oil Pump	5
90	27170/4170	M/Screw 18 UNC 2A x 1.1/2"	1
91	27170/4371	Gasket — Oil Pump	1
92	27170/7367	Oil Filter } Pump Lubricated Models	1
93	27170/7368	Oil Filter Insert	1
95	17170/6057	Eccentric Shaft — (Not Extended Shaft & Pump Lubricated Models)	1
	17170/6109	Eccentric Shaft — (Extended Shaft Models)	1
	37170/9788	Eccentric Shaft — Extension Piece Assy — (Pump Lubricated Models)	1
96A	37170/8259	Piston & Eccentric Rod Assy — 0037 Models (Comprising items 97A, 98A, 99A, 100A)	2
97A	37170/6357	Piston Pin & Rivet Assy	2
98A	17170/6790	Eccentric Rod	2
99A	17170/8252	Piston	2
100A	27170/6232	Piston Pin Crimp Spring	2
96B	37170/8258	Piston & Eccentric Rod Assy — 0028, 0042 Models (Comprising items 97A, 98A, 99B, 100A)	2
99B	17170/8251	Piston	2
96C	37170/8260	Piston & Eccentric Rod Assy — 0050 Models (Comprising items 97C, 98A, 99C, 100A)	2
97C	37170/6358	Piston Pin & Rivet Assy	2
99C	17170/8254	Piston	2
96D	37170/8261	Piston & Eccentric Rod Assy — 0062 Models (Comprising items 97D, 98A, 99D, 100A)	2
97D	37170/6359	Piston Pin & Rivet Assy	2
99D	17170/8255	Piston	2

SUMP PLATE, OIL SIGHT GLASS AND SHUT-OFF VALVES

103	27170/8138	Screen — Suction Strainer	1
106	27510/0695	Sight Glass Retainer	1
107	27510/0563	Gasket Sight Glass	1
108	27510/0562	Sight Glass	1
109	27510/0564	Washer Sight Glass	1
110	27170/6447	M/C Screw 3/8" 24 UNF 2A x 1.1/8" — Fixing Sump Plate	17
111	27170/6111	Gasket — Sump Plate	1
112	17170/6043	Sump Plate	1
113	17170/9643	Mounting Foot	1
114	27170/6447	M/C Screw 3/8" 24 UNF 2A x 1.1/8" — Fixing Mounting Foot	2
115	27170/6426	Shut-off Valve 5/8" (Discharge) (HRP)	1
	or		
	27170/6640	Shut-off Valve 5/8" (Discharge) (Scott)	1
	or		
	27171/6640	Shut-off Valve 5/8" (Discharge) (Primore)	1
116	27170/6144	Gasket Shut-off Valve 5/8"	1
117	27170/6443	M/C Screw 5/16" 24 UNF 2A x 1.3/8" — Securing 5/8" Shut-off Valve (HRP)	2
	or		
	27170/6439	M/C Screw 5/16" 24 UNF 2A x 3/4" — Securing 5/8" Shut-off Valve (Scott & Primore)	2

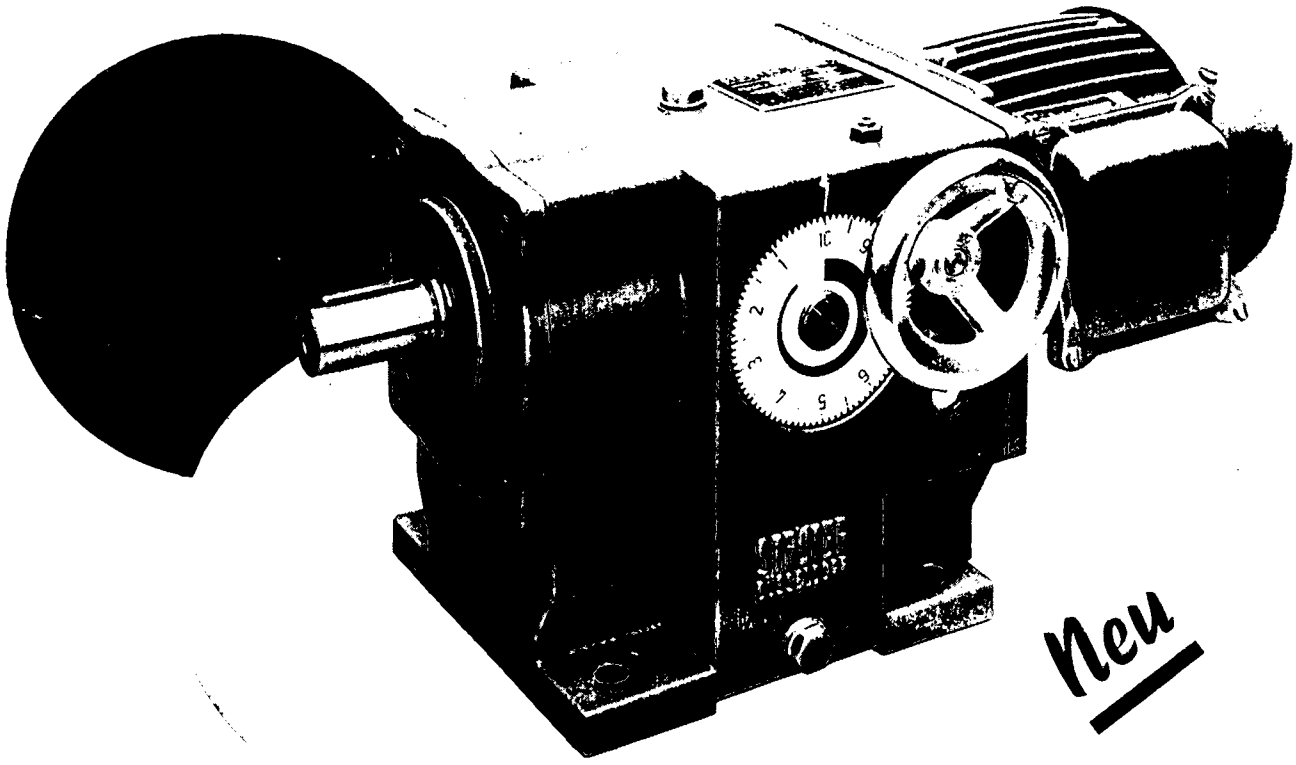
118	27170/8142	Shut-off Valve 7/8" (Suction) (Nobis)	1
	or		
	27171/8142	Shut-off Valve 7/8" (Suction) (Henry)	1
119	27170/9815	Gasket Shut-off Valve 7/8"	1
120	27170/6450	Screw 1/2" UNF x 1.1/4" Securing 7/8" Suction Shut-off Valve	2
121	27170/8143	Shut-off Valve 1.1/8" (Suction) (Nobis)	1
	or		
	27171/8143	Shut-off Valve 1.1/8" (Suction) (Henry)	1
122	27170/9815	Gasket Shut-off Valve 1.1/8"	1
123	27170/6450	Screw 1/2" UNF x 1 1/4" — Securing 1.1/8" Shut-off Valve	2
124	27170/6421	Crankcase Heater — 100 W 240 V	1
125	27150/0201	Flexible Conduit — 16 mm	0.61 m
126	27150/0200	Adaptor 16 mm	2
127	27150/0202	Locknut 16mm	1
128	27150/0183	Washer 1" od x 3/4" id	
129	27170/6423	Retainer — Crankcase Heater	1
130	27170/6448	M/Screw 3/8" UNF x 1.1/4"	2
131	27200/0470	Washer Plain 3/8" UNF	2
		STAR DELTA MODEL	
132	27170/9764	Check Valve 5/8"	1
133	57170/4714	Unloading Valve Assembly	1
		Comprising Items 134 to 136	
134	27170/4704	Solenoid Valve 7/8" Sporlan B1052	1
135	17170/4710	Flange 1.1/8"	1
136	17170/4711	Flange 5/8"	1
137	27170/4662	Gasket — 1.1/8" Flange	1
138	27170/4716	Gasket — 5/8" Flange	1
139	27170/6452	M/Screw 1/2" UNF x 3" — Securing 1.1/8" Shut-off Valve	2
140	27170/6443	M/Screw 5/16" UNF x 1.3/8" — Securing 5/8" Shut-off Valve (HRP)	2
	27170/6439	M/Screw 5/16" UNF x 1.3/4" — Securing 5/8" Shut-off Valve (Scott)	2

Note:

Compressor Designation: SB refers to Shipboard Model

STRÖTER DÜSSELDORF

STUFENLOSE GANZSTAHL-REGELTRIEBE



STRÖTER-Ganzstahl-Regeltrieb Typ A

Besondere Vorteile:

- Regelbereich 1:10
- Reibring aus Hartmetall
- kompakte Bauart
- vollkommen geschlossen
- keine beweglichen Außenteile
- Bauformen horizontal und vertikal
- im Lauf und im Stillstand verstellbar
- viele Drehzahlbereiche

und was Sie noch mehr interessiert:

- kurze Lieferzeiten

Hans Ströter oHG - 4000 Düsseldorf - Getriebebau

Schmierstoff-Empfehlung
für STRÖTER-Ganzstahl-Regelgetriebe

Aufstellung Die Regelgetriebe sind nur in der Bauform aufzustellen, für die sie erstellt wurden.

Inbetriebsetzung Bei der Montage sind Verspannungen der Gehäusefüße oder des Flansches zu vermeiden. Das Aufziehen der Riemenscheiben, Kupplungen usw. erfolgt unter Verwendung der Gewindebohrung im Wellenstumpf. Schläge oder Stöße auf die Wellenstümpfe sind zu vermeiden. Bei axialen Drücken, beispielsweise durch Schnecken- oder Kegelräder verursacht, müssen dieselben durch ein zusätzliches Längslager aufgenommen werden.

Ölwechsel Der Regeltrieb kommt betriebsfertig und mit Ölfüllung zum Versand. **Es ist besonders darauf zu achten, daß der Öleinfüllstopfen mit einem Entlüftungsloch versehen ist.** Andernfalls ist der Öleinfüllstopfen auszuwechseln. Der Ölstand wird im Stillstand kontrolliert, wobei das Ölstandsauge zur Hälfte mit Öl befüllt sein muß.
Nach 200 Betriebsstunden ist der erste Ölwechsel vorzunehmen. Weitere Ölwechsel folgen nach jeweils 2000 Betriebsstunden. Als Füllung verwende man Öle mit mildwirkenden Hochdruckzusätzen und einer Viskosität von ca. 61-75 mm²/s (cSt) 40° C. Vor der Ölneufüllung ist der Regeltrieb mit Spülöl zu reinigen.

Recommended Lubrication
for STRÖTER All-Steel Variable Speed Gear

Installation Variable speed gears are only to be installed in the construction design for which they were produced.

Running During installation, care should be taken to avoid putting undue pressure on the housing feet and the flange. Fitting of the pulleys, couplings etc. is carried out using the thread situated on the shaft end. Knocking or jolting the shaft ends should be avoided. In the event of axial pressures caused, for instance, by worm or bevel gears, these must be taken up by an additional thrust bearing.

Oil Change The variable speed gear is dispatched ready for operation and filled with oil. **Special care should be taken that the oil filler plug is provided with an air hole.** The plug must otherwise be changed. Oil level is checked with the gear inoperative, and the oil level indicator must be filled to the halfway mark.
After 200 hours of operation, the first oil change must be carried out. Further oil changes should take place after each 2000 hours of operation. The oils used should contain mild acting high pressure additives and should have a viscosity of about 61-75 mm²/s (cSt) 40° C. Prior to refilling with fresh oil, the gear is to be cleaned with flushing oil.

Agip	BP	Chevron	Esso	Mobil	Texaco
AGIP BLASIA 57	BP Energol GR-XP 68 (ISO), BP Energol HLP 68 (ISO).	Chevron Gear Compound 68, Chevron Non-Leaded Gear Compound 68	SPARTAN 68	Mobilgear 626	Meropa 68, Rando Oil HD C

AGIP AG, München — **AGIP** Companies all over the world

Deutsche BP AG, Hamburg — **BP** Companies all over the world

DEUTSCHE TEXACO VERKAUF GMBH, Hamburg — **TEXACO** and **CALTEX** Companies all over the world

CHEVRON ERDOEL DEUTSCHLAND GMBH, Frankfurt — **CHEVRON** Companies all over the world

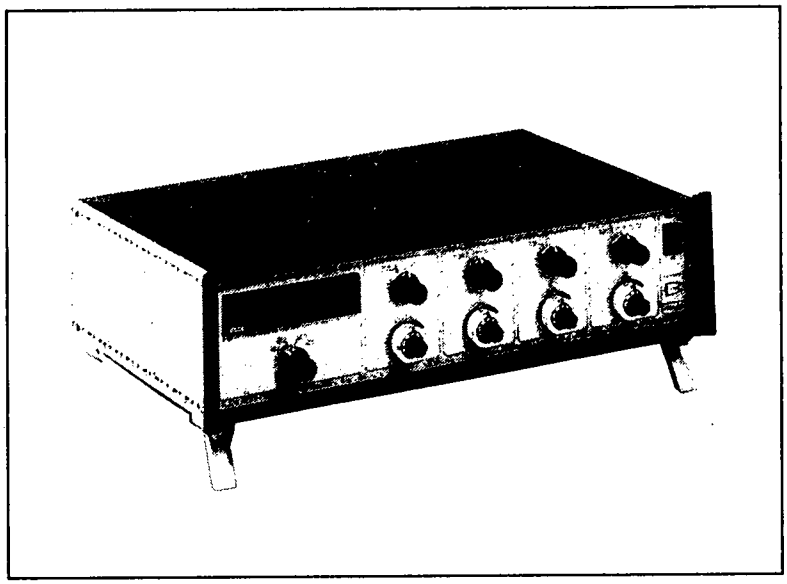
ESSO AG, Hamburg — **ESSO** Companies all over the world

MOBIL OIL A.G. in Deutschland, Hamburg — **MOBIL OIL** Companies all over the world

X-5870-E-NL
January 1990

INSTALLATION AND OPERATING MANUAL

BROOKS CONTROL AND READ OUT EQUIPMENT FOR THERMAL MASS FLOWMETERS MODELS 5875-5876-5878



Model 5878

CAUTION: It is recommended that this publication be read in its entirety before performing any operation. Failure to understand and follow these instructions could result in serious personal injury and/or damage to the equipment.

Brooks Instrument B.V.
Groeneveldselaan 6
3903 AZ Veenendaal
P.O. Box 56
3900 AB Veenendaal
The Netherlands
Tel. (0)8385 - 63911
Tlx 37106
Telefax (08385) - 63314

Dear Customer:

This Brooks Instrument Division, Emerson Electric Co,, product you have just received is of the highest quality available, offering superior performance to the user. This controller provides the finest degree of accuracy, repeatability, and widest operating parameters available for extremely reliable gas measurement and control of mass flow rate.

Because of the wide variety of applications, we have expressly designed this instrument to provide user selectable functions in a single instrument to meet ever changing process conditions. Additionally, this "state-of-the-art" design has been packaged and materials selected to permit application to a variety of often corrosive and hostile conditions.

To realize the full potential of the inherent design flexibility and ease of maintenance, may we suggest you review this manual in its entirety.

Should you need additional information concerning the 5870 Series Read-out /Controllers, please feel free to contact your local Brooks Instrument Division Sales Office.*
We are pleased to have this opportunity of servicing you for your gas measurement and control needs.

Sincerely,

BROOKS INSTRUMENT DIVISION
Emerson Electric Co.

* The Brooks Instrument Sales Office Addresses you will find on the cover.

WARNING

This instrument contains electronic components that are susceptible to damage by static electricity. Proper handling* procedures must be observed during the removal, installation, or other handling of internal circuit boards or devices.

*** Handling Procedure:**

1. Power to unit must be removed.

2. Personnel must be grounded, via a wrist strap or other safe, suitable means before any printed circuit card or other internal device is installed, removed or adjusted.

3. Printed circuit cards must be transported in a conductive bag or other conductive container. Boards must not be removed from protective enclosure until the immediate time of installation. Removed boards must be placed immediately in protective container for transport, storage, or return to factory.

Comments

This instrument is not unique in its content of ESD (electrostatic discharge) sensitive components. Most modern electronic designs contain components that utilize metal oxide technology (NMOS, CMOS, etc.). Experience has proven that even small amounts of static electricity can damage or destroy these devices. Damaged components, even though they appear to function properly, exhibit early failure.

TABLE OF CONTENTS

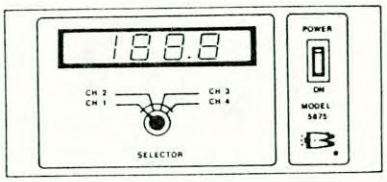
Section 1 INTRODUCTION

1-1 General Description

The 5870-Series "Control and Read out Equipment", has been designed to power and control Mass Flow Controllers, and to indicate flowrates of Mass Flowmeters.

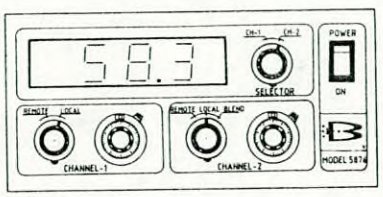
1-2 Model Description

- For use with Mass Flowsensors, serie: 5810, 5811 and 5812.



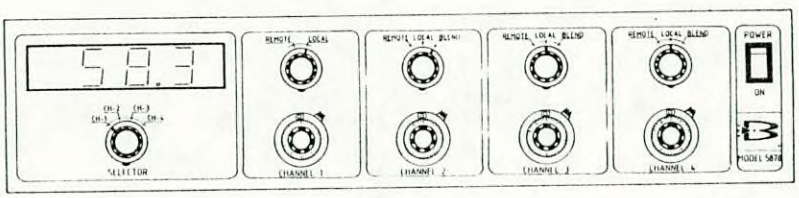
Model 5875.
Power Supply and Read Out Unit,
suitable for up to four (4) sensors.

- For use with Mass Flow Controllers, serie: 5850, 5851, 5858 and 5842.



Model 5876.
Dual Channel Power Supply, Read Out
and Control Unit.

Model 5878.
Four Channel Power Supply, Read Out
and Control Unit.



1-3 General Specification

Power input	:	110/220 Volts ±10%, 50/60 Hz.
Power output	:	+ and - 15 Vdc., for max. up to four (4) Mass Flowcontrollers.
Power consumption	:	Model 5875, 10W.
	:	Model 5876, 15W.
	:	Model 5878, 25W.
Signal inputs	a. :	0-5 Vdc. flowrate signal from Flowsensor.
	b. :	0-5 Vdc. setpoint signal, internal resistance signal source: max. 300 ohms.
Signal outputs	a. :	5 Vdc. reference voltage, max. load: 8 mA.
	b. :	0-5 Vdc. linear to flowrate.
Electrical connections	a. :	One off 15-pins "D"-type connector for combined output signals (0-5 Vdc., per channel). Mating connector is included.
	b. :	Two, or four off 15-pins "D"-type connector for connecting the Mass Flowcontrol Meters.
Display	:	3½-digit L.E.D. indicator, Character height: 13 mm. Max. reading: 199,9. Indication is in percentage of flow range.
Controls	:	Rotary switch for channel selection of the flowrate indicator. 5 k Ohm ten turn setpoint potentiometers, with locking lever and dial. Power ON/OFF switch. Rotary switch per channel for "BLENDING" ON/OFF and remote/local setpoint
Housing	:	Anodized aluminium.
Execution	:	Table-top, or panel mounting.
Ambient temperature	:	0-50°C.

Section 2 INSTALLATION

2-1 Receipt of Equipment

When the equipment is received, the outside packing case should be checked for any damage incurred during shipment.
If the packing case is damaged, the local carrier should be notified at once regarding his liability. A report should be submitted to the Product Service Department, Brooks Instrument Division, Emerson Electric Co., Veenendaal, The Netherlands.

Remove the envelope containing the shipping list. Carefully remove the equipment from the packing case. Make sure spare parts are not discarded with the packing material. Inspect for damaged or missing parts.

2-2 Return Shipment

Do not return any assembly or part without a Return Material Report. The Return Material Report is available from all District Sales Offices and the Product Service Department, Veenendaal, The Netherlands.
Information describing the problem, corrective action, if any, and the work to be accomplished at the factory must be included.

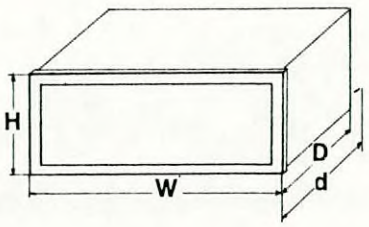
2-3 Recommended Storage Practice

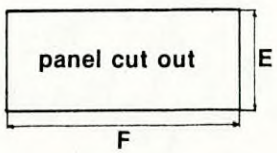
If intermediate or long term storage is required for equipment, as supplied by Brooks Instrument Division, it is recommended that said equipment be stored in accordance with the following:

1. Within the original shipping container.
2. Stored in a sheltered area, preferably a warm dry heated warehouse.
3. Ambient temperature (21°C. Nominal, 32°C. Max. 7°C. Min.)
4. Relative humidity 45% nominal (60% max., 25% min.)

Upon removal from storage, a visual inspection should be conducted to verify the condition of equipment is "as Received".

2-4 Housing Dimensions



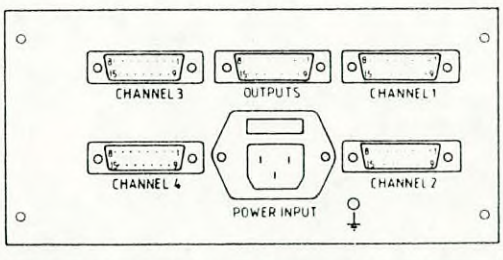


Dimensions:

Model	H x W (mm)	D = d-60 (mm)	Panel cut out	
			e (mm)	f (mm)
5875	96 x 192	247	90	186
5876	96 x 192	247	90	186
5878	96 x 384	247	90	378

* The 5870 series normally are supplied as table top units.
For panelmounting: please remove the stand offs and use the supplied brackets for panel mounting.

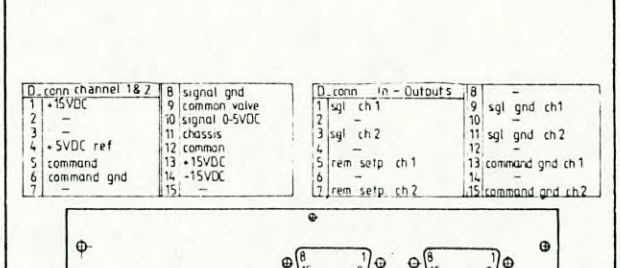
2-5 External Wiring Diagrams



D-connector channel 1 & 2	FUNCTION
1	-
2	-
3	-
4	-
5	-
6	-
7	-
8	Signal gnd
9	-
10	0 - 5V Output
11	Chassis
12	Common
13	+15 Vdc
14	-15 Vdc
15	-

D-connector outputs	FUNCTION
1	Output channel 1
2	-
3	Output channel 2
4	-
5	Output channel 3
6	-
7	Output channel 4
8	-
9	Signal gnd ch 1
10	-
11	Signal gnd ch 2
12	-
13	Signal gnd ch 3
14	-
15	Signal gnd ch 4

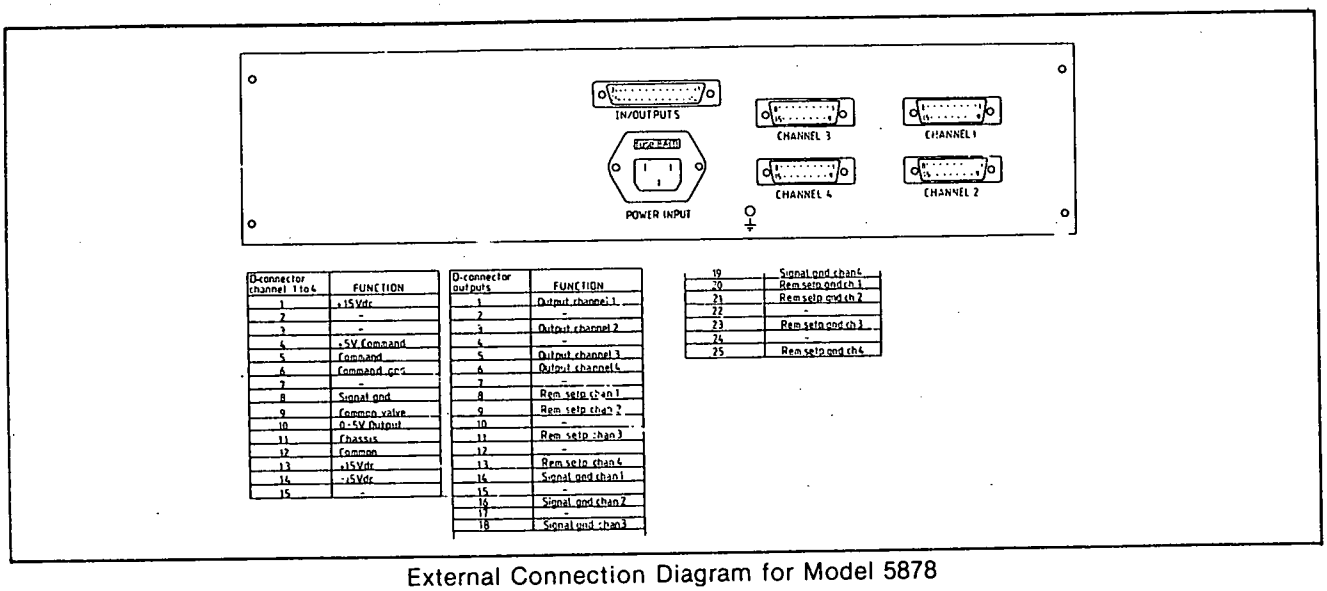
External Connection Diagram for Model 5875



D-conn channel 1 & 2		8	signal gnd
1	+15VDC	9	common valve
2	–	10	signal 0-5VDC
3	–	11	chassis
4	+5VDC ref	12	common
5	command	13	+15VDC
6	command gnd	14	-15VDC
7	–	15	–

D-conn in - Outputs		8	–
1	sgl ch 1	9	sgl gnd ch1
2	–	10	–
3	sgl ch 2	11	sgl gnd ch2
4	–	12	–
5	rem setp ch 1	13	command gnd ch 1
6	–	14	–
7	rem setp ch 2	15	command gnd ch2

External Connection Diagram for Model 5876



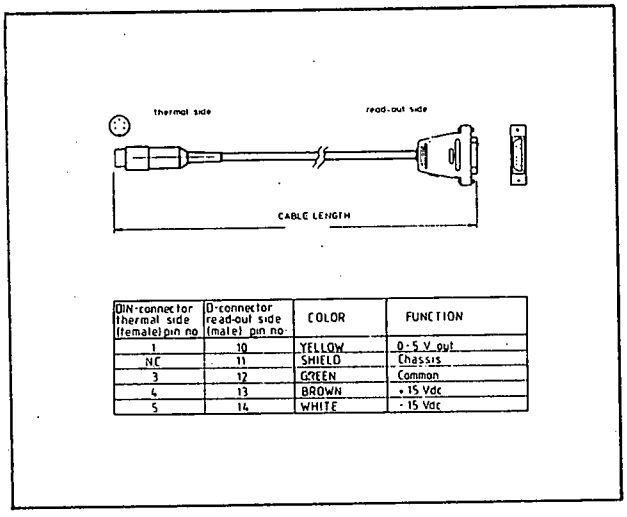
D-connector channel 1 to 4	FUNCTION
1	+15Vdc
2	-
3	-
4	+5V Command
5	Command
6	Command gnd
7	-
8	Signal gnd
9	Common valve
10	0-5V Output
11	Chassis
12	Common
13	+15Vdc
14	-15Vdc
15	-

D-connector outputs	FUNCTION
1	Output channel 1
2	-
3	Output channel 2
4	-
5	Output channel 3
6	Output channel 4
7	-
8	Rem setp chan 1
9	Rem setp chan 2
10	-
11	Rem setp chan 3
12	-
13	Rem setp chan 4
14	Signal gnd chan 1
15	-
16	Signal gnd chan 2
17	-
18	Signal gnd chan 3

19	Signal gnd chan 4
20	Rem setp gnd ch 1
21	Rem setp gnd ch 2
22	-
23	Rem setp gnd ch 3
24	-
25	Rem setp gnd ch 4

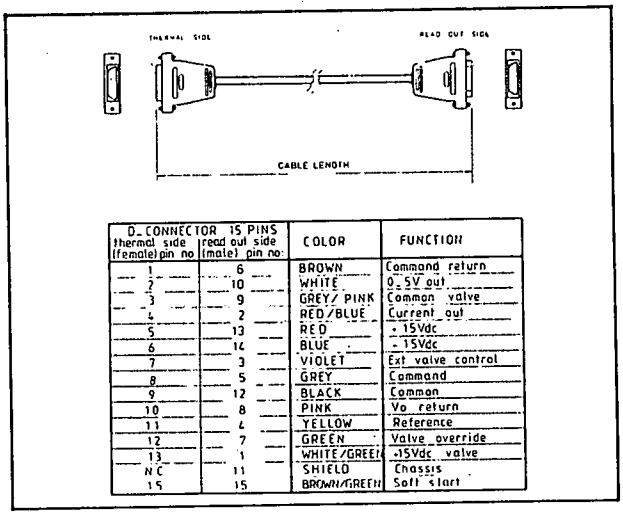
External Connection Diagram for Model 5878

2-6 External connection cables



DIN-connector thermal side (female) pin no	D-connector read-out side (male) pin no	COLOR	FUNCTION
1	10	YELLOW	0-5 V out
NC	11	SHIELD	Chassis
3	12	GREEN	Common
4	13	BROWN	+ 15 Vdc
5	14	WHITE	- 15 Vdc

Cable assy with D- and DIN-connector



D-CONNECTOR 15 PINS thermal side (female) pin no	read out side (male) pin no	COLOR	FUNCTION
1	6	BROWN	Command return
2	10	WHITE	0-5V out
3	9	GREY/PINK	Common valve
4	2	RED/BLUE	Current out
5	13	RED	+ 15Vdc
6	14	BLUE	- 15Vdc
7	3	VIOLET	Ext valve control
8	5	GREY	Command
9	12	BLACK	Common
10	8	PINK	Vo return
11	4	YELLOW	Reference
12	7	GREEN	Valve override
13	1	WHITE/GREEN	+15Vdc valve
NC	11	SHIELD	Chassis
15	15	BROWN/GREEN	Soft start

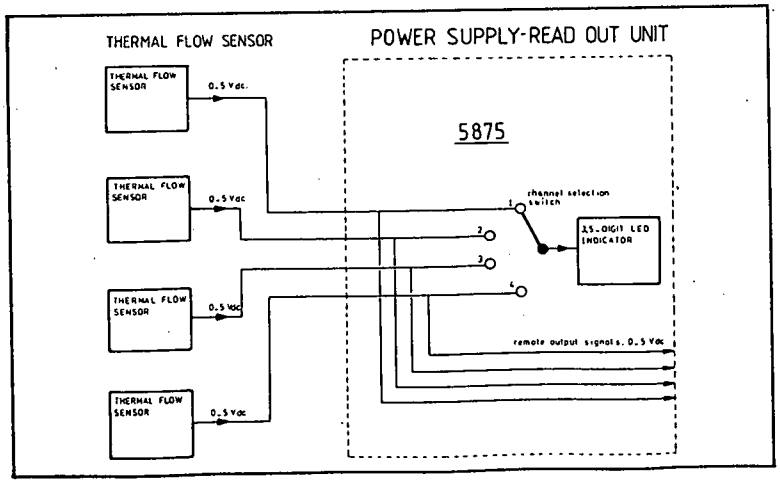
Cable assy with (2x) D-connectors

Section 3 OPERATION

3-1 Theory of operation model 5875

The power Supply Read Out Unit model 5875, has been designed to power Mass Flowsensors and to indicate flowrate.
Flowrate indication has been realised with a 3½-digit L.E.D. display calibrated in percentage of flow.
Channel selection can be determined with a rotary switch.
A socket on the rear panel is available for remote output signals: 0-5 Vdc. linear to flowrate. Max. load 2 mA.

3-2 Block diagram Model 5875



3-3 Theory of operation Models 5876 and 5878

The Dual and Four Channel Power Supply, Read Out and Control Unit, models 5876 and 5878 have been designed to power Mass Flow Controllers.
Flowrate is indicated by a 3½-digit L.E.D. display, calibrated in percentage of flow.
Channel selection can be determined with a rotary switch.
The setpoint signals for the Mass Flow Controllers can be switched to three different references by means of frontpanel mounted rotary switches.

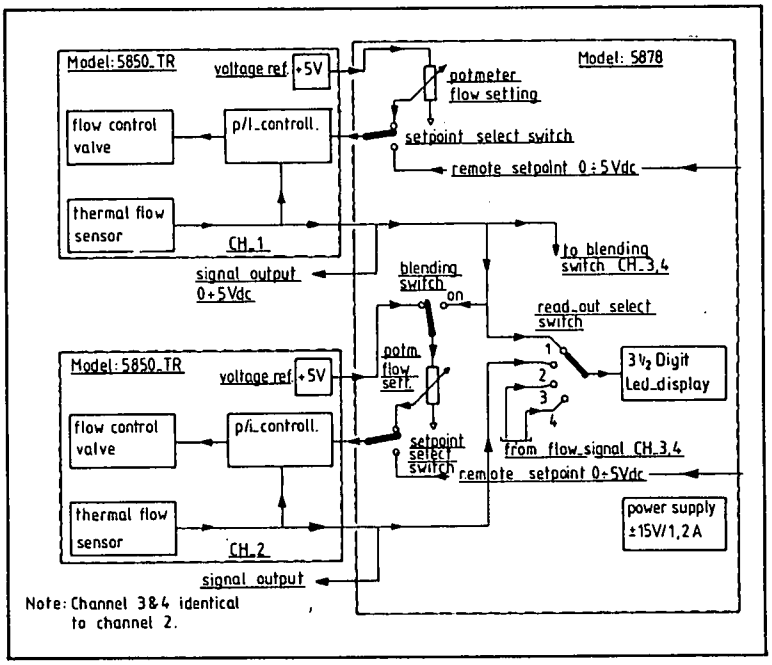
The three posibilities are:
1. **Local:**
The setpoints can be adjusted with the potentiometers in the frontpanel.

2. **Remote**
The setpoint signals of a remote reference are used.
The setpoint potentiometers are not in use.

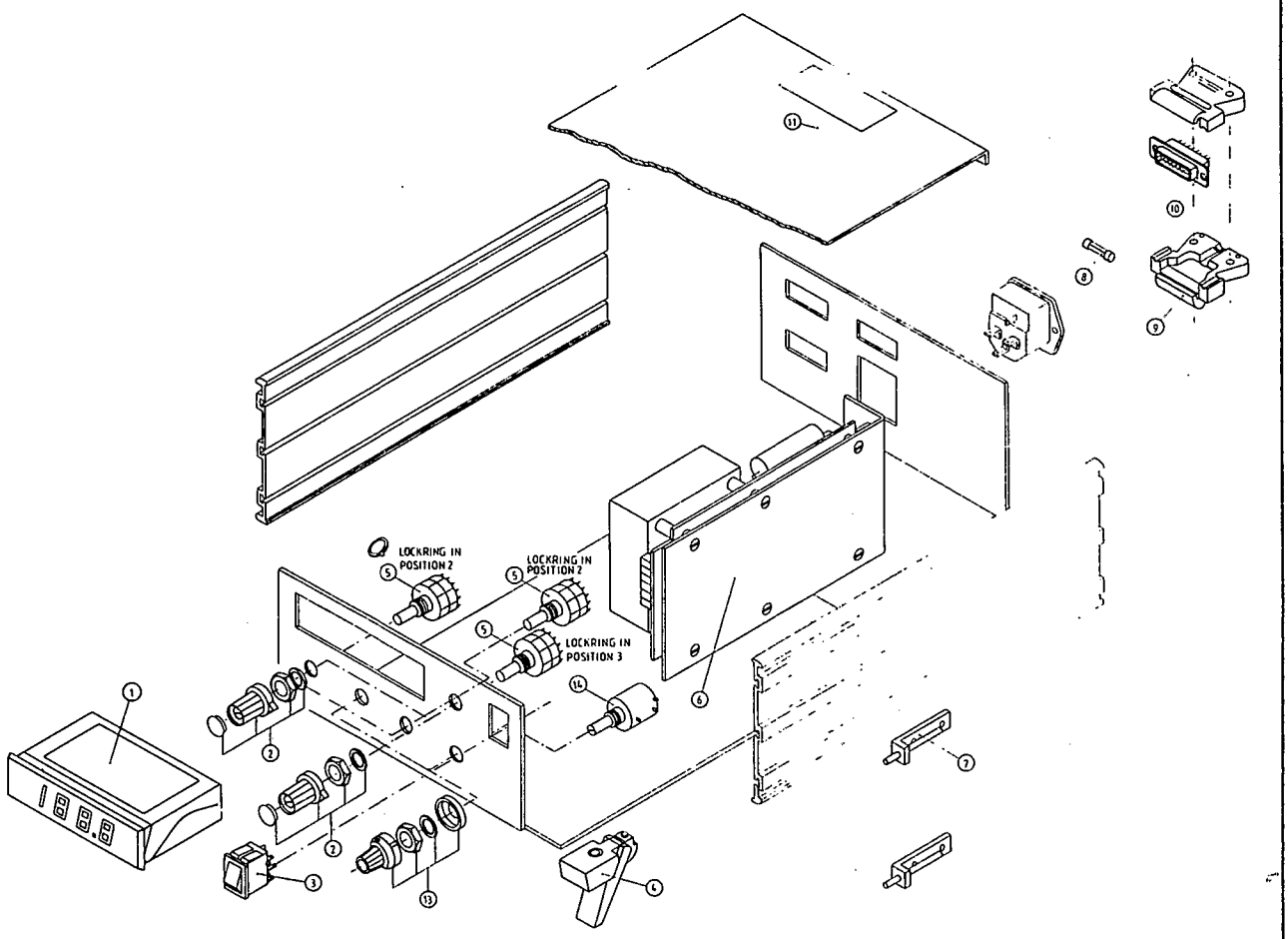
3. **Blending**
Channel one is the master channel and can be switched to local or remote setpoint. The other channels can be switched tot the "blend" mode.

In this mode the flowrate signal of channel one is used as a reference voltage for the setpoint potentiometers of the slave channels.
The dial shows the percentage of the rate of flow of the belonging slave channel, when the master flowrate is 100%.

3-4 Block diagram model 5878



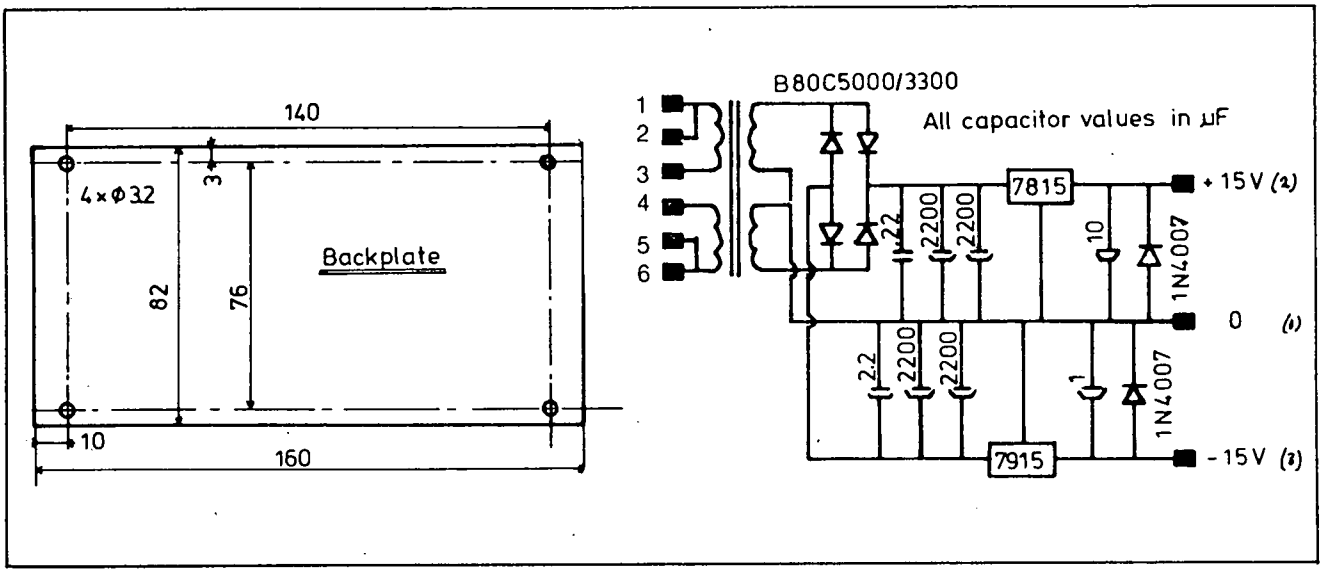
4-2 Spare parts Model 5876 2-Channel Blender



Ref. Nr.	Partnumber	Description	Remarks	Qty. used
1	549-V-003-HVK	Digital panel meter		1
2	*498-C-081-PLQ	Knob with cap		3
3	*859-E-008-PZZ	Tumbler switch. DPDT		1
4	594-B-041-AAA	Pedestal		2
5	860-F-001-PTP	Rotary switch. 3 position	setpoint selector	2
5	860-P-002-PTP	Rotary switch. 2 position	Indicator selector	1
6	641-D-029-ETB	Power supply unit		1
7	*852-Z-171-EAA	Mounting bracket		2
8	*365-Z-031-PDZ	Fuse 630 mA	For 115 Vac supply	2
8	*365-Z-030-PCZ	Fuse 315 mA	For 220 Vac supply	2
9	206-Z-069-AAA	Connector hood		1
10	206-E-007-AAA	D-connector: 15 pin. male		1
11	613-Z-326-EAD	Top plate 247 x 177 mm.		1
13	*233-Z-179-ZZZ	Dial potmeter 10-turn		2
14	*635-D-020-GJE	Potmeter 10-turn, 5K-Ohms		2

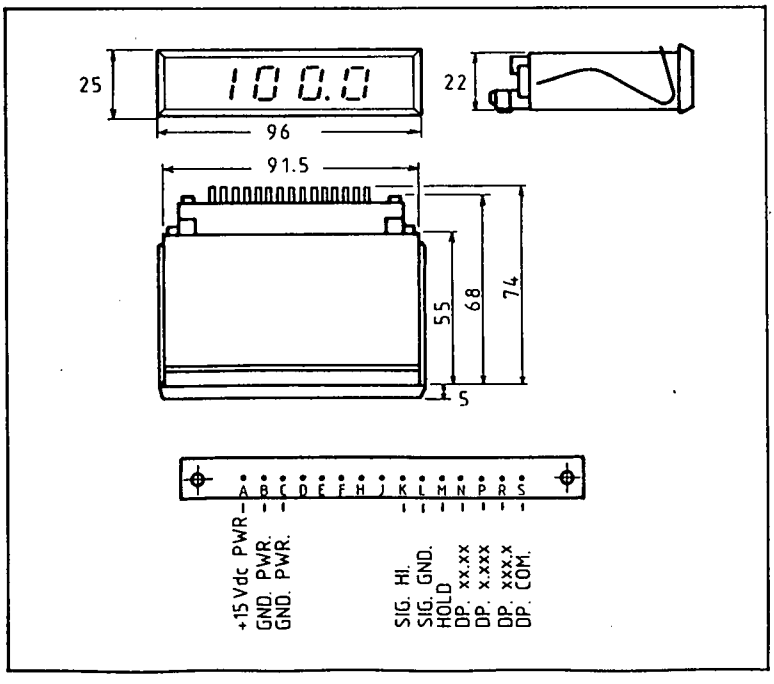
4-4 Open frame power supply, suitable for up to four (4)Mass Flow Controllers

110 Vac power supply	: connect to pin 1 and 6 to power 110 Vac, connect pin 2 to 4 and pin 3 to 5.
220 Vac power supply	: connect to pin 1 and 6 to power 220 Vac, connect pin 3 to 4.
Power input	: 110/220 Volts ±10%, 50/60 Hz.
Power output	: + and - 15 V.dc., 1,2 Amp. Max. power: 18,0 Watts
Dimensions	: 68 x 160 x 82 mm. (HxWxD)
Part number	: 641-D-029-ETB



4-5 3½-digit L.E.D. Indicator

Max. reading	: 199,9
Character height	: 13 mm.
Power requirements	: + 15 Vdc., 100 mA
Signal input	: 0-5 Vdc.
Dimensions	: 25 x 96 x 68 mm. (HxWxD)
Panel cut-out	: 22 x 92 mm.
Part number	: 549-V-003-HVK



4-6a Interconnecting cable complete with plugs, for connecting 5875-Series:
Power supply and Read-Out Unit to the series: 5810, 5811 and 5812 Mass Flowmeters.
LENGTH: 3 meter. PART NUMBER: 124-Z-233-AAA

4-6b Interconnecting cable:
LENGTH: 6 meter. PART NUMBER: 124-Z-234-AAA

4-7a Interconnecting cable complete with plugs, for connecting 5876/5878 serie:
Power supply, Read-Out and Control Unit to the series 5850, Mass Flow Controllers.
LENGTH: 3 meter.
PART NUMBER: 124-Z-236-AAA

4-7b Interconnecting cable:
LENGTH: 6 meter
PART NUMBER: 124-Z-237-AAA

4-8a Interconnecting cable complete with plugs, for connecting 5876/5878 serie:
Power supply, Read-Out and Control unit to the series 5851, Mass Flow Controllers:
LENGTH: 3 meter
PART NUMBER: 124-Z-380-AAA

4-8b Interconnecting cable:
LENGTH: 6 meter
PART NUMBER: 124-Z-381-AAA

Guarantees

If at any time within one year after shipment, but not thereafter, it is proved that any part of the equipment furnished by us was defective when shipped by us, we will repair or replace the same free of charge, F.O.B. our plant. Notice of this claim must be made to us within one year after delivery. Our liability is limited to replacement of such defective parts or equipment. There are no guarantees or warranties expresed or implied other than those herein specificially mentioned.

Brooks Instrument Division shall not in any event be liable for any consequential damages, secondary charges, expenses for erection or disconnection, or losses resulting from any alleged defect in the apparatus.

It is understood that corrosion or erosion of materials is not covered by our guarantee.

Brooks Instrument B.V.
P.O. Box 56
3900 AB Veenendaal
The Netherlands

CALIBRATION CERTIFICATE THERMAL MASS FLOWMETER

Cust. : Leif Jensen ApS
Tag.no. : -
P.O. no. : 9007.0605

Our ref. S.N. : M24630
Model no. : 5850TR/C1A1C6D10
S.N. Electronics : M24630 Channel: 1

Customer Conditions	Calibration Conditions
Fluid : Air	Fluid : Air
Temp. : t = 20 °C	Cal.press. : P1 a = 6 bar
Upstr.press. : P1 a = 6 bar	Cal.press. : P2 a = 5 bar
Downstr. press. : P2 a = 5 bar	Bar.press. : P = 1023 +/- 1,2 m bar
Range : 0 - 1 Pn l/min	Temp. : t = 21,4 °C.
	Corr. factor : K = 0,9404
	Normal (n) K = P x 273,15 / 1013,33 x (273,15 + t)
	Standard (st) K = P x 293,15 / 1013,33 x (273,15 + t)

Ind. reading Volt dc	Desired flow gas Pn l/min Air	Actual flow gas Pn l/min Air	Error % of max.
5,00	1,00	1,001	+0,12
3,75	0,75	0,748	-0,18
2,50	0,50	0,499	-0,06
1,25	0,25	0,251	+0,11
0,50	0,10	0,099	-0,08

Remarks:

Gas conversion factor: -
Air x - = -

Toolno: 07004/02

OEM FILE NR: D100

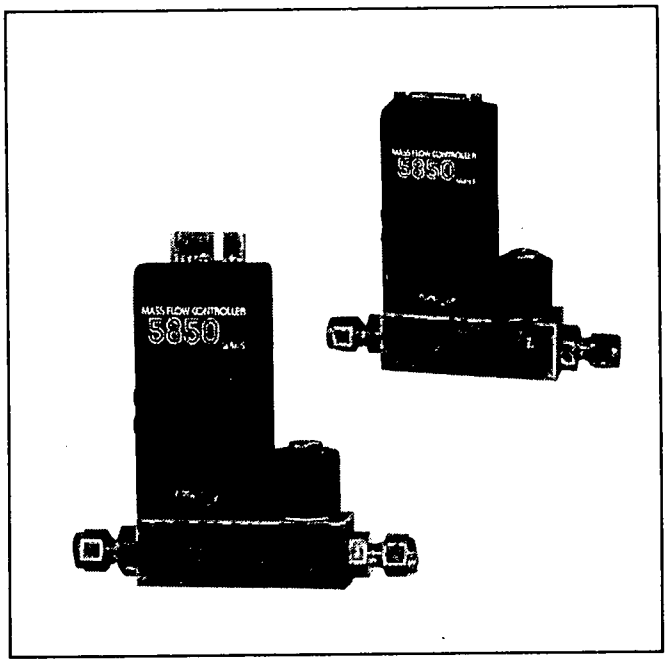
Restrictor size : 10 µ
Orifice size : 0,014 inch
Valve seat mat'l : Viton
O-ring mat'l : Viton
Max. press. : 100 bar
Helium leak test : 1X10^{-6} m bar.l.s.$^{-1}$

Date : 21-04-'00
Calibrator : LP
Certified by : [signature]

X-5850TR-E-NL
May 1990
Revision E

INSTALLATION AND OPERATING MANUAL

BROOKS MASS FLOW METER / CONTROLLER
MODEL 5850TR



Model 5850TR

CAUTION:

It is recommended that this publication be read in its entirety before performing any operation. Failure to understand and follow these instructions could result in serious personal injury and/or damage to the equipment.

Brooks Instrument B.V.
Groeneveldselaan 6
3903 AZ Veenendaal
P.O. Box 56
3900 AB Veenendaal
The Netherlands
Tel (0)8385 - 63911
Telex 37106
Fax (0)8385 - 63314

Dear Customer,

The Brooks Instrument Mass Flow Controller you have just received is of the highest quality available, offering superior performance to the user. This controller provides the finest degree of accuracy, repeatability, and widest operating parameters available for extremely reliable gas measurement and control of mass flow rate.

Because of the wide variety of applications for mass flow controllers, we have expressly designed this instrument to provide user selectable functions in a single instrument to meet ever changing process conditions. Additionally, this "state-of-the-art" design has been packaged and materials selected to permit application to a variety of often corrosive and hostile conditions.

To realize the full potential of the inherent design flexibility and ease of maintenance, may we suggest you review this manual in its entirety.

Should you need additional information concerning the 5850 Series Mass Flow Controllers, please feel free to contact your local Brooks Instrument Division Sales Office.*
We are pleased to have this opportunity of servicing you for your gas measurement and control needs.

Sincerely,

BROOKS INSTRUMENT DIVISION
OF THE ROSEMOUNT MEASUREMENT
AND CONTROL GROUP.

* The addresses you will find on the cover.

CAUTION

This instrument contains electronic components that are susceptible to damage by static electricity. Proper handling* procedures must be observed during the removal, installation, or other handling of internal circuit boards or devices.

*** Handling procedure:**

1. Power to unit must be removed.

2. Personnel must be grounded, via a wrist strap or other safe, suitable means before any printed circuit card or other internal device is installed, removed or adjusted.

3. Printed circuit cards must be transported in a conductive bag of other conductive container. Boards must not be removed from protective enclosure until the immediate time of installation. Removed boards must be placed immediately in protective container for transport, storage, or return to factory.

COMMENTS

This instrument is not unique in its content of ESD (electrostatic discharge) sensitive components. Most modern electronic designs contain components that utilize metal oxide technology (NMOS, CMOS, etc.). Experience has proven that even small amounts of static electricity can damage or destroy these devices. Damaged components, even though they appear to function properly, exhibit early failure.

TABLE OF CONTENTS

LIST OF ILLUSTRATIONS

TABLE

SERV' INSTRUMENTATION

CERTIFICAT D'ETALONNAGE

Sur Volumetre étalon (N° BNM : D93136 : D93137 : D93138 : D93139)

Client Doveurope
N° de dossier
Date 5-01-95

N° de série 9501005
Type 5850TR

Condition du client

Gaz Air

Pression amont 4bar
Pression aval 1bar
Gamme 0-1 l/min

Condition d'étalonnage

Gaz Air
Température du gaz 292,55 K
P.d'étalonnage 100 KPa
P.dans le volumétre 101,1 KPa
Facteur de correction 0,932 unité

Volume utilise: 200 Cm^3

Mesure	Tension	Temps	Débit theorique	débit réel	Erreur de E.M
en %	Volts	Sec.	l/min	l/min	en %
100 %	5,000	11,19	1	0,999	-0,07
75 %	3,750	14,94	0,75	0,748	-0,15
50 %	2,500	22,26	0,50	0,502	+0,23
25 %	1,25	44,03	0,25	0,254	+0,40
10 %	0,500	108,52	0,1	0,103	+0,30

normale K = Pe x 273,15 / 101,3 x Te

standard K = Pe x 293,15 / 101,3 x Te

Facteur de conversion : 1

Test horizontal T
test vertical

Remarque

Orifice
Cartouche frittée 10µ
Etalonneur DG

Joints Teflon,Kalrez
Joints Viton T

Siège Social :
Z.I. Broteau Nord
69540 IRIGNY
Tél. 78 51 47 50
Fax 78 51 59 96

Agence Sud-Est :
Héliopolis A3-ZA l'Anjoly
13127 VITROLLES
Tél. 42 79 28 23
Fax 42 79 28 24

Société Anonyme au capital de 250 000 F. - RCS LYON B 338 504 962 - APE 2913 - SIRET 338 504 962 00030

Section 1 INTRODUCTION

1-1 Purpose

The Brooks Model 5850TR **Mass Flowmeter / Mass Flow Controller** is a mass flow measuring device, designed for accurately measuring and rapidly controlling flows of gases.

1-2 Description

The Brooks Model 5850TR Mass Flow Controller (M.F.C.) provides "state-of-the-art"mass flow measurement and P.I. control.
The Brooks Model 5850TR M.F.C. is used widely in the Semiconductor Industry as well as many others, where manual, electronic or computer controlled gas handling occurs.
The Model 5850TR consists of three basic units: a flow sensor, a control valve and an integrated electronic control system.
This combination produces a stable gasflow, selectable overshoot protection and eliminates the need for continuous monitoring and re-adjustment of gaspressures.

1-2-1 Standard user selectable features includes:

- **Soft start** provides a flow ramping function that effectively reduces gas flow over-/undershoot to a neglectable value.
  Refer to Section 2-4-2.

- **Remote programming** permits the user to program the Mass Flow Controller with an external 0-5Vdc, or 0-10Vdc command voltage in lieu of the command potentiometer.
  Refer to Section 2-4-3.

- **Valve override** permits the user to fully open and close the control valve independent of the command setting.
  Refer to Section 2-4-4.

- **External valve control** permits the user flexibility to provide an external valve control source independent of the standard control incorporated within this Mass Flow Controller.
  Refer to Section 2-4-5.

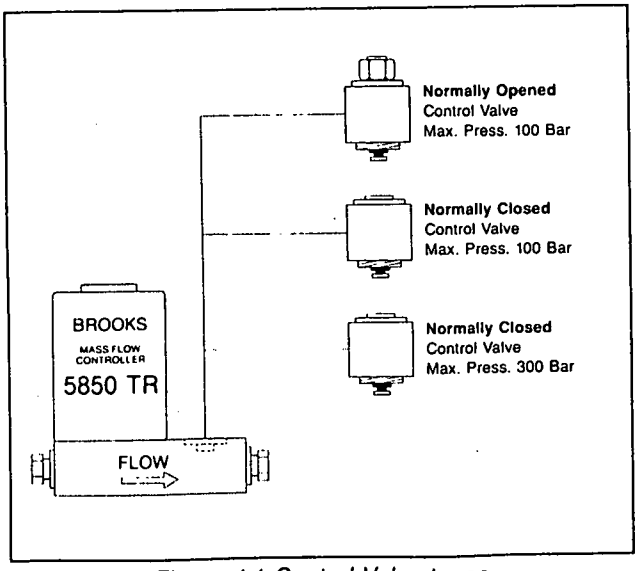


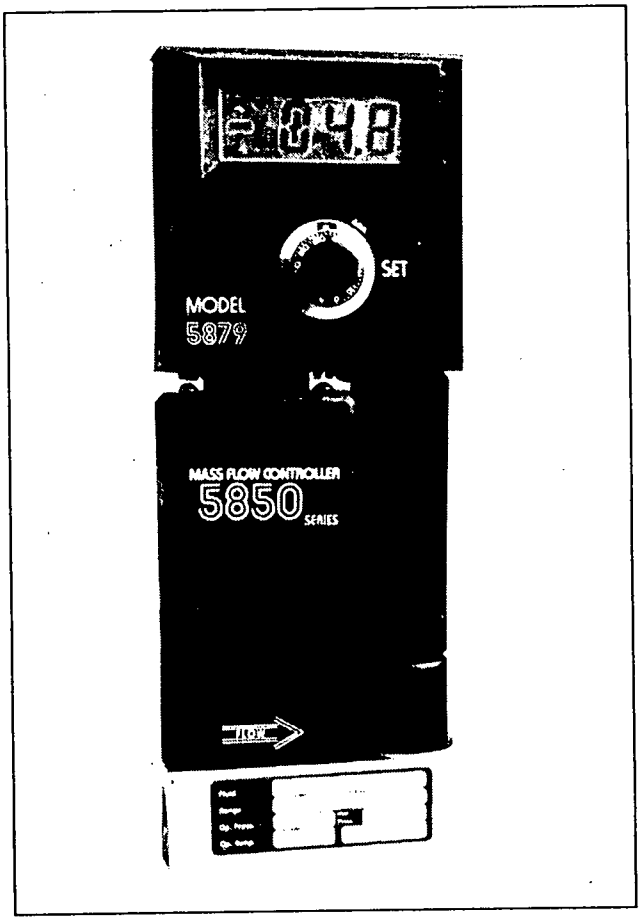
Figure 1-1 Control Valve types

The 5850TR M.F.C. can be supplied with three different type control valves:

- Normally Opened, max. 100 Bar operating pressure.
- Normally Closed, max. 100 Bar operating pressure (std).
- Normally Closed, max. 300 Bar operating pressure.

1-2-2 Optional features

The Mass Flow Controller in combination with the integral Indicator/Controller, Model 5879 can easily be used for local Read-Out and Control adjustment.
The 5879 is supplied with a power supply adapter and interconnecting cable.



Model 5850 / 79

1-3 Receipt of equipment

When the equipment is received, the outside packing case should be checked for any damage incurred during shipment.
If the packing case is damaged, the local carrier should be notified at once regarding his liability.
A report should be submitted to the Product Service Department, Brooks Instrument / Rosemount.
Refer to the cover for full address.
Remove the envelope containing the shipping list.
Carefully remove the equipment from the packing case.
Make sure spare parts are not discarded with the packing material.

1-4 Return Shipment

Do not return any assembly or part without a Return Material Report.The Return Material Report is available from all District Sales Offices and the Product Service Department.
Information describing the problem, corrective action, if any, and the work to be accomplished at the factory must be included.

1-5 Recommended Storage Practice

If intermediate or long term storage is required for equipment, as supplied by Brooks Instrument Division, it is recommended that said equipment be stored in accordance with the following:

1. Within the original shipping container.
2. Stored in a sheltered area, preferably a warm, dry, heated warehouse.
3. Ambient temperature (21°C Nominal, 32°C max. / 7°C min.)
4. Relative humidity 45% Nominal (60% max., 25% min.)

Upon removal from storage, a visual inspection should be conducted to verify the condition of equipment is "as received".
If the equipment has been in storage for an excess of ten (10) months or in conditions in excess of those recommended, all pressure boundary seals should be replaced and the device subjected to a pneumatic pressure in accordance with the applicable vessel codes.

1-6 Specifications

Standard ranges in ml_n/min Normal is defined as: milliliter at 0°C (273K) and 1,013 Bar Abs	Any full scale range between 5 ml_n/min and 20.000 ml_n/min (Nitrogen equivalent)
Rangeability	50 to 1
Accuracy, including Linearity	± 1,0% full scale at calibrated conditions.
Repeatability	± 0,2% full scale
Attitude insensitivity	The M.F.C. can be mounted in "any" position with maximum deviation in specified accuracy of 0,25% full scale.
Pressure sensitivity	± 0,1% full scale/Bar
Temperature sensitivity	± 0,1% /°C of full scale in temperature range: 0 - 65 °C
Operating and ambient temperature range	0 - 65 °C
Max. operating pressure	100 Bar in combination with the normally opened or normally closed valve. 300 Bar in combination with the normally closed high pressure valve or as sensor only.
Leak integrity, inboard-outboard	1 x 10^{-6} mBar l/s of Helium (except for PTFE sealing)
Warming-up time	45 minutes

Power requirements **MASS FLOW METER**	+15 Vdc, ±5%, +25 mA max. max. ripple 7 mV p-p −15 Vdc, ±5%, −15 mA max. max. ripple 7 mV p-p	
Required Power Supply **MASS FLOW CONTROLLER**	When supplied with **negative valve voltage** +15Vdc, ±5%, +25mA max max. ripple 7 mV p-p −15Vdc, ±5%, 180mA max. max. ripple: 7 mV p-p	When supplied with **positive valve voltage** +15Vdc, ±5%, +180mA max. max. ripple, 7 mV p-p −15Vdc, ±5%, −15mA max. max. ripple 7 mV p-p
Output Signal	0-5 Vdc min. load: 1 K-ohm max. ripple: 3 mV	Optional: 0-10 Vdc min. load: 4 K-ohm max. ripple: 6 mV Or: 0-20 mA max. 400 ohm floating load
Remote Programming	External voltage: 5 Vdc Load resistance: min. 1 K-ohm Load resistance: max. 5 K-ohm	or 0-10 Vdc min. 4 K-ohm max. 5 K-ohm
Electrical connections	Card Edge - 20 pins, or "D" connector - 15 pins	
Materials of Construction	Wetted parts stainless steel with Viton® , PTFE, Buna-N® or Kalrez®	
Gas Connections	9/16" - 18 UNF	
Gas fittings (The inlet gas fitting is supplied with an inletfilter)	6 mm. Tube Compression ¼" Tube Compression 1/4" VCO 1/4" VCR 1/4" NPT 1/8" Tube Compression 3/8" Tube Compression	

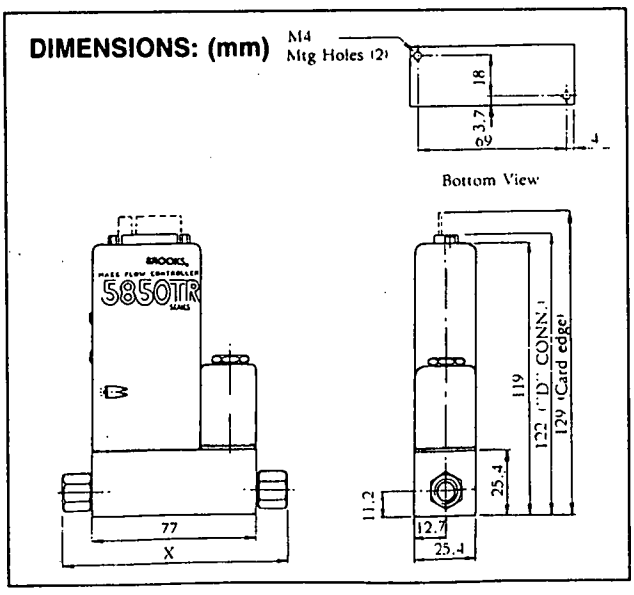


Figure 2-1 Model 5850TR Dimensions

Connections	Dim.X
9/16" - 18 UNF	77
1/4" Tube Compression	129
1/8" Tube Compression	124
1/4" VCR	125
1/4" VCO	117
1/4" NPT	118
6 mm. Tube Compression	129

Note: Dimensions are in mm.

1-7 Standard Manufacturing Procedures

Brooks Instrument warranties the supply of very high quality Flow measurement and control equipment. Upon receipt of incoming materials, till shipment of instruments, fabrication of the BROOKS MASS FLOW CONTROLLERS are monitored at every production stage.

Assembly, The Mass Flow Controllers are assembled in our cleanroom.

E.S.D. Handling, the printed circuit boards are assembled by qualified personnel, who are protected against Electro Static Discharge.

Pressure test, each Mass Flow Controller is pressure tested at 1,5 times the maximim working pressure.

Burn-in test, each instrument undergoes a temperature burn-in test for 48 hours. In this time the instruments are continuously tested under severe conditions.

Calibration, in our calibration department the instruments are calibrated in accordance with the customers requirements.
Brooks Instrument uses their patented VOL-U-METER, and BELL PROVER calibration equipment, which are used as a **primary standard,** certified by the National Bureau of Standards.

Helium leak-test, when the Mass Flow Controllers have been calibrated, the instruments are subject to a leak test, using a Helium Leak Detector.
Sensitivity: 1 x 10^{-11} ml/sec. He.
For model 5850TR, Brooks warranties an inboard-outboard leak integrity: 1 x 10^{-6} m.bar. l/sec. of Helium.

Final inspection, The instruments are visually inspected, indentified for serial control and completed with a calibration certificate.

E.S.D. package, each Mass Flow Controller is carefully packed in a specially designed Electro Static Discharge box, provided with a sticker for serial control.

Section 2 INSTALLATION

2-1 Gas Connections

Standard inlet and outlet connections supplied with Model 5850TR are 1/4" tube compression fittings, for flowrates up to 10 l_n/min. and 3/8" tube compression fittings for higher flowrates, 6 mm tube compression fittings, 1/4"-VCO, 1/4"-VCR, 1/4"-NPT, or 1/8" tube compression fittings are available upon request.
Prior to installation, make certain all piping is clean and free of obstruction. Install the piping in such a manner that permits easy removal if the instrument has to be removed for cleaning, or bench troubleshooting.

2-2 In-line Filter

It is recommended an in-line filter be installed upstream and sometimes downstream from the flowsensor to prevent the possibility of any foreign material entering the Mass Flow Sensor or Controller.
The filter element should be periodically replaced or may be ultrasonically cleaned.

Refer to table: 2-2

Maximum Flow Rate	Recommended Filter Size
100 ml_n/min.	1 micron
500 ml_n/min.	2 micron
1 or 5 l_n/min.	7 micron
10 or 20 l_n/min.	15 micron

Table 2-2 Recommended Filter Size

2-3 Installation

CAUTION: When installing the controller, care should be taken that no foreign materials enter the inlet or outlet off the instrument. Do not remove the protective end caps until time of installation.

Recommended installation procedures:
A. The Model 5850TR should be located in a clean dry atmosphere relatively free from shock and vibration.
B. Leave sufficient room for access to the electrical components.
C. Install in such a manner that permits easy removal if the instrument requires cleaning.

CAUTION: When used with a reactive (sometimes toxic) gas, contamination or corrosion may occur as a result of plumbing leaks or improper purging. Plumbing should be checked carefully for leaks and the controller purged with dry Nitrogen before use.

D. The Model 5850TR Mass Flow Controller can be installed in any position.
However, mounting orientations other than the original factory calibration (see data sheet) will result in a ±0,25% maximum full scale shift.
E. When installing controllers with full scale flow rates of 10 l_n/min or higher; be aware that sharp abrupt angles in the system piping directly upstream of the controller may cause a small shift in accuracy. If possible have at least 10 pipe diameters of straight tubing upstream of the 5850TR Mass Flow Controller.

NOTE: The control valve in the Model 5850TR provides precision control and is not designed for positive shut off. If positive shut off is required, it is recommended that a separate shut-off valve be installed in-line.

CAUTION: Since the Model 5850TR control valve is not a positive shut-off, a separate solenoid valve may have been installed for that purpose. It should be noted that a small amount of gas may be trapped between the downstream side of the mass flow controller and the solenoid resulting in a surge upon actuation of the controller. This surge can be reduced in magnitude by locating the controller and solenoid valve close together or by moving the solenoid valve upstream of the controller.

2-4 Electrical Connection (Refer to figure 2-2 to 2-5)

The 5850TR can be supplied with a Card Edge connector suitable for flat cable connections, or with a 15-pins "D"-connector suitable for round cable connections.

2-4-1 Setpoint

The command potentiometer (if used) may be furnished with the instrument or may be supplied by the user. The potentiometer should be a 1 K-ohm or 5 K-ohm 10-turn precision potentiometer with 0,25% linearity. (Beckman 7240 Series or equivalent.)
Card Edge connections: refer to figure 2-2 and 2-3.
"D" connections : refer to figure 2-4 and 2-5.

2-4-2 Soft Start (standard option, for controller only)

To enable Soft-Start:

Card Edge	connect pin E (black wire) to pin C (blue wire)
"D"-connector	connect pin 15 to pin 3 or 9

To disable Soft-Start:

Card Edge	disconnect pin E (black wire) from pin C (blue wire)
"D"-connector	disconnect pin 15 from pin 3 or 9

2-4-3 Remote Programming

If the controller is to be programmed for an external 0-5 Vdc command voltage, the command potentionmeter is not used.
The external command voltage (+) is applied to the command signal and (−) to the command signal return.

Card Edge	refer to figure 2-3 command signal to pin A. command signal return to pin B.
"D"-connector	refer to figure 2-5 command signal to pin 8 command signal return to pin 1.

2-4-4 Valve Override

It is possible to drive the control valve fully open or close, independent of the controller position.

Control valve normally closed	Opened	Closed
Card Edge p.v.v., pin 9 Card Edge n.v.v., pin 9	+15 Vdc −15 Vdc	−15 Vdc +15 Vdc
Sub "D" p.v.v., pin 12 Sub "D" n.v.v., pin 12	+15 Vdc −15 Vdc	−15 Vdc +15 Vdc

Control valve normally opened	Opened	Closed
Card Edge p.v.v., pin 9 Card Edge n.v.v., pin 9	−15 Vdc +15 Vdc	+15 Vdc −15 Vdc
Sub "D" p.v.v., pin 12 Sub "D" n.v.v., pin 12	−15 Vdc +15 Vdc	+15 Vdc −15 Vdc

2-4-5 External Valve Control

It is possible to drive the valve with an external P.I. controller. This can be enabled by removing Jumper J2 a-b and inserting Jumper J2 a-c.

2-4-6 Current output (only available at Card Edge connection, N.C. valve).

The 5850TR is provided with a current output of 0 to 20 mA into floating load.
The "+" of the indicator must be tied to pin 4 (violet wire).
The "−" of the indicator must be tied to pin K (grey wire).

If an **external** voltage source of +24 Vdc is available the current output can be used as follows: the "+" of the indicator must be tied to the +24 Vdc whilst the pin K (grey wire) must be tied to the "−" input of the indicator.
Also the minus of the 24 Vdc must be connected to pin C (blue wire).

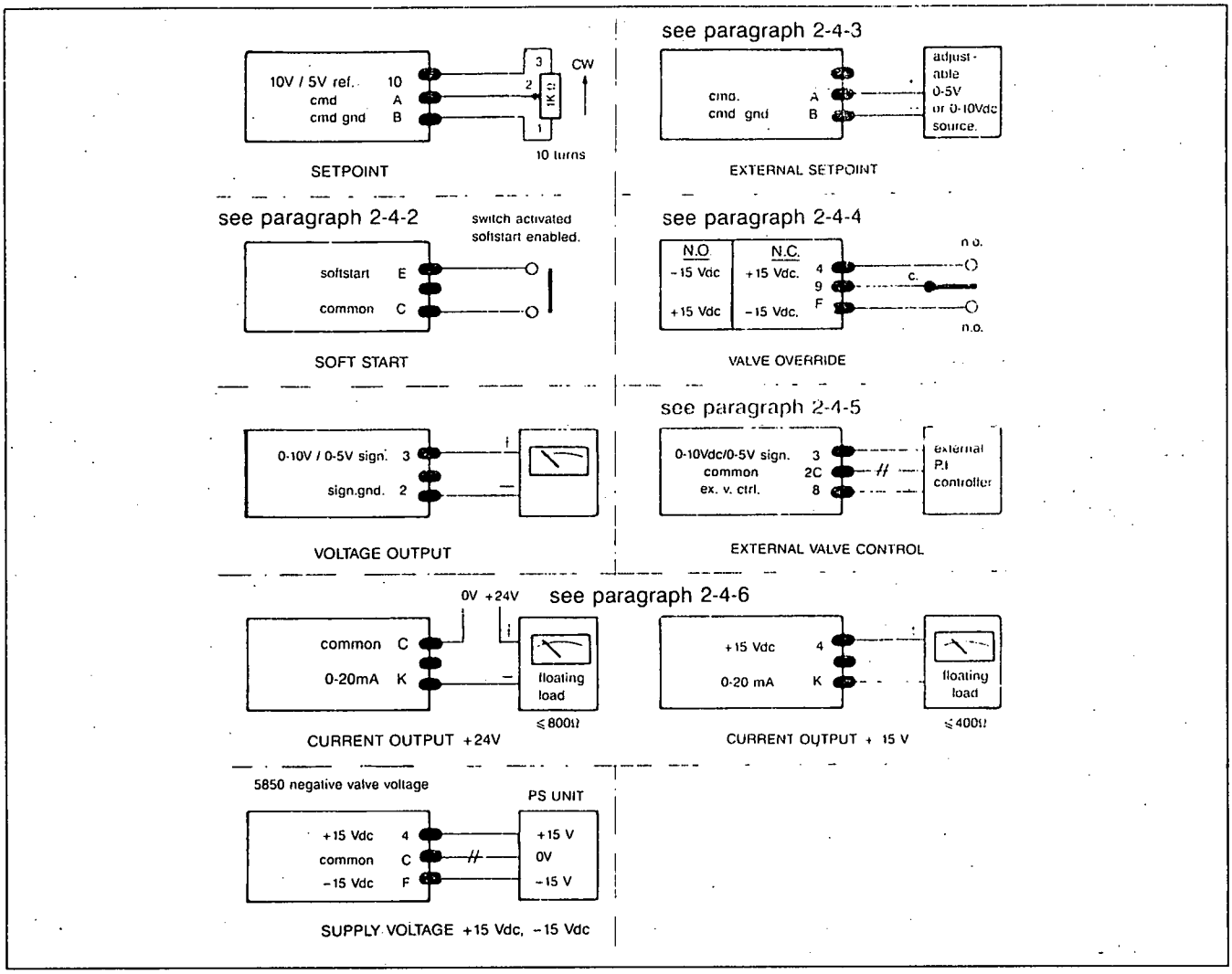


Figure 2-2
5850TR Hook-up Diagrams

Card Edge

PCB NO	NO	CLR	DESCRIPTION
L	20	BLK	
10	19	WHT	+5/+10 Vdc. Ref. outp.
K	18	GRY	CURRENT outp.
9	17	VIOL	Valve Over Ride
J	16	BLU	+15 Vdc input
8	15	GRN	Ext. Valve Contr.
H	14	YEL	SLOT
7	13	ORG	SLOT
F	12	RED	-15Vdc input
6	11	BWN	NOT USED
E	10	BLK	SOFT START
5	9	WHT	
D	8	GRY	NOT USED
4	7	VIOL	+15 Vdc input
C	6	BLU	supply vol. com.
3	5	GRN	0-5Vdc/0-10Vdc signal outp.
B	4	YEL	command com.
2	3	ORG	sign. common.
A	2	RED	command wiper
1	1	BWN	chassis grnd
PCB NO	NO	CLR	DESCRIPTION

PIN NUMBER ASSIGNMENT TABLE

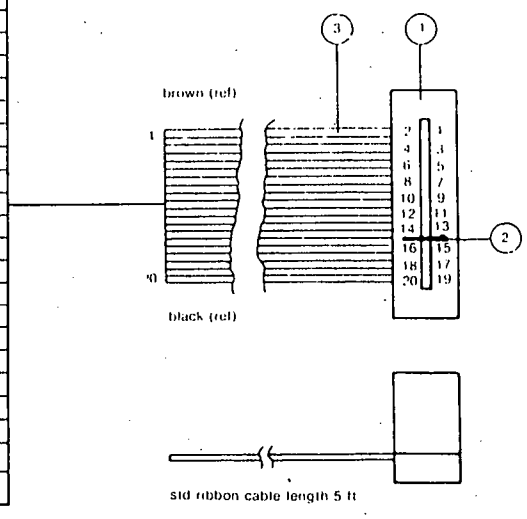


Figure 2-3
5850TR Connections Diagram Card Edge

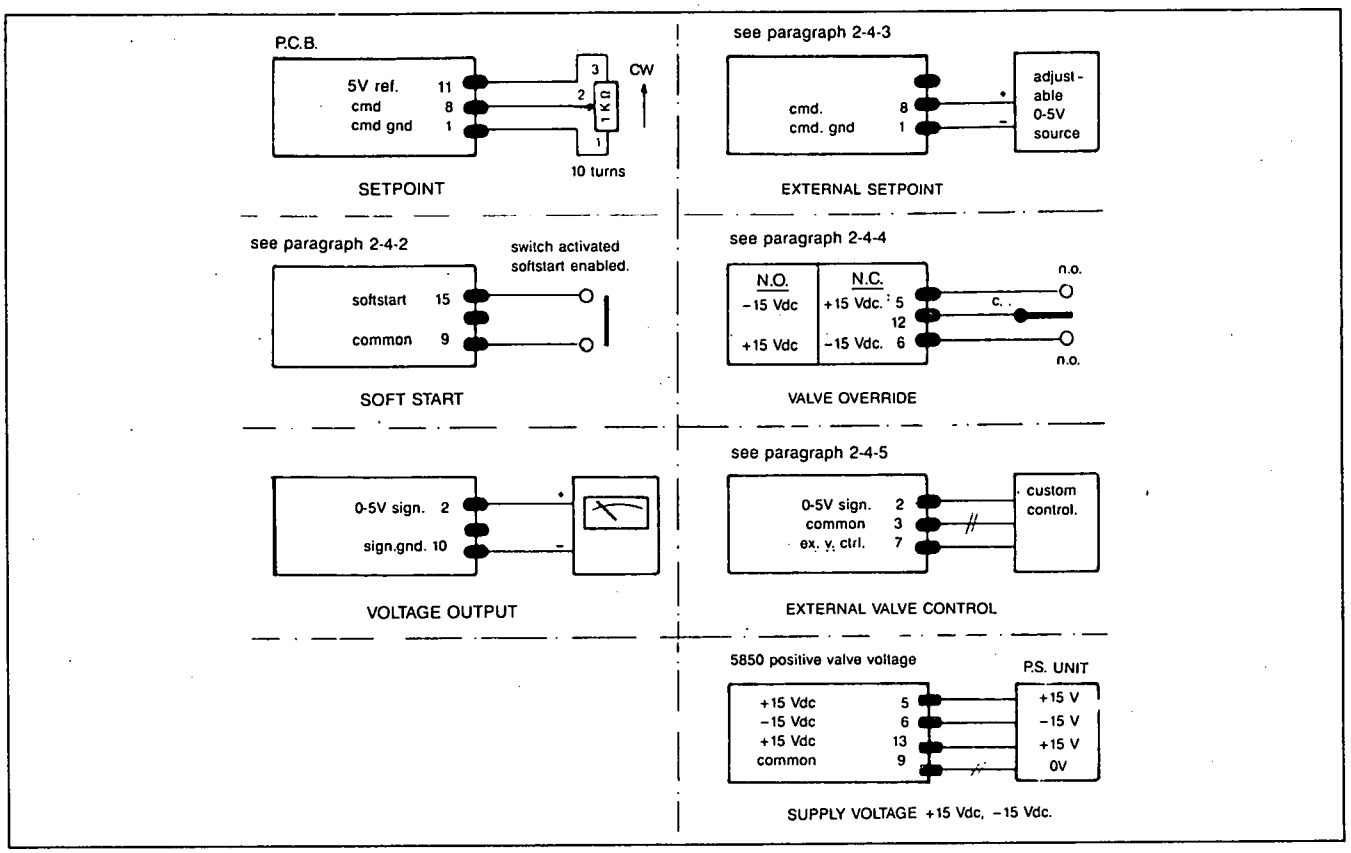
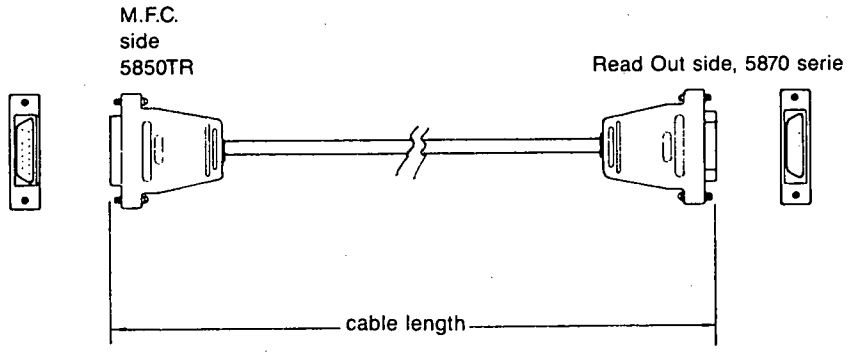


Figure 2-4
5850TR Hook-up Diagrams
15 pins sub "D"-connector



"D"-CONNECTOR 15-pins		COLOR	FUNCTION
M.F.C. pin.no	readout side pin.no		
female	male		
1	6	BROWN	Command ground
2	10	WHITE	0-5V Sign. output
3	9	GREY/PINK	Common valve
4	2	RED/BLUE	Not used
5	13	RED	+15 Vdc Input
6	14	BLUE	-15 Vdc Input
7	3	VIOLET	Ext. valve control
8	5	GREY	Command Wiper
9	12	BLACK	Common
10	8	PINK	Signal ground
11	4	YELLOW	5V ref. output
12	7	GREEN	Valve override
13	1	WHITE/GRN	+15 Vdc valve
NC	11	SHIELD	Chassis
15	15	BWN/GRN	Soft start

Figure 2-5
5850TR Connections Diagram "D"-Connector

Section 3 OPERATION

3.1 Theory of Operation

The thermal mass flow sensing technique used in the 5850TR works as follows:
A precision power supply provides a constant power heat input (P) at the heater, which is located at the mid-point of the sensor tube. Refer to Figure 3-1. At zero, or no flow conditions the heat reaching each temperature sensor is equal. Therefore the temperatures T1 and T2 are equal. When gas flows through the tube the upstream sensor is cooled and the downstream sensor is heated, producing a temperature difference. The temperature difference T2-T1, is directly proportional to the gas mass flow.
The equation is: $\Delta T = A * P * Cp * m$

Where:
ΔT = Temperature difference T2-T1 (K)
Cp = Specific heat of the gas at constant pressure ($kJ.kg^{-1}.K^{-1}$)
P = Heater power (kJ/s)
m = Mass Flow (kg/s)
A = Constant of proportionality (S^2-K^2/kJ^2)

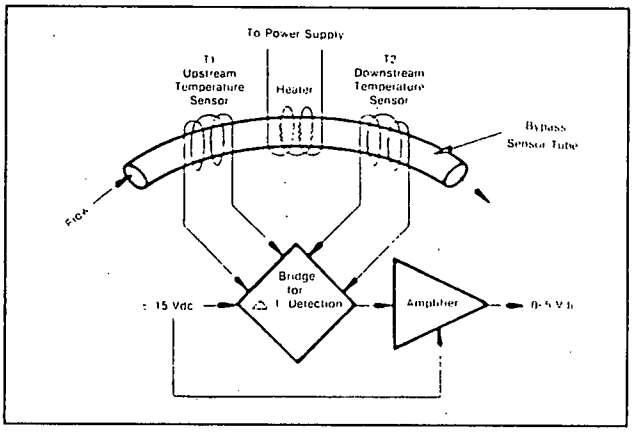


Figure 3-1 Flow Sensor Operational Diagram

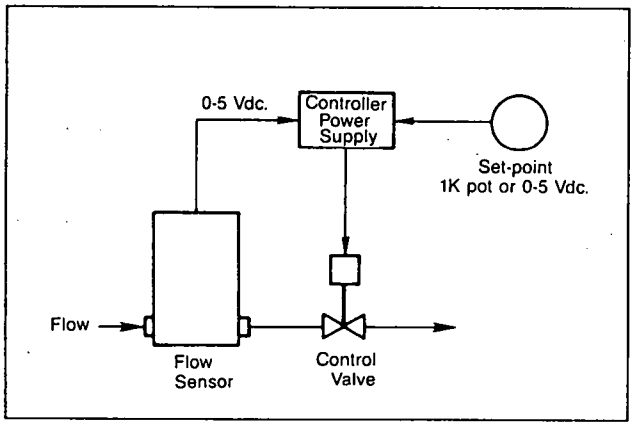


Figure 3-2 Control System Blockdiagram

A bridge circuit interprets the temperature difference and a differential amplifier generates a linear 0-5 Vdc signal directly proportional to the gas **mass flow rate.** A flow restrictor performs a ranging function similar to a shunt resistor. This restrictor provides a pressure drop that is linear with flow rate. The sensor tube has the same linear pressure drop/flow relationship. The ratio of the restrictor flow to the sensor tube flow remains constant over the range of the meter. Different restrictors have different pressure drops and produce meters with different full scale flow rates. The span adjustment in the electronics affects the fine adjustment of the meters full scale flow.

In addition to the mass flow sensor the Model 5850TR Mass Flow Controller has an integral control valve and control circuit. The control circuit senses any difference between the flow sensor signal and adjusts the current in the modulating solenoid valve in increase of decrease the flow.

The printed control board offers you the following features:
- soft start
- valve override

and a setpoint input for 0-5Vdc or 0-10Vdc signal, or a command potentiometer.
- precision reference voltage is provided to drive the command potentiometer.

The voltage is presented to the whiper by the voltage divider action and is applied to the command input of the controller.

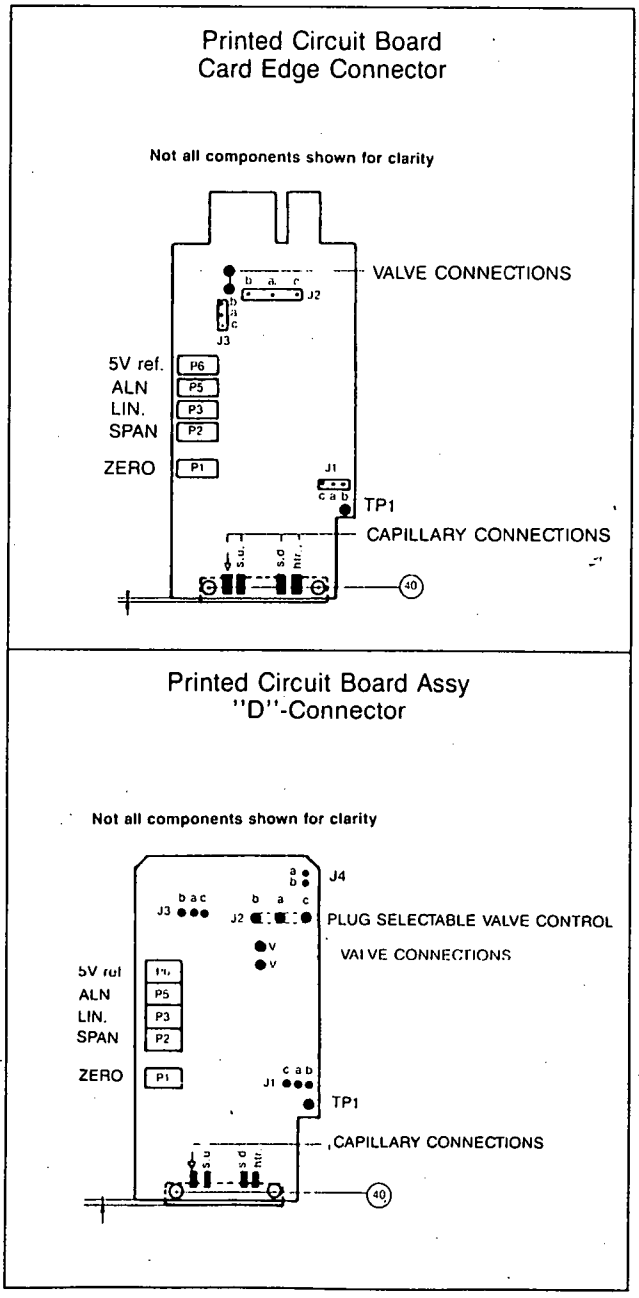
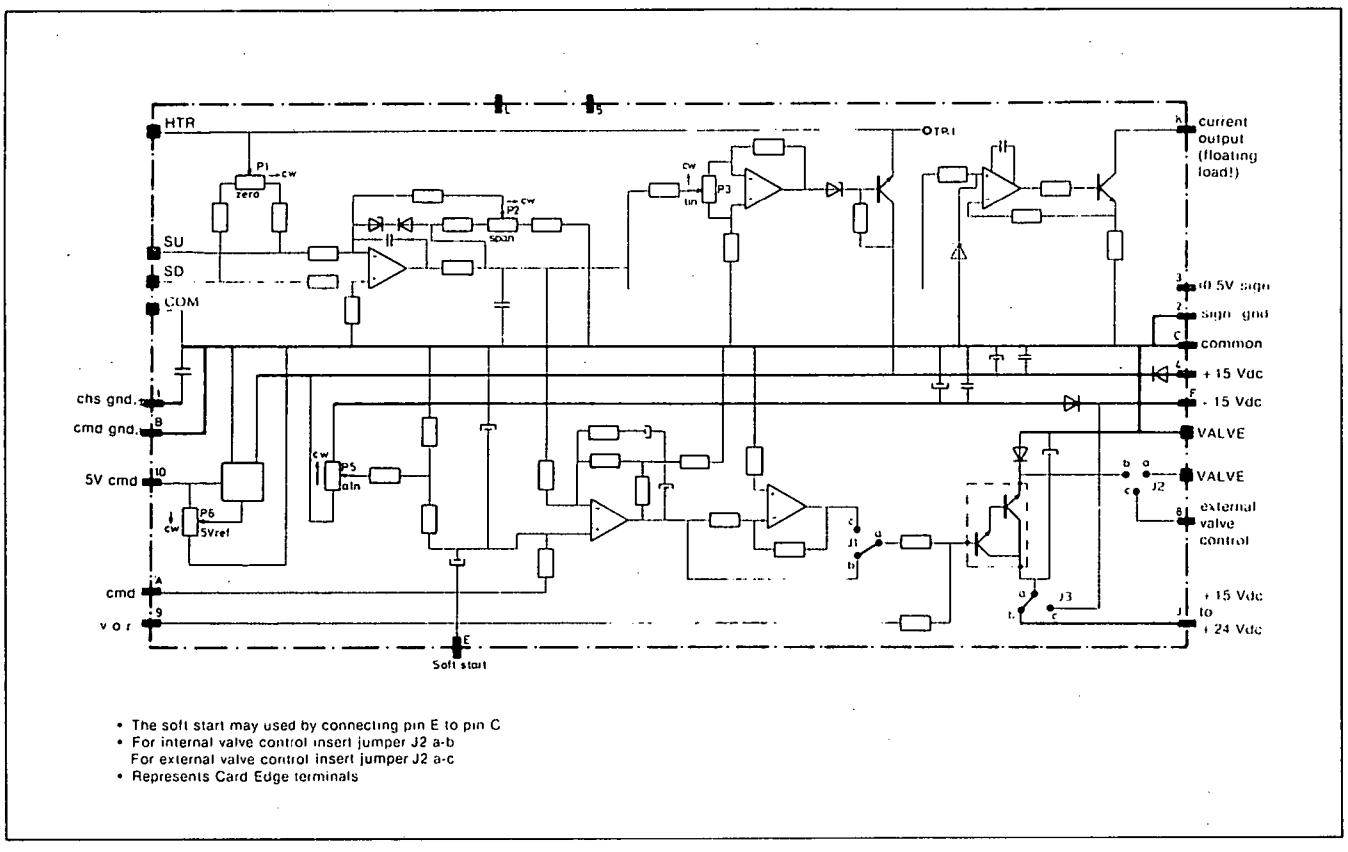
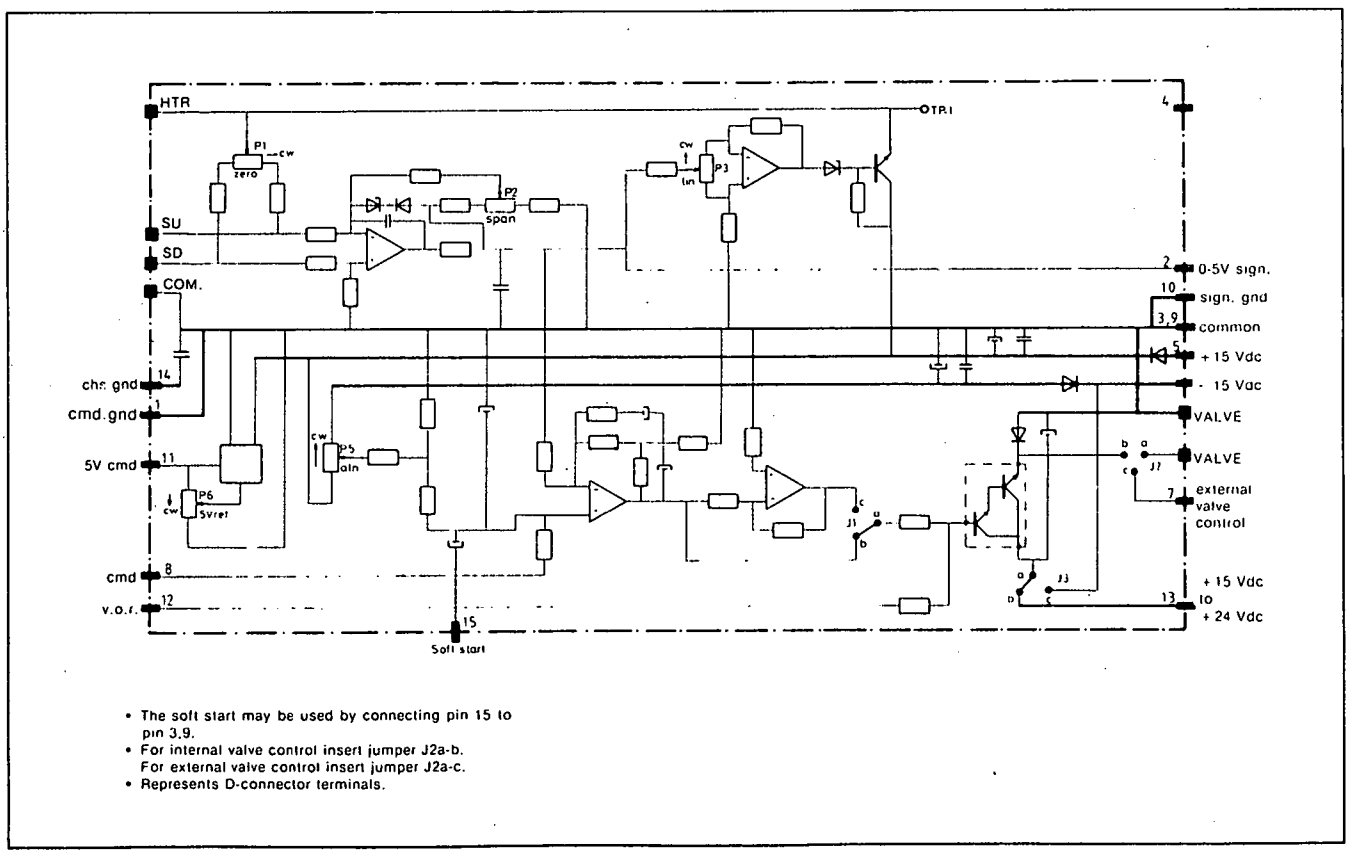


Figure 3-3 Printed Circuit Board Assy



- The soft start may used by connecting pin E to pin C
- For internal valve control insert jumper J2 a-b
  For external valve control insert jumper J2 a-c
- Represents Card Edge terminals

Figure 3-4
Schematic Diagram 5850TR Electronics with
Card Edge Connections



- The soft start may be used by connecting pin 15 to pin 3,9.
- For internal valve control insert jumper J2a-b.
  For external valve control insert jumper J2a-c.
- Represents D-connector terminals.

Figure 3-5
Schematic Diagram 5850TR Electronics with
"D"-Connector

3-2 Operating procedure (refer to figure 2-2 to 2-5 Customer Hook-up Diagram).

A. Apply power to the M.F.C. and allow approximately 45 minutes for the instrument to warm up and stabilize.
B. Turn on gas supply.
C. Command 0% flow and observe the controllers output signal.
The output should be slightly positive: +15 mVdc for the N.C. Valve and +100 mVdc for the N.O. Valve.
D. Set command for desired flowrate to assume normal operation.

3-3 Zero Adjustment

Each 5850TR is factory adjusted to provide a +15 mVdc signal at zero flow. The adjustment is made in our calibration laboratory which is temperature controlled. After initial installation and warm-up in the gas system the zero flow indication may be other than the factory setting. This is primarily caused by changes in temperature between our calibration laboratory and the final installation. The zero flow reading can also be affected to a small degree by changes in line pressure and mounting attitude. To check zero always mount the controller in its final configuration and allow a minimum of 20 minutes for the temperature of the controller and its environment to stabilize. Using a suitable voltmeter check the controller output signal. If it differs from the factory setting adjust it by removing the lower pot hold plug, which is located closest to the controller body. Adjust the zero potentiometer (refer to Figure 3-3) until the desired output signal is obtained.

3-4 Calibration procedure (refer to figure 3-3 to 3-6).

NOTE:
Calibration of the 5850TR mass flow controller requires the use of a digital voltmeter (DVM) and a primary flow standard calibrator such as the Brooks 'Vol-U-Meter® '. It is recommended that the calibration be performed only by trained and qualified service personnel.

If the mass flow controller is to be used on a gas other than the calibration gas, apply the appropriate sensor conversion factor. Size the orifice for actual operating conditions.

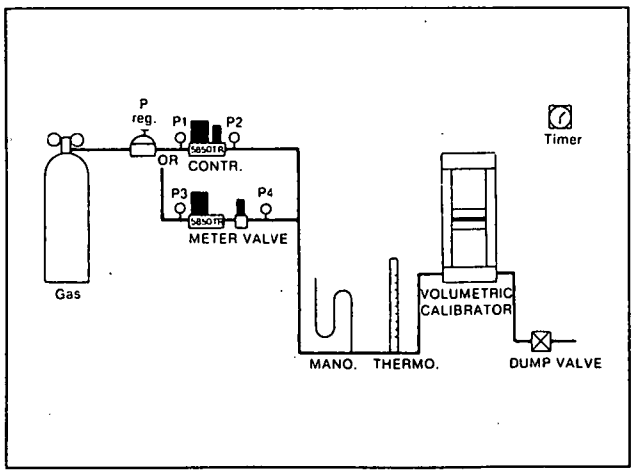


Figure 3-6
Typical Calibration Installation

The calibration procedure is written for all M.F.C. models, please refer only to those chapters which are applicable.

With the meter installed in an unpressurized gas line, apply power and allow approximately 45 minutes for warm up. During the warm-up, adjustment and calibration check procedures do not allow the control valve to open when gas flow is not present. This situation is not a normal operation mode, it will cause the control valve to heat up abnormally. A meter with an abnormally warm valve will be difficult to calibrate. This situation can be prevented by switching the valve override "closed" when there is no gas flow. Also avoid unnecessary periods with the valve override "open".

1-Reference, P6

Ref. adjustment. -Connect D.V.M. positive lead to the command potentiometer terminal CW.
- Card Edge, voltage output, pin 10, negative to command pin B.
- Sub "D", pin 11 and negative to command pin 1.

Adjust Ref P6 for 5.000 V.

2-Zero, P1

ZERO adjustment - Connect DVM positive to the output and DVM negative to the signal common. Adjust Zero, P1 for +15 mV ± 2 mV.

3-Alignment, P5

ALN. adjustment- Set command potentiometer to 100%. Adjust ALN P5 for 5.000V flow output.
- Card Edge, voltage output; connect DVM positive lead to the output pin 3, and negative to pin 2.
- Sub "D", connect positive lead to the output pin 2 and negative to pin 10.

4-Total Error

Set the command potentiometer to 10% of ref. voltage (0,500V)
Check and record output reading. The difference (in millivolts) between the command and output is "Total Error".

5-Alignment, P5

ALN adjustment, P5 to minus one-half of error.

6-Linear, P3

LIN adjustment. -Set command potentiometer to 100%, with DVM connected to TP1, adjust LIN (P3) for 11,0V.

7-Span, P2

SPAN adjustment -With command potentiometer at 100%, using suitable volumetric calibration equipment, adjust SPAN P2 for proper full scale flow.

8-Zero, P1

Set command potentiometer to 0% of flow.
Connect DVM positive to output and readjust zero (P1) for 15mV ±2 mV.

9-LIN adjustment

Set command potentiometer to 50% of flow and measure the flow rate using suitable volumetric calibration equipment.
Calculate the error as a percentage of full scale.

$$\text{Ful scale error} = \frac{100\% \text{ (measured flow rate-desired flow rate)}}{\text{F.s. flow rate}}$$

Example:
What is the percent of full scale error when
F.s. = 100 ml_n/min.

Measured flow rate = 51,5 ml_n/min.
Desired flow rate = 50,0 ml_n/min.

$$\text{Full scale error} = \frac{100\ (51{,}5 - 50)}{100} = 1{,}5\%$$

Note:
If the result of the percentage of error calculation is negative, be sure the "negative" percentage of error is used when calculating the TP1 voltage.

10-

Set command potentiometer to 100% of flow.
Note the voltage at TP1.
Calculate the new TP1 voltage: (the error from step 9) times (-0,178 V/%).

Example:
If step 9 error = 1,5%
and TP1 voltage = 11,000V
Then the new TP1 = 1,5% x (-0,178 V/%)* + 11V
= -0,267 V + 11V
= 10,733 V

*A linearity adjustment factor units = volts/percent.

11-

Adjust LIN (P3) for new TP1 voltage.

12-

Repeat steps 7, 8 and 9. If the error from step 9 is less than 0,5% then calibration is complete.
If not, then repeat steps 10, 11 and 12.

3-5 Sizing of the Control Valve

When a change of the flow conditions is required; it may be necessary to change the flowrestrictor (refer to par. 4-4) and orifice size.

When calculating the Kv-value following information is required.

For proper sizing following information is required:

Upstream pressure	P1 (Abs) Bar
Downstream pressure	P2 (Abs) Bar
Gas temperature	T (Kelvin)
Maximum flow	Q (m^3_n/h)
Gas density	φ (kg/m^3_n)

Depending on the ratio between P1 and P2, we have to make different calculations:

- Over critical, when $\frac{P2}{P1} > 0{,}5$

$$Kv = \frac{Q \text{ max.}}{514} \times \sqrt{\frac{\varphi \times T}{(P1-P2) \times P2}}$$

- Under critical, when $\frac{P2}{P1} \leqslant 0{,}5$

$$Kv = \frac{Q \text{ max.}}{257 \times P1} \times \sqrt{\varphi \times T}$$

The table 3-5-1 refers to the Kv-values and appropriate orifice sizes.
The next largest orifice size should be selected in case of interpolation.

3-5-1- Kv-Values and max. Acceptable Pressure Drop over the Valve.

Kv value (m^3_n/h)	Orifice diameter (inch)	Max. ΔP(Bar)	Partnumber
5×10^{-6}	0,0013"	500	577-Z-363-BMT
2×10^{-5}	0,002"	500	577-Z-364-BMT
5×10^{-5}	0,003"	350	577-Z-365-BMT
11×10^{-5}	0,004"	230	577-Z-366-BMT
18×10^{-5}	0,005"	160	577-Z-367-BMT
4×10^{-4}	0,007"	100	577-Z-368-BMT
9×10^{-4}	0,010"	60	577-Z-369-BMT
2×10^{-3}	0,014"	36	577-Z-401-BMT
$4{,}7 \times 10^{-3}$	0,020"	22	577-Z-370-BMT
$1{,}05 \times 10^{-2}$	0,028"	13	577-Z-371-BMT
$1{,}4 \times 10^{-2}$	0,032"	11	577-Z-372-BMT
$3{,}3 \times 10^{-2}$	0,048"	6	577-Z-137-BMT

Section 4 MAINTENANCE

4-1 General

No routine maintenance is required on the Model 5850 TR other than an occasional cleaning. If an in-line filter is used, the filtering element should periodically be replaced or ultrasonically cleaned.

4-2 Control valve (refer to figure 5-1)

The control valve may be disassembled in the field by the user for cleaning or servicing.
Disassemble the valve as follows:

1. remove the jam nut (14) on top of the valve assembly.
2. remove the screw (5) and cover (3) of the controller.
3. remove the coil housing (13) (including item 12 and 11).
4. **carefully** remove the stem assembly (1) as not to be bend the lower guide spring (9).
5. remove plunger assembly (16).
6. remove orifice (19).

Clean the parts and carefully assemble in reverse of the above procedure.
O-ring seals should be inspected and may need to be replaced during the maintenance procedure. O-ring seals must be lubricated with HALO-CARBON 25-10M grease prior to installation.

NO LUBRICATION SUBSTITUTE IS RECOMMENDED.

4-3 Trouble shooting

CAUTION: It is important that this instrument be serviced only by properly trained and qualified personnel.

System Checks
The 5850TR is generally used as a component in gas handling systems which can be quite complex. This can make the task of isolating a malfunction in the system a difficult one. An incorrectly diagnosed malfunction can cause many hours of unnecessary downtime. If possible, make the following system checks before removing a suspected defective mass flow controller for bench troubleshooting or return, especially if the system is new:

1. Verify that the process gas fittings have been correctly connected and leak checked.
2. If the mass flow controller appears to be functioning but cannot achieve set-point, verify that sufficient inlet pressure and pressure drop are available at the controller to provide the required flow.

WARNING:
If it becomes necessary to remove the controller from the system after exposure to toxic, pyrophoric, flammable, or corrosive gas, purge the controller thoroughly with dry inert gas such as nitrogen, before disconnecting the gas connections. Failure to correctly purge the controller could result in fire, explosion, or death. Corrosion or contamination of the mass flow controller upon exposure to air may also occur.

Trouble	Possible cause	Check, corrective action
NO OUTPUT	No power in	1. Check for ±15 Vdc power supply
	Obstruction in sensor	1. Flush sensor in both directions with non-residuous solvent. Air dry thoroughly. **Do not attempt to service or disassemble sensor.** 2. Return to factory.
	P.C. Board failure	1. Return to factory.
WILL NOT ZERO	Gas leak	1. Check downstream gas connection 2. Return to factory.
	P.C. Board failure	1. Return to factory
OUT OF CALIBRATION	Gas leak	1. Check all gas connections
	Dirty sensor	1. Flush with non-siduous solvent. Air dry thoroughly. **Do not attempt to service or disassemble sensor.** 2. Return to factory.
	Change in composition of metered gas	1. Refer to table 4-4-1 for conversion factor. 2. Return to factory.
	P.C. Board failure	1. Return to factory.
	Clogged restrictor	1. Ultrasonically clean. 2. Replace restrictor.

If any of the above services are performed, it is recommended calibration of the unit be verified using suitable volumetric calibration equipment.

4-4 Use of the Gas Conversion Table.

The Gas Conversion Table 4-4-1 is used to calculate the flowrate for gases other than the preselected gas.

The Mass Flow Controller is factory set to a preselected gas, pressure and flowrange. The flowrate accuracy of the new gas will generally be within ± 3% of the calculated flow at any output, repeatability remains ± 0,2% full scale.
To change to a new gas, multiply the output reading by the ratio of the gasfactor for the desired gas, to the gasfactor for the calibration gas.

Actual gas flow rate =

$$\text{Output reading} \times \frac{\text{factor new gas}}{\text{factor calibrated gas}}$$

Or for example:
The controller is calibrated for N_2
The desired gas is CO_2
Output reading is 75 ml_n/min.
Then:

$$\text{Actual gas flow rate } CO_2 = 75 \times \frac{0{,}77}{1{,}00}$$

$$= 57{,}75 \text{ } ml_n/min.$$

In order to calculate the conversion factor for a gas mixture the following formula should be used:

$$\text{Sensor Conversion Factor Mixture} = \frac{100}{\frac{P1}{\text{Conv. factor Gas 1}} + \frac{P2}{\text{Conv. factor Gas 2}} + \frac{Pn}{\text{Conv. factor Gas n}}}$$

Where:
P1 = percentage (%) of gas 1 (by volume)
P2 = percentage (%) of gas 2 (by volume)
Pn = percentage (%) of gas n (by volume)

Example:
The desired gas is 20% Helium (He) and 80% Chlorine (Cl_2) by volume. The desired full scale flow rate of the mixture is 20 ml_n/min.

Sensor conversion factor for the mixture is:

$$\text{Factor Mixture} = \frac{100}{\frac{20}{1{,}39} + \frac{80}{0{,}83}} = 0{,}903$$

Air equivalent flow = 20/0,903 = 22,15 ml_n/min.

It is generally accepted that the mass flow rate derived from this equation is only accurate to ± 3%. The sensor conversion factors given in Table 4-4-1 calculated based on a gas temperature of 21°C and a pressure of 1 Bar abs. The specific heat of most gases are not strongly pressure and temperature dependent, however, gas conditions that vary widely from these reference conditions may cause an additional error due to the change in specific heat due to temperature and/or pressure.

Table 4-4-1 Gas conversion factor chart.

USE OF THE CONVERSION TABLE

The conversion table is used to determine the flow rate for gases other than the preselected gas.
The flowmeter is factory set to a preselected gas (mostly air), pressure and flow range.
To change to a new gas, multiply the output reading by the factor, in cases the flowmeter is calibrated on air or Nitrogen.

Gas	Symbol	Specific Heat Cp at 25°C and 1 Atm.J/mole K	Toxic	Flammable	Sensor Conversion Factor*	Density kg/m³n
Acetylene	C_2H_2	44.308	No	Yes	0.657	1.173
Air	-	29.13	No	No	1.000	1.293
Allene	C_3H_4	60.84	No	Yes	0.479	1.787
Ammonia	NH_3	36.953	Yes	Yes	0.788	0.771
Argon	Ar	24.83	No	No	1.398	1.784
Arsine	AsH_3	38.522	Yes	Yes	0.756	3.478
Boron Trichloride	BCl_3	65.655	Yes	No	0.444	5.227
Boron Trifluoride	BF_3	50.242	Yes	No	0.580	3.025
Bromine Pentafluoride	BrF_5	101.4	Yes	Yes	0.287	7.806
Bromine Trifluoride	BrF_3	66.65	Yes	Yes	0.440	6.108
Butane	C_4H_{10}	100.365	No	Yes	0.290	2.593
Butene	C_4H_8	87.329	No	Yes	0.334	2.503
Carbon Dioxide	CO_2	37.564	No	No	0.775	1.977
Carbon Monoxide	CO	29.204	Yes	Yes	0.997	1.250
Carbon Tetracloride	CCl_4	84.438	Yes	No	0.345	6.860
Carbonyl Fluoride	COF_2	108.5	Yes	Yes	0.268	2.045
Carbonyl Sulfide	COS	42.752	Yes	Yes	0.681	2.680
Carbon Tetrafluoride (Freon 14)	CF_4	61.27	No	No	0.475	3.906
Chlorine	Cl_2	35.317	Yes	Yes	0.825	3.214
Chloroform	$CHCl_3$	65.756	Yes	Yes	0.443	5.323
Chlorine Trifluoride	ClF_3	67.117	Yes	Yes	0.434	4.125
Cyanogen	$(CN)_2$	38.338	Yes	Yes	0.499	2.322
Cyclopropane	C_3H_6	57.559	Yes	Yes	0.506	1.877
Deuterium	D_2	29.204	No	Yes	0.997	0.177
Diborane	B_2H_6	53.346	Yes	Yes	0.546	1.235
Dichlorosilane	SiH_2Cl_2	65.73	Yes	Yes	0.443	4.506
Dimethylamine	$(CH_3)_2NH$	43.428	Yes	Yes	0.671	2.011
Dimethylether	$(CH_3)_2O$	49.40	Yes	Yes	0.590	2.055
Ethane	C_2H_6	53.346	No	Yes	0.546	1.357
Ethyl Chloride	C_2H_5Cl	102.090	Yes	Yes	0.285	2.879
Ethylene	C_2H_4	43.428	No	Yes	0.620	1.261
Ethylene Oxide	C_2H_4O	49.40	Yes	Yes	0.590	1.965
Fluorine	F_2	31.449	Yes	Yes	0.926	1.695
Fluoroform (Freon 23)	CHF_3	51.557	No	No	0.565	3.127
Freon 11	CCl_3F	77.613	No	No	0.375	6.281
Freon 12	CCl_2F_2	74.469	No	No	0.391	5.492
Freon 13	$CClF_3$	67.655	No	No	0.431	4.912
Freon 13 B1	$CBrF_3$	70.590	No	No	0.413	6.615
Freon 21	$CHCl_2F$	63.7	-	-	0.457	4.912
Freon 22	$CHClF_3$	57.524	No	No	0.506	3.906
Freon 113	$C_2Cl_3F_3$	126.10	No	No	0.231	7.920
Freon 114	$C_2Cl_2F_4$	112.992	No	No	0.258	7.479
Freon 115	C_2ClF_5	121.38	-	-	0.274	7.165
Freon 116	C_2F_6	126.65	No	No	0.227	6.139

* Nitrogen equals 1.000 for conversion factors.

Table 4-4-1 Gas Conversion factor chart. (Continued)

Gas	Symbol	Specific Heat Cp at 25°C and 1Atm.J/mole K	Toxic	Flammable	Sensor Conversion Factor*	Density kg/m³n
Germane	GeH_4	45.020	Yes	Yes	0.650	3.418
Helium	He	20.967	No	No	1.389	0.178
Hydrogen	H_2	28.851	No	Yes	1.010	0.090
Hydrogen Bromide	HBr	29.791	Yes	-	0.978	3.645
Hydrogen Chloride (Dry)	HCl	29.576	Yes	No	0.985	1.639
Hydrogen Fluoride	H.F.	16.155	Yes	No	1.000	0.893
Hydrogen Iodide	H.I.	30.497	Yes	Yes	0.955	5.789
Hydrogen Selenide	H_2Se	34.752	Yes	Yes	0.838	3.613
Hydrogen Sulfide	H_2S	34.218	Yes	Yes	0.851	1.539
Isobutane	C_4H_{10}	94.163	No	Yes	0.309	3.593
Isobutylene	C_4H_8	86.883	No	Yes	0.335	2.503
Krypton	Kr	21.037	No	No	1.385	3.708
Methane	CH_4	35.941	No	Yes	0.810	0.717
Methyl Bromide	CH_3Br	45.020	Yes	No	0.647	4.236
Methyl Chloride	CH_3Cl	42.326	No	Yes	0.688	2.308
Methyl Fluoride	CH_3F	38.171	No	Yes	0.763	1.518
Methyl Mercaptan	CH_4S	49.491	Yes	Yes	0.589	2.146
Neon	Ne	20.786	No	No	1.401	0.902
Nitric Oxide	NO	29.227	Yes	No	0.997	1.339
Nitrogen	N_2	28.98	No	No	1.005	1.251
Nitrogen Dioxide	NO_2	78.99	Yes	No	0.760	2.052
Nitrogen Trifluoride	NF_3	53.371	-	-	0.546	3.168
Nitrogen Trioxide	N_2O_3	65.618	Yes	No	0.444	3.389
Nitrous Oxide	N_2O	38.635	No	No	0.754	1.964
Oxygen	O_2	29.427	No	No	0.990	1.429
Perchloryl Fluoride	ClO_3F	-	-	-	0.449	4.571
Phosgene	$COCl_2$	57.693	Yes	No	0.505	4.418
Phosphine	PH_3	37.126	Yes	Yes	0.785	1.517
Phosphorus Pentafluoride	PF_5	-	Yes	No	0.347	5.620
Propane	C_3H_8	74.01	No	Yes	0.394	2.008
Propylene	C_3H_6	62.345	No	Yes	0.467	1.875
Silane	SiH_4	42.844	Yes	Yes	0.680	1.44
Silicon Tetrafluoride	SiF_4	73.492	Yes	No	0.396	4.648
Sulfur Dioxide	SO_2	39.884	Yes	No	0.730	2.858
Sulfur Hexafluoride	SF_6	97.152	No	No	0.300	6.516
Trimethylamine	$(CH_3)_3N$	91.931	Yes	Yes	0.317	2.639
Tungsten Hexafluoride	WF_6	-	-	-	0.290	13.28
Uranium Hexafluoride	UF_6	-	-	-	0.220	15.70
Vinyl Bromide	C_2H_3Br	55.531	Yes	Yes	0.525	4.772
Vinyl Chloride	C_2H_3Cl	53.607	Yes	Yes	0.543	2.788
Vinyl Fluoride	C_2H_3F	50.459	No	Yes	0.577	2.046
Xenon	Xe	21.012	No	No	1.386	5.851

* Nitrogen equals 1.000 for conversion factors.

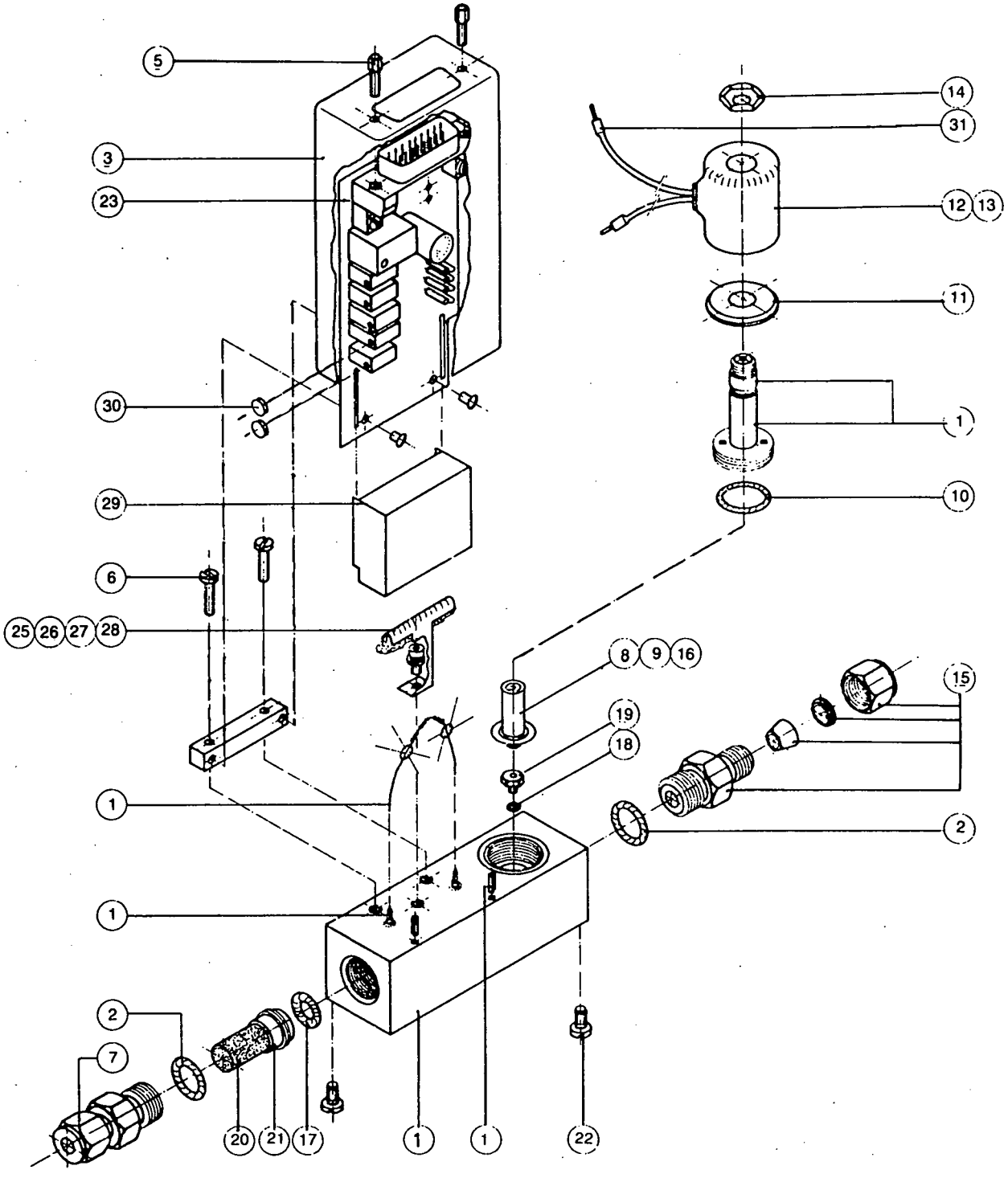


Figure 5-1
Exploded view 5850TR

5-1 Recommended spare parts 5850TR with N.C. valve, 100 Bar

Ref.no.	Quantity required	Description	Part number
1	1	Transducer body M.F.C. Sensor	092-B-033-BMA 092-B-036-BMA
2	2	O-ring for adapters Viton Teflon Buna-N	375-B-906-QTA 375-B-906-QMA 375-B-906-SUA
3	1	Housing cover Card Edge connection sub "D"-connection sub "D"-connection (sensor)	219-Z-190-EAA 219-Z-241-EAA 219-Z-243-EAA
5	2 1	Cil. screw Card Edge connection Mounting set sub "D"-connection	753-G-267-AAA 760-Z-037-ACS
7	1	Inlet Adapters 1/4" tube comp. fittings (incl. filter) 1/8" tube comp. fittings 1/4" VCR 1/4" NPT 6 mm tube comp. fittings 3/8" tube comp. fittings	320-B-080-BMA 320-B-083-BMA 014-Z-358-BMA 014-C-203-BMA 320-B-092-BMA 320-B-085-BMA
8	1	Seat assembly Viton Tefon Kalrez Buna-N	715-Z-046-AAA 715-Z-041-AAA 715-Z-162-AAA 715-Z-123-AAA
9	1	Lower guide spring	820-Z-073-BBA
10	1	O-ring valve seal Viton Teflon Buna-N	375-B-016-QTA 375-B-016-QMA 375-B-016-SUA
11	1	Filflix plate	613-E-444-ACJ
12	1	Coil	183-Z-128-AAA
13	1	Coil housing	441-Z-180-AAA
14	1	Nut	575-Z-011-ACJ
15	1	Outlet adapters 1/4" tube comp. fittings 1/8" tube comp. fittings 1/4" VCR 1/4" NPT 6 mm tube comp. fittings 3/8" tube comp. fittings	320-B-079-BMA 320-B-082-BMA 014-Z-357-BMA 014-C-202-BMA 320-B-091-BMA 320-B-150-BMA
16	1	Plunger assy	622-Z-108-AAA
17	1	O-ring filter bushing Viton Teflon Buna-N	375-B-109-QTA 375-B-109-QMA 375-B-109-SUA
18	1	O-ring under orifice Viton Teflon Buna-N	375-G-042-QTA 375-G-042-QMA 375-G-042-SUA
19	1	Orifice 0,0013" 0,002" 0,003" 0,004" 0,007" 0,010" 0,014" 0,020" 0,028" 0,032" 0,048" 0,052" 0,067"	577-Z-363-BMT 577-Z-364-BMT 577-Z-365-BMT 577-Z-366-BMT 577-Z-368-BMT 577-Z-369-BMT 577-Z-401-BMT 577-Z-370-BMT 577-Z-371-BMT 577-Z-372-BMT 577-Z-137-BMT 577-Z-138-BMA 577-Z-139-BMA

5-1 Recommended spare parts 5850TR with N.C. valve, 100 Bar (continued)

			Min.full scale	Max. full scale	
20 + 21	1	Restrictor assy	6,1	8,7 ml_n/min	110-Z-159-BMA
		Restrictor assy	8,6	12,1 ml_n/min	110-Z-160-BMA
		Restrictor assy	12,0	17,0 ml_n/min	110-Z-161-BMA
		Restrictor assy	16,9	23,9 ml_n/min	110-Z-162-BMA
		Restrictor assy	23,6	33.4 ml_n/min	110-Z-163-BMA
		Restrictor assy	33,1	46,9 ml_n/min	110-Z-164-BMA
		Restrictor assy	46,3	65,6 ml_n/min	110-Z-165-BMA
		Restrictor assy	64,8	91,7 ml_n/min	110-Z-166-BMA
		Restrictor assy	90,8	129 ml_n/min	110-Z-167-BMA
		Restrictor assy	127	180 ml_n/min	110-Z-168-BMA
		Restrictor assy	178	252 ml_n/min	110-Z-169-BMA
		Restrictor assy	249	352 ml_n/min	110-Z-170-BMA
		Restrictor assy	349	494 ml_n/min	110-Z-171-BMA
		Restrictor assy	488	691 ml_n/min	110-Z-231-BMA
		Restrictor assy	683	967 ml_n/min	110-Z-232-BMA
		Restrictor assy	958	1360 ml_n/min	110-Z-233-BMA
		Restrictor assy	1340	1890 ml_n/min	110-Z-234-BMA
		Restrictor assy	1870	2650 ml_n/min	110-Z-235-BMA
		Restrictor assy	2620	3710 ml_n/min	110-Z-236-BMA
		Restrictor assy	3670	5200 ml_n/min	110-Z-237-BMA
		Restrictor assy	5140	7300 ml_n/min	110-Z-238-BMA
		Restrictor assy	7200	10200 ml_n/min	110-Z-239-BMA
		Restrictor assy	10100	14300 ml_n/min	110-Z-228-BMA
		Restrictor assy	14100	20000 ml_n/min	110-Z-226-BMA
		Restrictor assy	19800	28000 ml_n/min	110-Z-224-BMA
23	1	P.C. Board N.C.; neg. valve volt, Card Edge conn. 0-5Vdc			097-B-107-ZZZ
		P.C. Board N.C.; pos. valve volt, sub. "D"-conn. 0-5Vdc			097-B-115-ZZZ
		P.C. Board N.C.; neg. valve volt. Card Edge conn. 0-10Vdc			097-B-177-ZZZ
		P.C. Board N.O.; neg. valve volt, Card Edge conn. 0-5Vdc			097-B-151-ZZZ
		P.C. Board N.O.; pos. valve volt, sub "D"-conn. 0-5Vdc			097-B-156-ZZZ
30	1	Cap for trimpots			620-Z-434-SXA

5-1-1 Recommended spare parts 5850TR with N.O. valve, 100 Bar

Ref. no.	Quantity required	Description	Part number
1	1	Transducer body	092-B-063-BMA
23	1	P.C. Board neg. valve volt. Card Edge conn. pos. valve volt. Card Edge conn. pos. valve volt. sub "D" conn.	097-B-151-ZZZ 097-B-152-ZZZ 097-B-156-ZZZ
40	1	Nut	573-Q-074-ACD
41	1	O-ring sleeve seal Viton Teflon	375-B-012-QTA 375-B-012-QMA
42	1	Plunger extension	830-Z-045-BMA
43	1	Ring	724-Z-202-AAA
44	1	Seat assembly - Kalrez	715-Z-197-AAA
45	1	Plunger assy	622--Z-110-CEA
46	1	Spacer 0,05 mm	810-A-303-BMA
47	1	Spacer 0,2 mm	810-A-304-BMA

5-1-2 Recommended spare parts 5850TR with N.C. valve, 300 Bar

Ref. no.	Quantity required	Description	Part number
1	1	Transducer body	092-B-064-BMA
11	1	Filflix Plate	613-E-452-ACJ
16	1	Plunger assy	622-Z-111-AAA

5-1-3 Service Tools

Quantity required	Description	Part number
1	5850 M.F.C. toolkit	778-D-017-AAA
1	Stem removal tool	908-Z-048-AAA
1	Orifice removal tool	908-Z-035-AAA

Repair Policy
Normal turn-around time is less than five (5) working days on any standard item returned for service. This applies to any product whether it is returned for warranty work or beyond warranty.

Guarantees
If at any time within one year after shipment, but not thereafter, it is proved that any part of the equipment furnished by us was defective when shipped by us, we will repair or replace the same free of charge, F.O.B. our plant. Notice of this claim must be made to us within one year after delivery. Our liability is limited to replacement of such defective parts or equipment. There are no guarantees or warranties expressed or implied other than those herein specificially mentioned.
Brooks Instrument Division shall not in any event be liable for any consequential damages, secondary charges, expenses for erection or disconnection, or losses resulting from any alleged defect in the apparatus.
It is understood that corrosion or erosion of materials is not covered by our guarantee.

VLT® INSTRUCTIONS

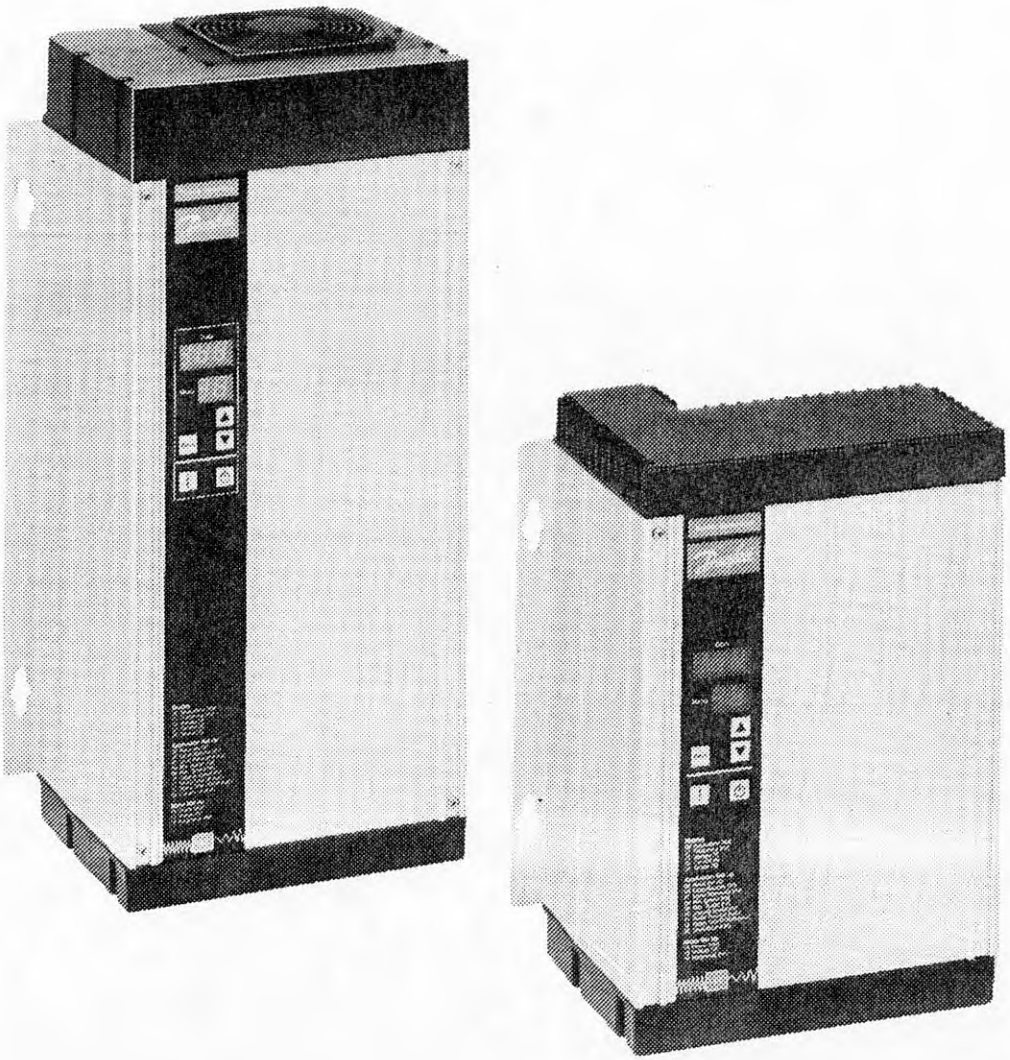
Drives and Controls

VLT® type 3002 - 3006

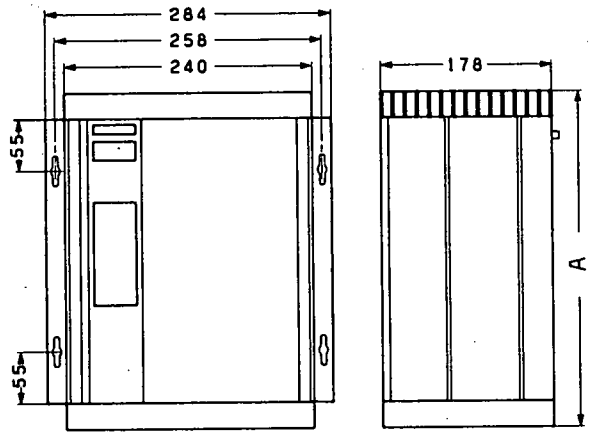
Standard control

200/230 V 380/415 V

175R0547

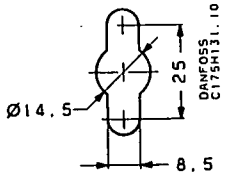


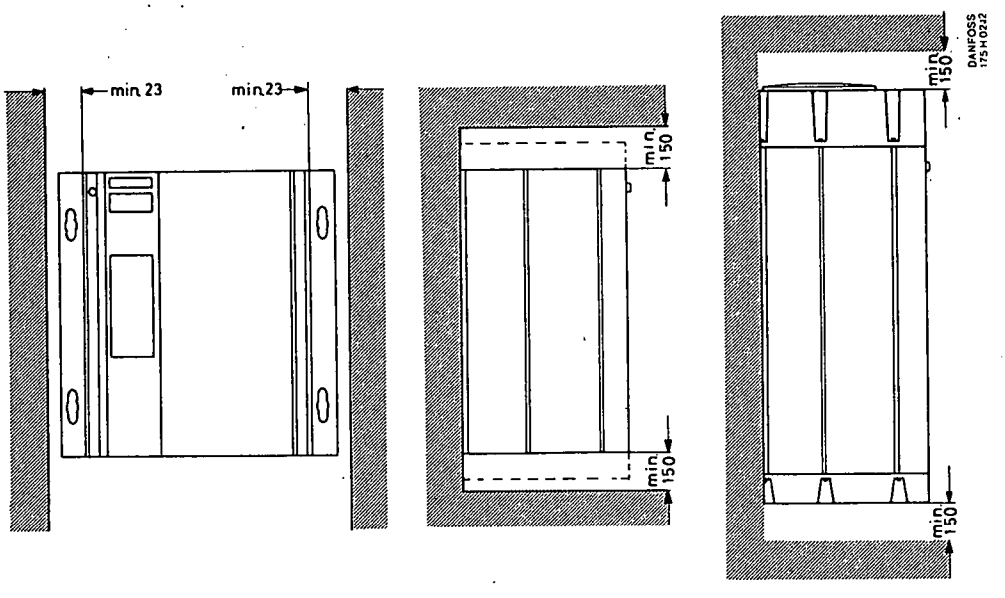
175R0547



1

A [mm] VLT®	3002-3004	3006
IP00	300	440
IP21	360	500
IP54	530	530
IP00 + option	440	550
IP21 + option	500	610
IP54 + option	530	640





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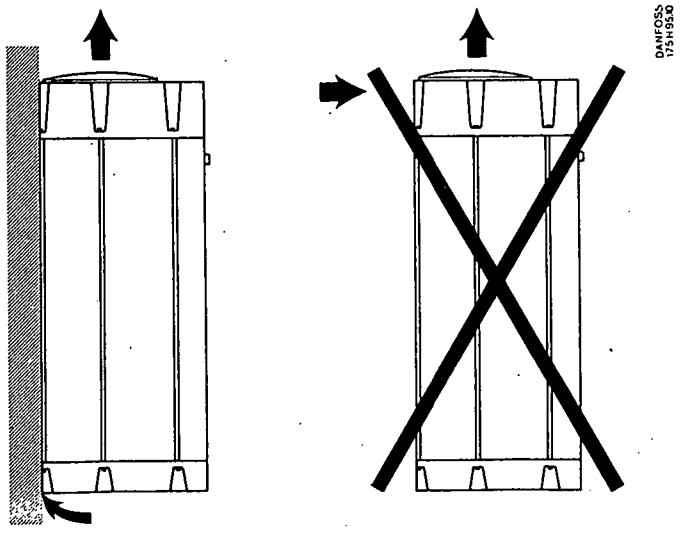

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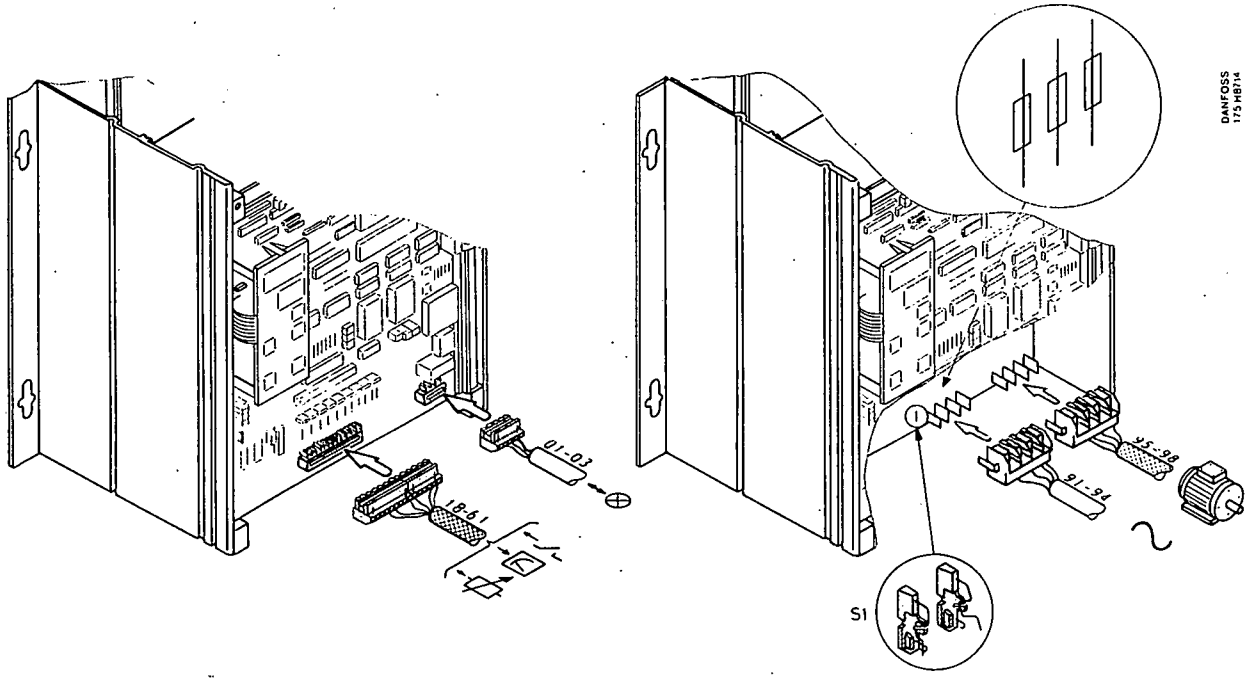

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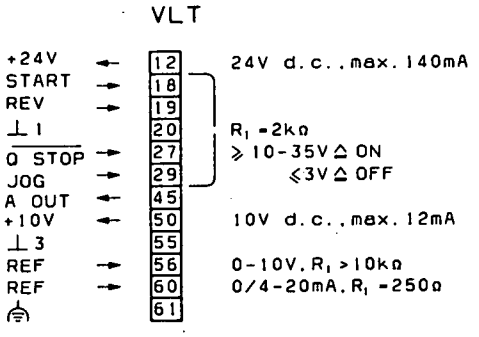

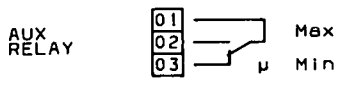

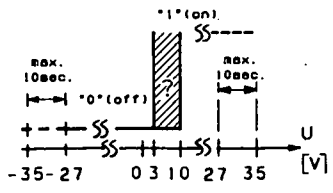

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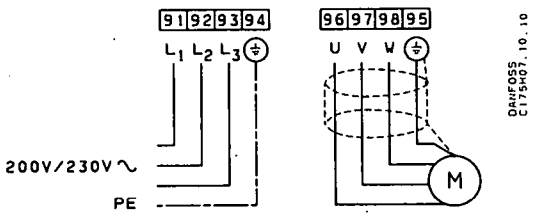

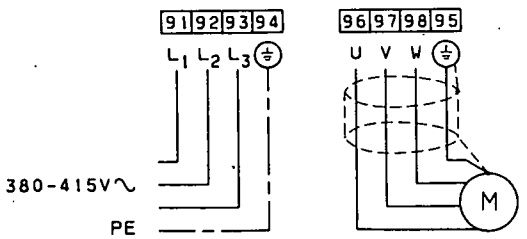

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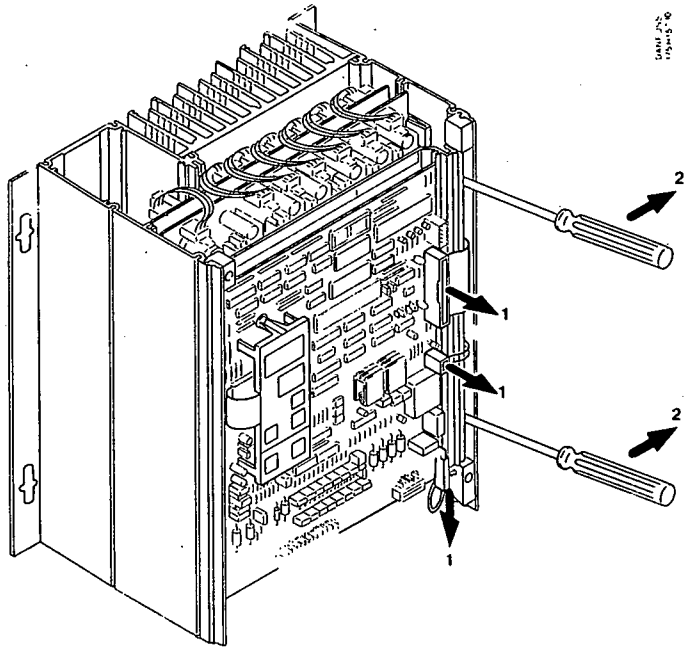
2
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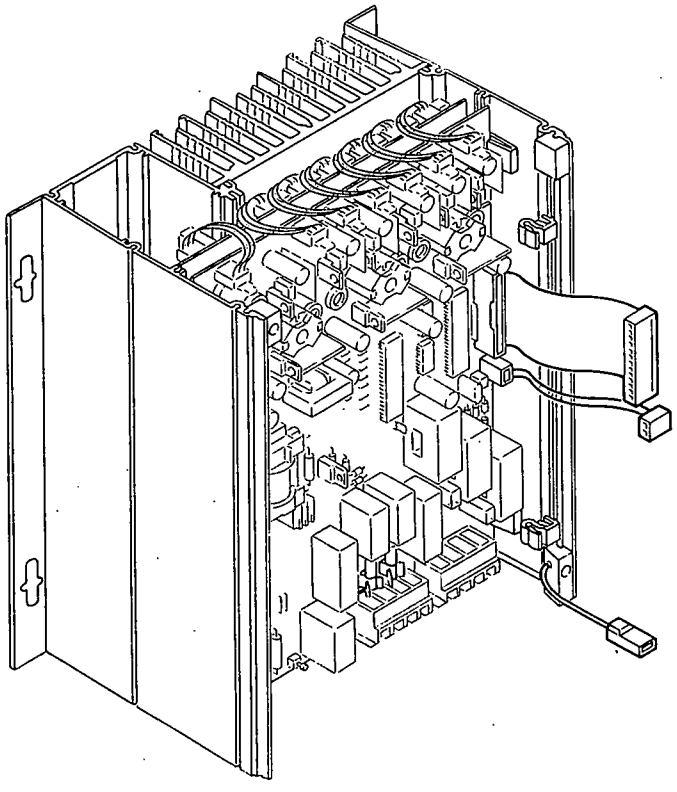
1



English

Warning:

1) Do not touch the electrical parts of the frequency converter when the supply voltage is connected and when the supply voltage has been disconnected wait at least four minutes before touching it.

2) When repairs are undertaken the power supply to the frequency converter must be disconnected. This is to prevent the motor starting without warning.

3) The pushbutton "Stop" (see page 26 fig. 1 pos. 2) does not disconnect the supply mains.

Introduction

The static VLT® frequency converters type 3002-3006 from Danfoss is an electronic unit for infinite control of the standard three phase asynchronous motor.
The frequency converter is available in the following versions:

- IP00, basic version, which can be installed together with an IP21 enclosure, brake option or radio noise filter (RFI filter).
  Special instructions explaining installation and electrical connection procedures must be followed, when installing the IP21 enclosure, brake option or RFI filter.
- IP54 version which can be mounted with brake option and radio noise filter.

The instruction contains the following main points:

- Control signals
- Mechanical assembly
- Electrical connection
- Operation
- Basic settings
- Fault indication

Control signals

This section describes the connection possibilities of the frequency converter control card.

The control card is divided up into 2 groups:

1) Analog input from reference source.
   - Digital input for sequence control.
   - Analog output for monitoring.
2) Relay contact that can be used for an alarm function .

Analog inputs

Terminals 50-61

The frequency converter registers the sum of the signals received on the reference inputs 56 and 60 and a reference frequency is calculated (see below)
Voltage output terminal 50 can supply the potentiometer (min. 1 kΩ). (See connection example page 30).

Terminals 56: voltage reference

Normal 0 - 10 V.

Terminal 60: Current reference

Can be programmed for either 0-20 mA or 4-20 mA signal in menu 24.

Digital inputs

Terminals 15 - 38

The frequency converter registers the digital signals as "on" with voltages higher than 10 V, and as "off" with voltages lower than 3 V (24 V PNP logic). If voltages from 27 to 35 or from -27 to -35 V are applied, they must not be connected for more than 10 seconds, see page 3 fig. 3.
The digital inputs can be supplied via the voltage output of terminal 12 .

Terminal 18 : Motor start.

To start, set the input to "on". There is a choice between different methods of connection. See menu 22.

Terminal19: Reversing of motor.

To reverse set the input to "on". There is a choice between different methods of connection. See menu 22.

Terminal 27: Quick stop.

The input must be set to "on" during operation. If this connection is interrupted the motor stops without ramp operation. See stop possibilities in menu 23.

Terminal 29: Jogging speed.

To change to jogging speed, set the input to "on" .
The jogging function can start the motor without "start" being activated. (It then runs without ramp operation).

Output signals

Terminal 45: Motor frequency / -current

A 0-20 mA or a 4-20 mA signal can be supplied.
(See menu 27 for selection possibilities).

Relay function

Terminals 01 - 03

The relay contact can be activated by the signals: Ready, trip, run, current warning or thermal motor protection.
(See menu 25).

Mechanical installation

The frequency converter is mounted direct on a wall or into a rack by means of the mounting fittings integrated with the unit. However the IP54 version must be mounted direct on a flat wall or plate, otherwise the air flow of the fan cannot follow the cooling ribs of the frequency converter. See page 2 fig. 3.

The frequency converter must be able to get rid of its surplus heat. Therefore air must pass freely under and over the rear wall ribs. The minimum distance to the surroundings appears from fig. 2 on page 2.
The maximum heat dissipation from the frequency converter Φ_{VLT} is:

VLT® type	3002	3003	3004	3006
Φ_{VLT} [W]	60	105	130	160

See separate instruction for mounting IP21 enclosure, brake option or RFI option.

Electrical connection

(The electrical connection to be made according to national rules and regulations).

- The connection plugs are removable. (Page 3 Fig. 1).
- The control signals are connected as shown on page 3 Fig.1 and 2. The function of the control signal has been described in the section 'control signals'.
- The supply mains and the motor are connected as shown on page 3 Fig. 1 and 3.

3 connection examples are shown on page 30:

1) Simple analog control using VLA 10
2) PLC control with internal supply
3) PLC control with external supply

$$f_{REF} = \frac{\text{Actual reference X } (f_{MAX} - f_{MIN})}{\text{Max. reference (10 V or 20 mA)}} + f_{MIN}$$

Note: Cables to the control signal and the motor must be screened in order to comply with radio noise regulations in accordance with VDE 0875 ,EEC directive 82/499 and EMC specifications.
The motor cable screen is connected to the earth in the frequency converter and in the motor.
The control cable screen is connected to a screened earth in the frequency converter. (Connection terminal 61).
If unscreened cables are used, the control inputs can, occasionally be subject to signal disturbances. Normally such a disturbance will not effect the frequency converter.

Note:
High voltage test
With a high voltage test, terminals U, V, W, L1, L2 and L3 must be short circuited and the filter capacitors must be disconnected with switch S1 (see page 3, fig. 1 and 3).
Extra protection
An ELVB, neutral earthing or earthing can be used as extra protection. Due to rectified load, the ELCB must not be used with the frequency converter.

Operation

Use the keyboard of push buttons to operate and programme. The start and stop buttons (page 26, fig. 1, pos. 1 and 2) overrides remote control.
Remove the "programming key" if you do not want to operate and programme via the pushbuttons (see page 26 fig. 2).

The frequency converter has about 40 menus, each one connected to a set of data. The "arrow up" and "arrow down" buttons are used to change between menus. "Data" always displays the value for that actual menu and it is always this data value that is used when regulating. The values can be changed by using the "arrow up" or "arrow down" buttons when the "data" button is pushed in.

After 15 sec. with the same data value or when shifting to another menu the data value is stored so that it is not erased in case of power failure. (excepting menu 07)

The data field will flash when an attempt is made to change data to an undefined area or if an attempt is made to change the data value of menus 5, 14, 15 and 16 without stopping the motor first.
The menu field will flash when the frequency converter is stopped by activating the pushbutton "stop". The frequency converter cannot be restarted via the external start functions.

Basic setting

The menus for output and setting are divided into five groups:

1) **Display indication**. Here the actual operation values can be read out (menu 00 - 04 + menu 17)
2) **Application settings.** Here the frequency converter is programmed so that the control fits the application in question (menu 05-13).
3) **Motor data**. The frequency converter has been optimised on the basis of three recommended motor sizes: nominal, over-size and under-size (see menu 14). Menus 14, 15 16 and 41 are set to the rated motor values.
4) **Control and supervising**: In menus 22-40 a number of control and monitoring possibilities can be selected for the specific application.
5) **Motor compensation**. Menus 18-21 and menu 42 are only applied in special cases:
   -When the motor size used cannot be programmed in menu 14.
   -When the practical operation shows an unacceptably low starting torque, lacking speed stability, jerking motor operation etc.

Factory values have been recorded into the frequency converter. These can be changed as required. The factory values are given on page 32 in the column entitled "Typical value".
In most cases you can use the factory values.
It might be necessary to change the recorded values for single menus in the group "application setting" (menu 5-13).
The menus of "motor data" must only be changed when the the size of the motor used is different from the size of motor recommended for the frequency converter, see page 12.
If the recorded factory data values have been changed it is a good idea to enter the new values in the form at the back of the instructions. This information will be very useful in connection with any re-programming.

Display indication
Menu 00
Customer selected display indication. (See below)
The reference value received from the remote control or via the keyboard can be seen on the display.
Setting of display with application rate factor, see menu 17.
At optimum slip compensation the read out value represents the speed of the motor shaft/machine. A display constant can be programmed (see menu 17)

$$\text{Menu 00} = \frac{\text{Actual reference frequency X Display constant (menu 17)}}{\text{Rated motor frequency (menu 16)}}$$

Menu 17
You can make an input of an application rate factor to be read out in menu 00. The value can be set from 0.1 to 999. Example: Motor data = 50 Hz, 1500 RPM and input data value of 100: At synchronous motor speed (50 Hz) the figure 100 can be seen on the display. At a 50% motor speed the figure on the display is 50.

Menu 01
Readout the frequency converter output frequency in [Hz].

Menu 02
Readout the current motor voltage in [V]. (Measuring of motor voltage on the motor will be inaccurate due to high frequency switching).

Menu 03
Readout the actual motor current in [A].

Menu 04
Readout the current motor torque in %. The output is proportional to the motor efficiency current. 100% is the equivalent of the recorded nominal motor current. The motor torque is a calculated value where the magnetising current (menu 42) appears.
Note : Actual motor torque can be read out at a set constant torque in menu 5 only.

Application setting
Menu 05
Set of load torque characteristic and slip function.
The motor voltage/frequency ratio is set by selecting from the following functions:

Constant torque/power output:
Data value:
0: No slip compensation, reversing via terminal 19 (100)
1: Slip compensation active, reversing via terminal 19 (101)

If a brake option is used: Set the data value from 100-106 (The last digit follows the above)

Quadratic torque applications:
(e.g. centrifugal pumps and fans)
You can choose among 3 factory programmed pump charactristics. However, here you may only use a motor size that can be programmed in menu 14, see "Motor data ".
Data value:
4: Pump application 1. Optimised efficiency , low breakaway torque and low motor noise level.
5: Pump application 2. Optimised efficiency and medium breakaway torque.
6: Pump application 3. Optimised efficiency and high breakaway torque.

Menu 06
Set the operating location
Data value:
0: Local reference
Set the reference value in menu 07.
1: Remote control reference
Analog remote control reference:
The reference value is received via the analog input terminal or on the "jog speed" input.
Digital remote control reference:
(See menu 22,data 4-5)
See page 28
The reference value is received via the digital input "arrow up" and "arrow down" or on the "jog speed" input.
Note:
Local control:
To make the motor start set menu 23 for 0 or make a connection between terminals 12 and 27

Menu 07
Local reference [Hz]
Changes are only possible if the data value in menu 06 is 0.
If the mains supply is disconnected the reference value is 0.

Menu 08
Set the min. speed [Hz]
The value is recorded between 0 and max. speed (menu 09).

Menu 09
Set the max. speed [Hz]
The value is recorded between min. speed (menu 08) and 120 Hz.

Menu 10
Set the jogging speed [Hz]
The value is recorded between 0 and 120 Hz but the motor speed cannot exceed the max. speed.
The jogging speed can be lower than the min. speed.

Menu 11
Set the ramp-up time [s]
Set the ramp time between 0.1 and 360 seconds.
The ramp time indicates the acceleration time from 0 Hz to rated motor frequency (menu 16) provided that the current limit of the frequency converter is not activated

Menu 12
Set the ramp-down time [s]
Set the ramp time between 0.1 and 360 seconds.
The ramp time indicates the deceleration time from rated motor freqeuncy (menu 16) to 0Hz, provided that the overvoltage limit of the frequency converter is not active.
With high breaking power it can be necessary to install a brake module.

Menu 13
Set the current limit [A]
The factory set value in menu 13 is the equivalent to a load of 160% torque.
It is possible to set a lower current limit.
The motor will not start if the value is too low.

Motor data
Menu 14
Set the motor size [kW]
Read off the nominal power of the motor and record the value in kW. For a motor of 1.5 kW, record "1.5".
It is possible to make an input of three motor sizes: an under-size, a nominal size or an over-size.
On a frequency converter type 3003 (1.5 kW motor) there is thus a choice between data values 1.1, 1.5 or 2.2.

Menu 15
Set the motor voltage [V]
Record the motor nominal voltage with data values 200, 220, 230, 380, 400, 415 or 440.

Menu 16
Set the motor frequency [Hz]
Record the motor nominal frequency (break frequency) with data values 50, 60, 87 or 100.

Menu 41
Rated motor current [A].
Used for thermal motor protection and the torque display in menu 4. Enter the value from the motor nameplate.

Control and supervising.
Menu 22
Set the start, stop, reset and reversing functions.
There are six different methods of connection for input terminals 18, 19 and 29. See page 28.
Select the current connection and set the data value to the applicable value.
Data value:
0: Start and reversing activated with make contacts.Reversing is made with a make contact.
1: Motor speed is in the same direction as the switch is activated. Use the pulse switch to reset after trip.
2: The pulse switch is used to start/ stop/and reset (stop and reset with break function). Use the switch to reverse.
3: The pulse switch is used for all functions (stop and reset with break function).
4: The start, stop and reversing functions on terminals 18 and 19 have been cancelled and replaced by "frequency UP" (18) and "frequency DOWN" (19). When terminal 29 is set to "ON" the actual analog reference is changed to the preprogrammed JOG reference. On the basis of that the speed can be changed through terminals 18 and 19.
5: As 4, but if terminal 29 is set to "ON" the actual analog reference is kept and on the basis of that the speed is now changed through terminals 18 and 19.

Menu 23
Set the quick stop or free-wheeling stop.
For input terminal "Q-STOP", there are two ways to stop the motor (See page 29 fig 1) .
Data value:
0: When the input cuts out, the motor brakes as fast as the motor and frequency converter permits..
1: When the input cuts out, the frequency converter "slips" the motor. The stop time depends on the inertia and friction of the system.

Menu 24
Set the analog reference input.
The reference signal , which can be received on terminal 60, can be registered in four ways.
The following are input signals with speed from min. frequency to maximum frequency.
Data value:
0: 0 - 20 mA
1: 4 - 20 mA
2: 20 - 0 mA
3: 20 - 4 mA

Menu 25
Set the relay function.
The relay, which is mounted on terminals 1, 2 and 3, is activated when the following is present.
Data value:
0: "Ready" signal.
1: "Trip" signal
2: "Run" signal
4: Current limit. Motor current is higher than the recorded value in menu 13.
6: Thermal overload: Based on time, current, voltage and frequency, the frequency converter calculates whether the motor thermal conditions are critical.
7: The frequency converter is "Ready" and the motor temperature is not critical (see "0" and "6").
8: As 7, and the control inputs are active for remote control (no local stop or reference)
11:The motor frequency is equal to the set reference.

Menu 27
Set the analog output function A OUT
The selected data value will affect output terminal 45 as follows:
Data value:
0: 0 - 20 mA for frequency = 0 - 100 Hz.
1: 4 - 20 mA for frequency = 0 - 100 Hz
2: 0 - 20 mA for frequency = 0 - max. frequency (see menu 09)
3: 4 - 20 mA for frequency = 0 - max. frequency (see menu 09)
4: 0 - 20 mA for received reference signal (see menu 00)
5: 4 - 20 mA for received reference signal (see menu 00)
11: "20" mA when the motor frequency is equal to the set reference.
100: 0-20 mA for the motor current =0-Imax (160 % torque)
101: 4-20 mA for the motor current 0-Imax (160% torque)
102: 0-20 mA for the motor current = 0 - current limit in menu 13
103: 4-20 mA for the motor current = 0 - current limit in menu 13
104: 0-20 mA for the motor torque = 0 - max. (160 %)
105: 4-20 mA for the motor torque = 0 - max. (160 %)
111: "20" mA when the motor current is equal to the current limit set in menu 13

Menu 29
Thermal motor protection
The frequency converter calculates on the basis of voltage, current, frequency and time if the motor temperature exceeds the permissible limits.
The cut-out curve is sketched on page 30 fig. 4. Warning and trip are indicated by code 85 in the menu display.
Programme menu 25 for remote indication.
You can choose between the following reactions to a too high motor temperature:
Data value:
0: No warning, no trip
1: Warning, no trip
2: Warning and trip.

Menu 30
Set the method of reset after trip.
If trip is registered there is a choice between manual or automatic reset (fault entry).
If the cause of the error has gone, automatic reset is attempted after 5 seconds. If the cause of the error has not gone, manual reset must be used. (5 successive automatic resets, within 20 min. are permissible)
Data value:
0: Manual reset. The fault code is remembered with mains drop out.
1: Automatic reset. The fault code is not remembered with mains failure.
Warning: The frequency converter can start without warning.
Manual restart done in the following ways:
1) Terminal 27 set = "OFF" (see menu 22) or
2) press the stop and start button of the keyboards of the frequency converter
In special cases it may be necessary to disconnect and reconnect the supply voltage (see also menu 84)

Menu 34
Set the DC braking time [s].
The DC braking is connected with stop, and when the frequency is down to 1 Hz.
Set the time where the DC braking is activated to between 0 and 15 s.

Menu 40
To re-programme the factory recorded data values.
Warning: All customer programmed data will be erased.
If factory recorded data values are required, use the following procedure:
1: Set the data value on 1 and change to the previous menu, or wait 15 s.
2: Disconnect the mains supply to the frequency converter. Wait 5 seconds and start up again.

Motor compensation
The settings of the menus 14, 15, 16, 18, 19, 20, 21, 41 and 42 vary according to the motor. The frequency converter is optimised on the basis of the three recommended motor sizes (see menu 14). In most applications the frequency converter can therefore control these motors without any problems. The menus 14, 15, 16 and 41 must only be set for the rated values of the motor.
Set therefore first menus 14, 15, 16 and 41 as indicated and pass over menus 18, 19, 20, 21 and 42. For the connection between the values see page 29, fig. 3. Curve 1 is for no load operation and curve 2 is for loaded operation.

Menus 18, 19, 20, 21 and 42 to be set according to the guide lines given below in the following cases:
- The motor size used cannot be be programmed in menu 14
- The starting torque of the practical operation is extremely low, unstable speed, motor operates in jerks etc.

1: Read the data value in menu 19 and note down the the value. Set then menu 19 for 0.
2: Start the motor unloaded and read the motor current in menu 03 at an output frequency of 5 Hz, 10 Hz, 25 Hz and 50 Hz. The measured current is the no-load current of the motor and the normal measuring result will be that the current is a little higher at high frequencies than at low frequencies.
3: If the currents deviate by more than 10% from each other the no-load characteristics of the motor is not typical and menus 18 and 21 must be set as follows:
a) If the current is too low at low frequencies: increase the start voltage in menu 18. The typical setting is 10% of rated motor voltage.
b) If the current is too high at high frequencies: reduce the voltage/ frequency ratio in menu 21. The typical setting is 10% lower than the ratio between mains voltage and mains frequency.
4: Set menu 42 for a value being higher than the highest current measured.
5: Set then menu 19
Set this menu for the original value
6: Adjust
-menu 19 if the dynamic torque is insufficient
-menu 20 if the speed is unstable or if the load is varying.

Menu 18
Start voltage [V]
Setting range 0 to 99.9
No-load voltage at
0,1 X nominal motor frequency
To be set when serveral motors are operating in parallel and when the starting torque is insufficient.
In applications where several motors are operating in parallel the start voltage must normally be raised.
NOTE: If the set value for starting voltage is too high the frequency converter will operate in the current limit and then trip out.

Menu 19
Start compensation [V/A]
Setting range 0 to 99.9.
Must only be set if the dynamic torque is insufficient.
For parallel operation of several motors set menu 19 for 0.
NOTE : If the set value for start compensation is too high the frequency converter will work in the current limit and then trip out.

Menu 20
Slip compensation [%]
Setting range 0 to 200.
The recorded value is in % of the nominal value.
Must only be set if the speed is unstable and if the load is varying.
Set menu 20 for 0 at parallel operation of several motors.

Menu 21
Voltage frequency ratio [V/Hz]
Setting range 0 to 20.
Must only be set in special cases. See introduction to "Motor compensations".

Menu 42
Motor magnetising current [A].
Used for motor compensation and torque display
The setting must only be changed if the the motor cannot be compensated correctly If the set value is too low the output frequency will typically increase when the motor load is reduced at low frequencies.

Fault indication

Display fault indications
Menu 80-99 and an applicable data value is recorded when the frequency converter registers a fault.
The menu shows the registerd fault.
The data value indicates what the frequency converter has done and what to do to start the motor again.

Menu 80
Current limit
Data value:
00: The frequency is regulated down
01: The frequency is regulated down to 0 Hz. Reset occurs automatically or manually (see menu 30).
The fault can be caused by:
- an overloaded or stalled motor
- a ramp time that is too short.
- start voltage set too high.
- start compensation set too high

Menu 81
Overvoltage
Data value:
00: Ramp operation stops
11: Inverter stop.
Reset either automatically or manually (see menu 30).
12: Inverter stop. Reset manually.
The fault can be caused by:
- over voltage at the supply mains
- ramp down time too short
- regenerative operation
- If brake option is used: set menu 05 between 100 -106

Menu 82
Undervoltage
Data value:
00: Warning.
11: Inverter stop.
Reset either automatically or manually (see menu 30).
12: Inverter stop.
Reset manually
The fault can be caused by:
- under voltage on the supply mains
- voltage drop on the supply mains

Menu 83
Internal voltage monitoring.
Data value:
11: Inverter stop.
Reset either automatically or manually (see menu 30).
12: Inverter stop. Reset manually.
The fault is caused by
- defective frequency converter

Menu 84
Inverter overload.
Data value:
02: Cut out due to high motor current for longer than permitted. Reset manually.
11: Inverter stop. Reset either automatically or manually (see menu 30).
12: Inverter stop. Reset manually.
The fault can be caused by:
- motor short circuiting
- earthing
- too short ramp up time
- thermal overloaded of the frequency converter
- other faults in the power section.

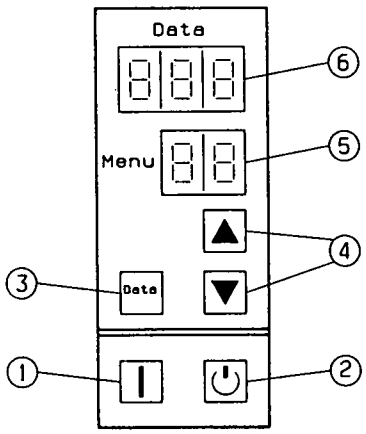
Warning: Interrupt always the supply voltage after short-circuit, earthing or thermal overload cut-out.

Menu 85
Thermal motor protection.
Data value:
00: Warning of high motor temperature
02: Trip because of too high motor temperature. Reset manually.

Menu 86
Indication of motor current and motor torque is cancelled if the output frequency exceeds 120 Hz.

Menu 99
Unit fault.
1: Check if the current supply to the external function is overloaded (terminals 50 and12)
2: Defective control card. Call service .

No light in display
The fault can be caused by:
- Missing phase
- Undervoltage



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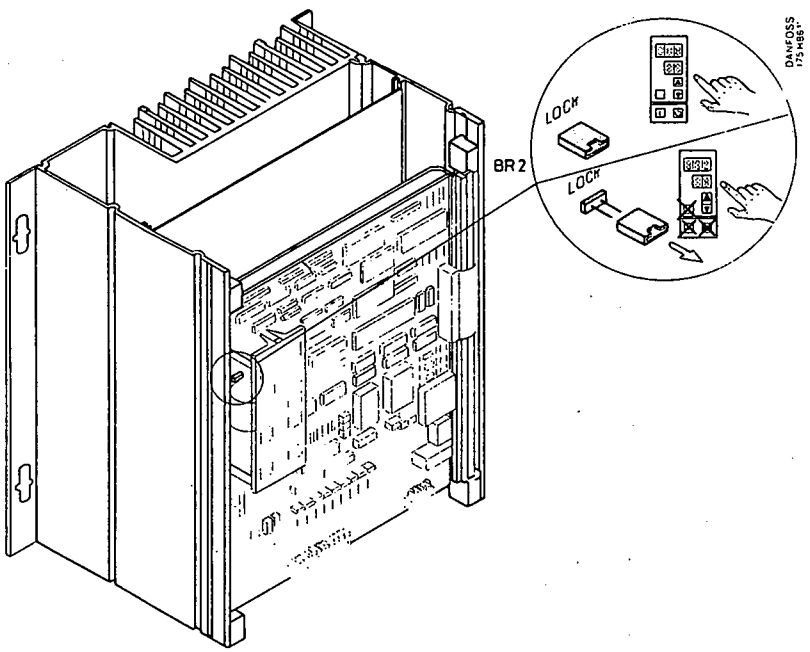

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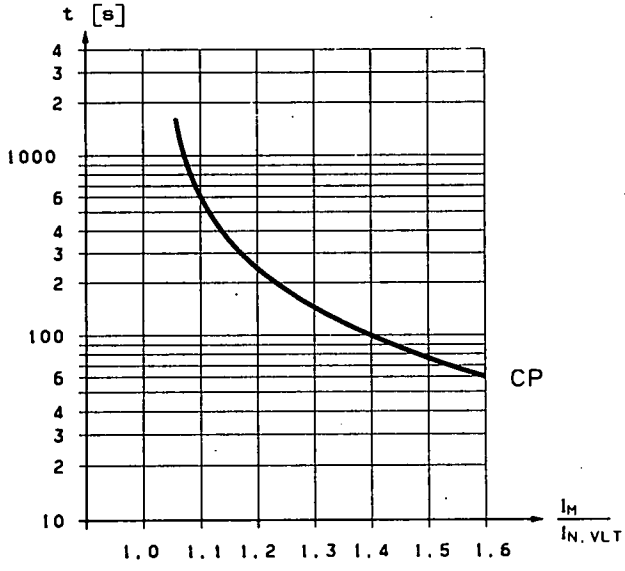
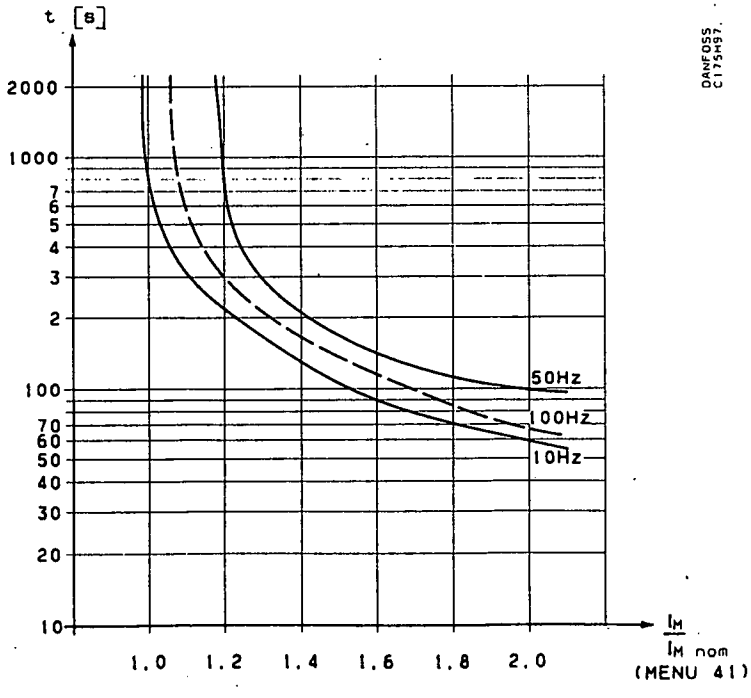
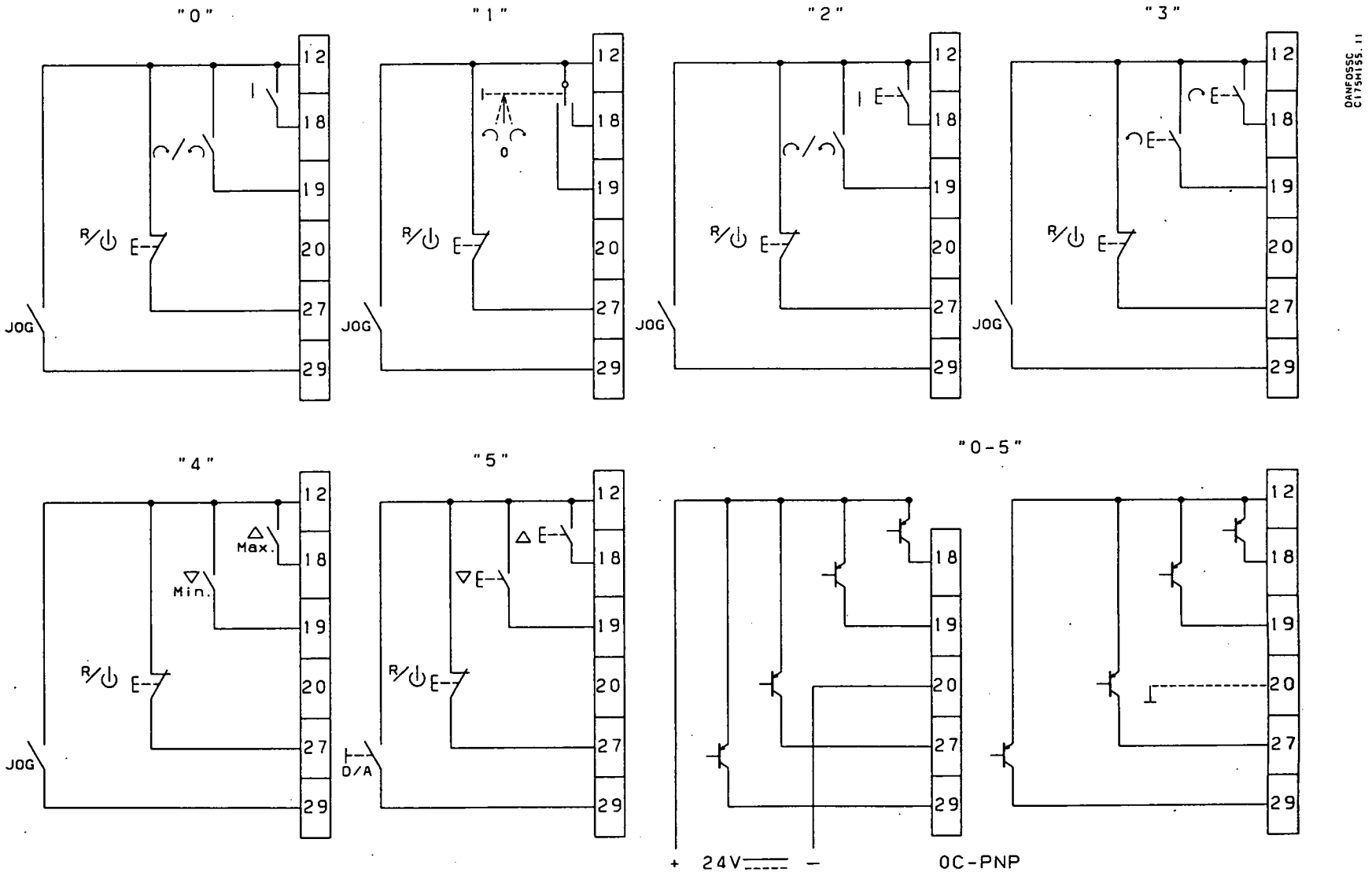

t [s]
4
3
2
1000
6
4
3
2
100
6
4
3
2
10
CP
1.0 1.1 1.2 1.3 1.4 1.5 1.6
IM / IN. VLT
DANFOSS
C175H94

1

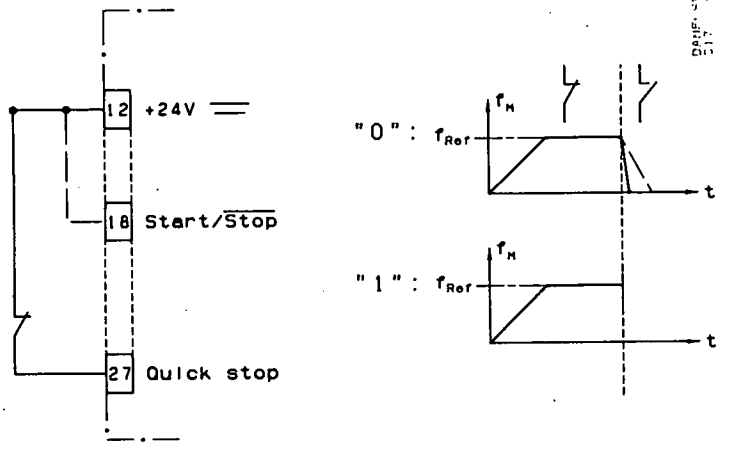

t [s]
2000
1000
7
6
5
4
3
2
100
70
60
50
40
30
20
10
50Hz
100Hz
10Hz
1.0 1.2 1.4 1.6 1.8 2.0
IM / IM nom
(MENU 41)
DANFOSS
C175H97

2

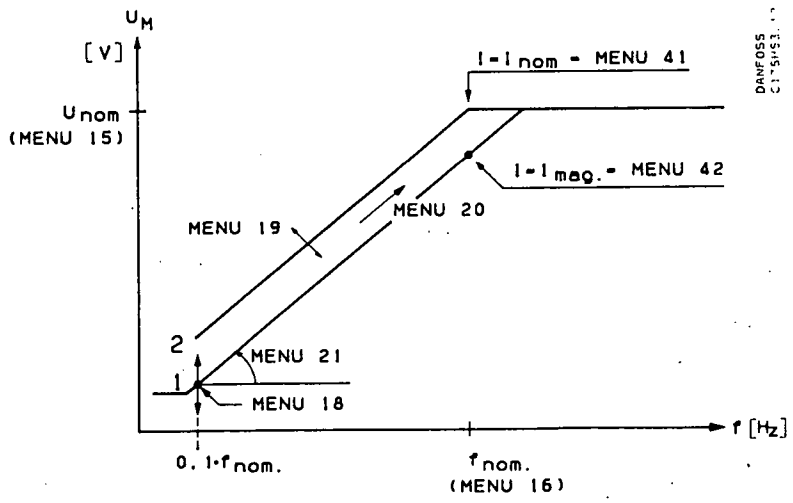
MENU 22


"0"
"1"
"2"
"3"
"4"
"5"
"0-5"
12
18
19
20
27
29
JOG
R/⏻ E
Max.
Min.
D/A
+ 24V⎓ −
0C-PNP
DANFOSSC
C175H155.11

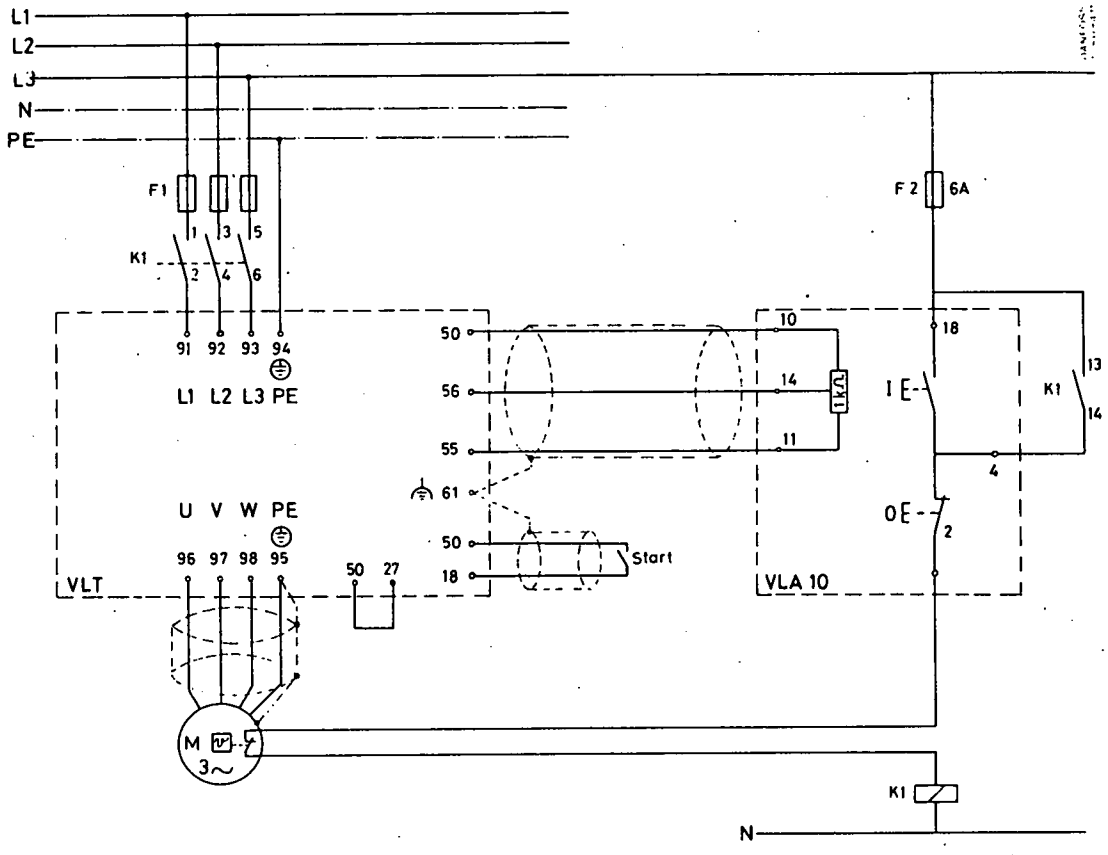
MENU 23


12 +24V
18 Start/Stop
27 Quick stop
"0": fRef
"1": fRef
fM
t

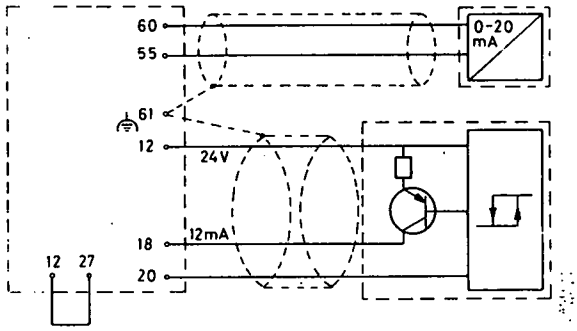
1


UM
[V]
Unom
(MENU 15)
1-1nom - MENU 41
1-1mag.- MENU 42
MENU 19
MENU 20
MENU 21
MENU 18
2
1
0.1·fnom.
fnom.
(MENU 16)
f [Hz]

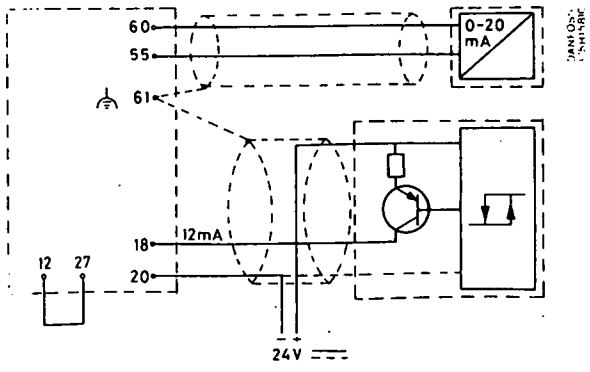
2



1 Analog VLA 10 control



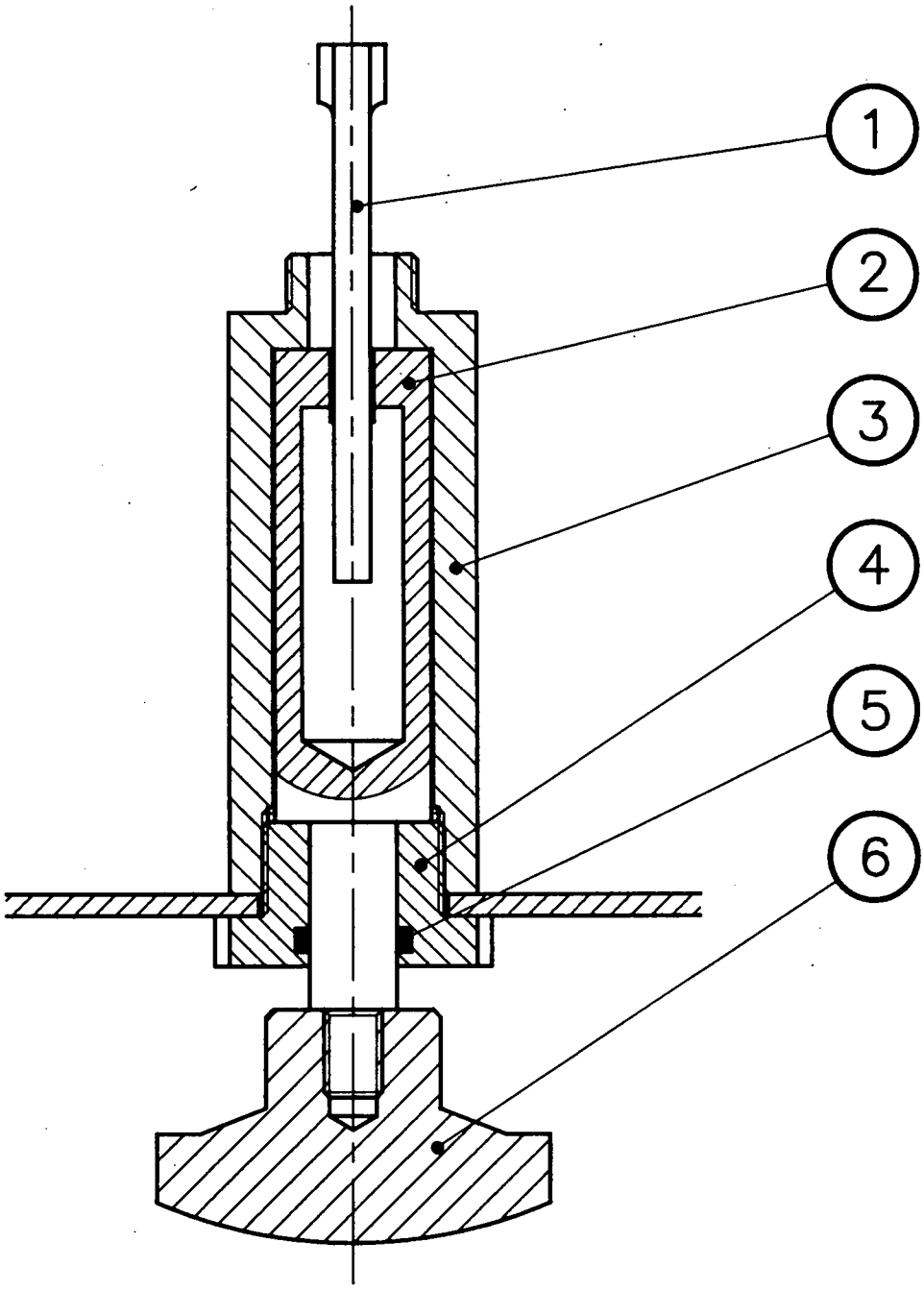
2 PLC control with internal supply



3 PLC control with external supply

Menu outline	380 V / 415 V Typical value	200 V / 230 V Typical value	NOTES
00 Application rate	-	-	
01 Frequency [Hz]	-	-	
02 Voltage [V]	-	-	
03 Current [A]	-	-	
04 Torque [%]	-	-	
05 Basic set up	1	1	
06 Local / remote (0/1)	1	1	
07 Local reference [Hz]	-	-	
08 Min. Speed [Hz]	0.0	0.0	15 HZ
09 Max. Speed [Hz]	50.0	50.0	50 HZ
10 Jogging speed [Hz]	10.0	10.0	
11 Ramp time up [s]	1.0	1.0	
12 Ramp time down [s]	1.0	1.0	
13 Current limit [A]	3.5/ 6.6/ 9.0/ 16.0	6.7/ 12.5/ 17.0	
14 Motor power [kW]	0.75/ 1.5/ 2.2/ 4.0	0.75/ 1.5/ 2.2	2,2
15 Motor nominal voltage [V]	380	200	380
16 Motor nominal frequency [Hz]	50	50	50-60
17 Application rate factor	100	100	
18 Start voltage [V]	42.1/41.1/38.7/37.5	22.0/ 22.2/ 19.3	
19 Start compensation [V/A]	16.0/ 5.0/ 5.0/ 2.3	4.2/ 2.19/ 1.86	
20 Slip compensation [%]	100	100	
21 U/f - ratio [V/Hz]	6.8/ 6.9/ 7.0 /7.1	3.7/ 3.7/ 3.8	
22 Start / stop mode + " ▲ ▼ "	0	0	
23 Digital input select	1	1	
24 Analog input select	0	0	
25 Relay output select + ext. sum	7	7	
27 Analog output (current/frequency)	2	2	
29 Thermal motor protection	1	1	
30 Trip reset mode	0	0	
34 DC braking time [s]	0	0	
40 Restore factory settings	-	-	
41 Motor nominal current [A]	2.0/ 3.7/ 5.3/ 9.1	3.8/ 7.8/ 10.0	
42 Motor magnetization current [A]	1.1/ 2.0/ 2.4/ 3.6	2.0/ 3.2/ 4.6	
80-99 Fault indications	-	-	

NOTE : The values refer to the VLT® types : 3002/ 3003/ 3004/ 3006 3002 / 3003 / 3004 respectively



Tolerancer ifølge DS 2075, hvor intet andet er angivet.	Antal	Stykliste nr.	Maskine	Evt. bem.

Afkortningsmål:	
Antal	Dimension

TECHNOHOY
CARL HOYER A/S AARHUS – DENMARK

Regulation
KVP – Valve, DANFOSS

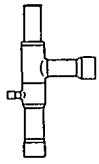
Materiale | Maskintype MF 50/75

Skala	Tegn.	NB
1:1	Dato	11.10.90

D 16328

INSTRUCTIONS

KVP, KVL, KVR



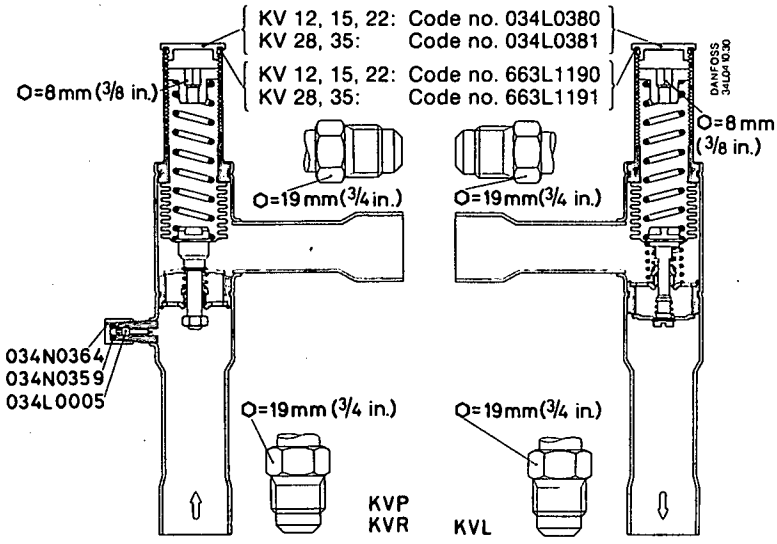
034R9631

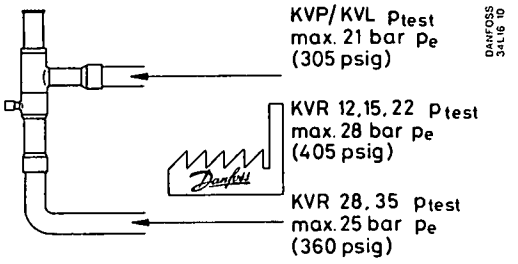
034R9631

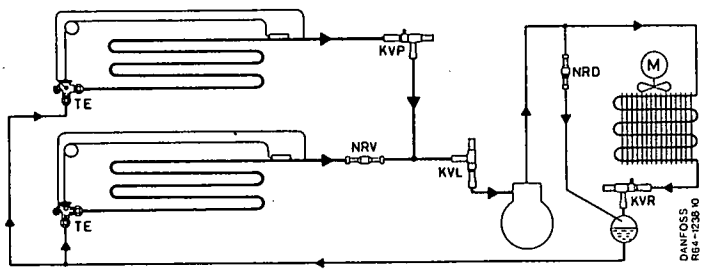
R 12, R 22, R 502

KVP: p_e = 0 → 5.5 bar (0 → 80 psig)
KVL: p_e = 0.5 → 6 bar (7 → 87 psig)

KVR 12, 15, 22: p_e = 5 → 20 bar (72 → 290 psig)
KVR 28, 35: p_e = 5 → 17.5 bar (72 → 240 psig)







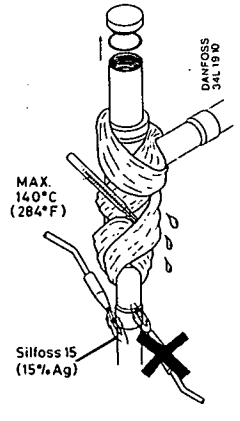
KVP, KVL:
$t_{max.}$ (R 12, R 22, R 502) = +60°C (140°F)
$t_{min.}$ (R 12, R 22, R 502) = −45°C (−50°F)
$p_{working\ max.}$ = 14 bar p_e (205 psig)

KVR:
$t_{max.}$ (R 12, R 22, R 502) = +105°C (220°F)
$t_{max.}$ (R 12, R 22, R 502) = −45°C (−50°F)

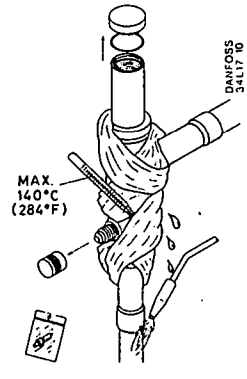
KVR 12, 15, 22:
$p_{working\ max.}$ = 21.5 bar p_e (312 psig)

KVR 28, 35:
$p_{working\ max.}$ = 19.3 bar p_e (280 psig)

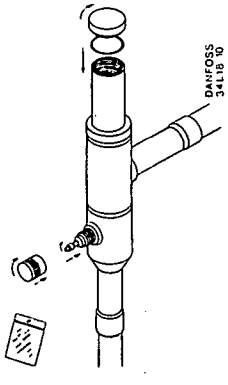
KVP, KVL, KVR



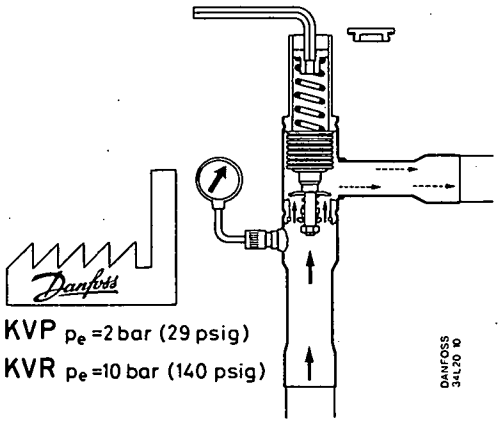
KVL

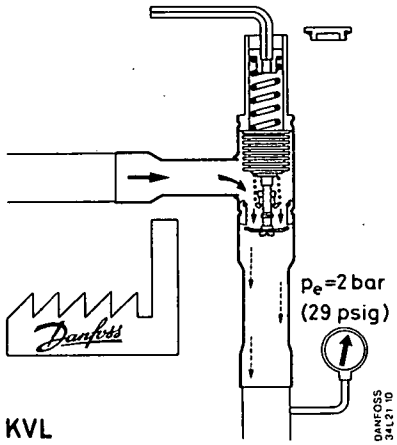


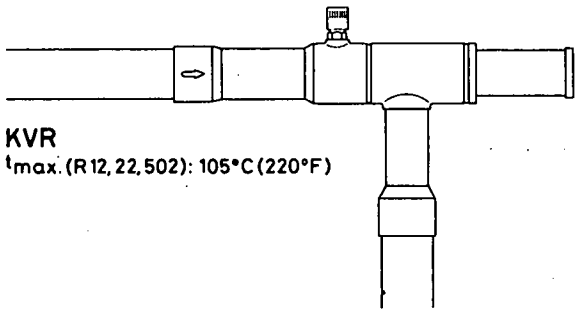
KVP, KVR

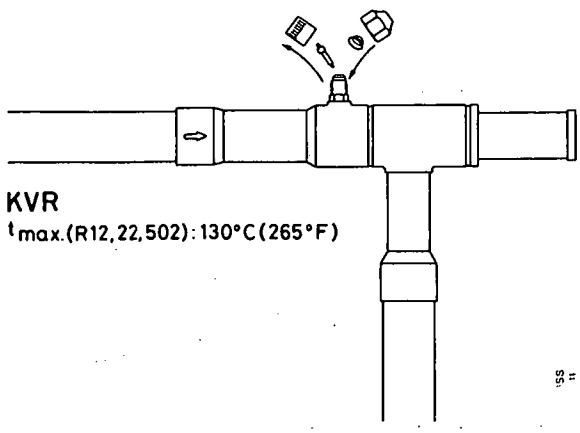


KVP, KVR

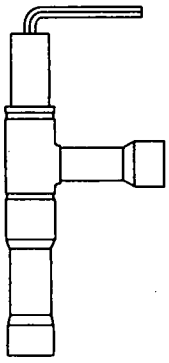








360° ⊖ ⊕ KVP/KVL 12,15,22 ~ 0.45 bar (6 psi)
28,35 ~ 0.3 bar (4 psi)

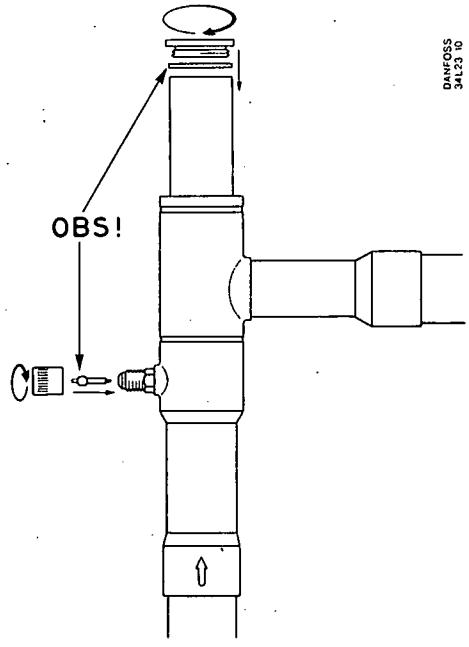


KVR 12,15,22

	72	108	145	181	218	253	290 psi	
	5	7.5	10	12.5	15	17.5	20 bar	
360° ⊖ x	2	1	0	1	2	3	4 x 360° ⊖	
R 12	22	35	46	54	62	69	75	°C
	72	95	115	129	144	156	167	°F
R 22	6	18	27	35	42	48	53	°C
	43	64	81	95	108	118	127	°F
R502	2	14	23	31	38	44	50	°C
	36	57	73	88	100	111	122	°C

KVR 28,35

	80	102	123	145	166	188	210	232	253 psi	
	5.5	7	8.5	10	11.5	13	14.5	16	17.5 bar	
360° ⊖ x	3	2	1	0	1	2	3	4	5 x 360° ⊖	
R 12	25	33	40	46	51	56	61	65	69	°C
	77	91	104	115	124	133	142	149	156	°F
R 22	8	15	22	27	32	36	40	44	48	°C
	46	59	72	81	90	97	104	111	118	°F
R502	4	11	18	23	28	32	37	41	44	°C
	39	52	64	73	82	90	99	106	111	°F



KVP, KVR

Printed in Denmark by Danfoss Litho

INSTRUCTIONS

KP 5, 5A

60R9512

KP 5: R 12, R 22, R 500, R 502

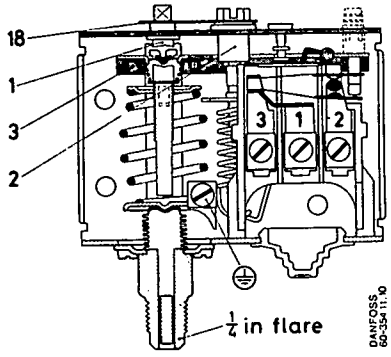


Fig. 1
KP 5

KP 5A: R 717 (NH_3), R 12, R 22, R 500, R 502

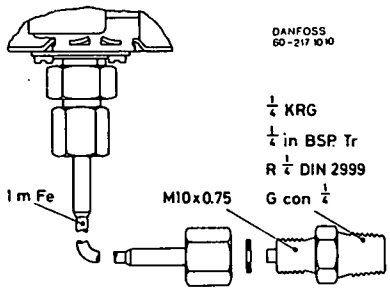
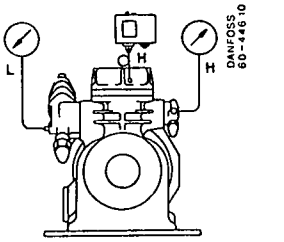


Fig. 2
KP 5A



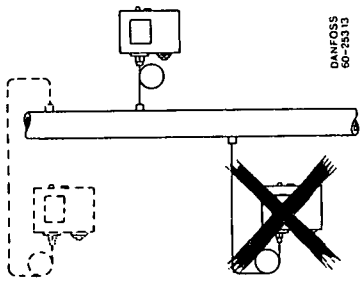


Fig. 4

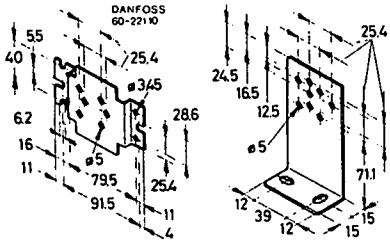


Fig. 5 60-1055 60-1056

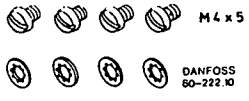


Fig. 6 60-1054

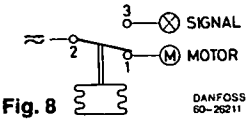


Fig. 8

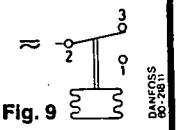


Fig. 9

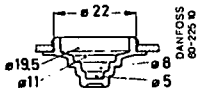


Fig. 10

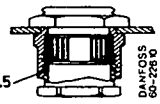


Fig. 11 50 stk./pieces/ Stck./pièces **60-1059**

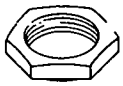


Fig. 12 50 stk./pieces/ Stck./pièces **60-1061**

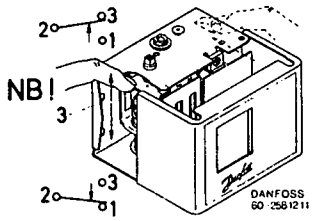


Fig. 13

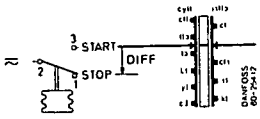


Fig. 14a

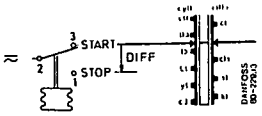
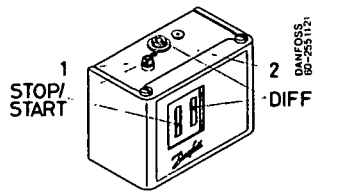


Fig. 14b



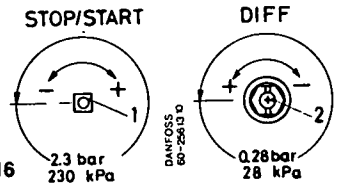


Fig. 16

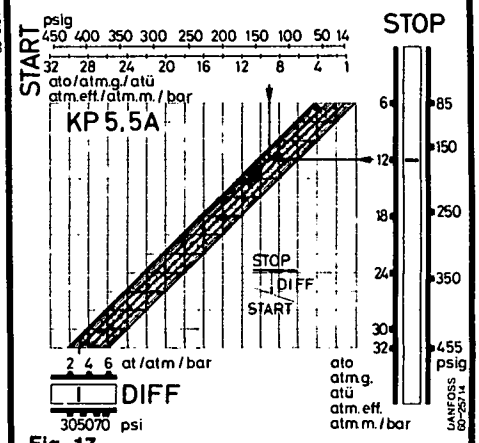


Fig. 17

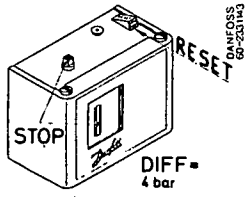


Fig. 18

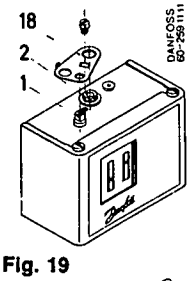


Fig. 19

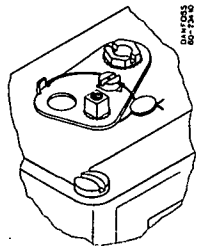


Fig. 20

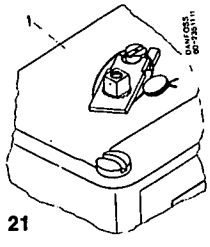


Fig. 21

100 stk./pieces/ Stck./pièces
60-1057

Fig. 22

DANSK

Højtryksspressostater

Fig. 1. KP 5 med flare-tilslutning
1. Områdespindel
2. Differensspindel
3. Hovedarm
18. Låseplade

Fig. 2. KP 5A tilslutning

Funktion
Kontakterne 2–1 bryder, og 2–3 slutter ved stigende tryk. Se fig. 8 og 9.

Tekniske data
Tilladelig omgivelsestemp.
−40 til +65°C (+80°C i max. 2 timer)
Max. till. prøvningstryk
p_e = 33 bar
Kapsling og tæthed
I henhold til IEC 144 og DIN 40050:
IP 44 (SEV)
Det er en forudsætning, at apparatet er monteret på en plan tavle eller på en konsol. Apparatet skal placeres således på konsollen, at alle frihuller er dækket.
Kontaktbelastning
Se apparatets skala.
Max. startstrøm = 112A 380 V.

Montering
Fig 3 og 4. Korrekt montering.
NB! Hold kontra på tilslutningsstudsen, når flare-omløberen spændes eller løsnes!

Fig. 5. 2 typer monteringskonsoller med skruer og skiver. Bestilles separat.

Fig. 6. 4 stk. ekstra skruer og skiver. Anvendes ved montering på eksisterende konsol. Bestilles separat.
NB! Anvendes der eventuelt andre skruer, sørg da for, at de ikke stikker mere end 1,5 mm ind i apparatet.

El-tilslutning
Fig. 8 og 9. Alt efter den valgte funktion foretages tilslutning til klemmerne 2–1 eller 2–3.

Fig. 10. Kabelgennemføring af plast.
Kan anvendes ved 6–14 mm kabel.

Fig. 11. Pg 13,5 kabelforskruning med spec. møtrik. Bestilles separat. Kan anvendes ved 6–14 mm kabel.
Ved 8–16 mm kabel kan anvendes en standard kabelforskruning.

Fig. 12. Ekstra møtrik til Pg 13,5 kabelforskruning. Bestilles separat.

Afprøvning
Fig. 13. Hovedarmen (3) vippes.
Ved afprøvning af reset-apparater skal »RESET«-knappen påvirkes, samtidig med at hovedarmen (3) vippes.
NB! Benyt kun den viste metode ved afprøvning!

Indstilling
Fig. 14.
»START« = starttryk
»STOP« = stoptryk
»DIFF« = differens
Alt efter den valgte funktion og klemmetilslutning indstilles stop- eller starttrykket på områdeskalaen.

Apparater uden reset
Fig. 15 og 16. Eksempel: Kompressormotoren ønskes stoppet ved stigende tryk (højtrykssikring). Indstil stoptrykket på »STOP«-skalaen. Én omdrejning af områdespindelen (1) ~ 2,3 bar.
Differensen = stoptrykket minus starttrykket.
Indstil differensen på »DIFF«-skalaen.
Én omdrejning af differensspindelen (2) ~ 0,28 bar.
Kontroller start- og stoptrykket med manometer!

Fig. 17. Eksempel på indstilling af KP 5 uden reset.
Ønsket stoptryk = 12 bar
Ønsket starttryk = 9 bar
Differensen bliver 12 − 9 = 3 bar
Stoptrykket = 12 bar indstilles på »STOP«-skalaen.
Differensen = 3 bar indstilles på »DIFF«-skalaen.
Kompressormotoren/styrestrømmen tilsluttes klemme 1. Fasen tilsluttes klemme 2. Se fig. 9 og 14.

Apparater med max. reset
Fig. 18. Indstil stoptrykket på »STOP«-skalaen. Differensen er fast indstillet til 3 bar. Kompressormotoren genstartes efter stop ved at trykke på »RESET«-knappen. Genstart kan først ske, når trykket er faldet ca. 3 bar under det indstillede stoptryk.

Låsning af indstillingen
Apparater uden reset
Fig. 19. Områdespindelen (1) og differensspindelen (2) kan låses med låsepladen (18).

Fig. 20. Ønskes plombering, anvendes plombeskrue. Se fig. 22.

Apparater med max. reset
Fig. 21. Områdespindelen (1) kan låses med den medleverede låseplade.

Fig. 22. Plombeskrue. Bestilles separat.

ENGLISH

High-pressure controls

KP 1, KP 5 with flare connection
1. Range setting spindle
2. Differential setting spindle
3. Main arm
18. Locking plate

Fig. 2. KP 5A connection

Function
Contacts 2–1 break and contacts 2–3 make at a rise in pressure. See fig. 8 and 9.

Technical data
Permissible ambient temperature
−40 to +65°C (−40 to +150°F); +80°C (+176°F) for maximum 2 hours
Maximum permissible test pressure
p_e = 33 bar (470 psig)
Enclosure and tightness
In accordance with IEC 144 and DIN 40050: IP 44 (SEV).
It is a condition that the unit is mounted on a plain board or on a bracket. The unit shall be placed on the bracket in such a way that all open holes are covered.
Rating
See dial on unit.
Max. starting current = 112A 380 V.

Fitting
Fig. 3 and 4. Correct fitting.
NOTE: Keep a countergrip with a spanner on the connector during tightening or slackening of the flared coupling nut!

Fig. 5. Two types of mounting bracket with screws and washers. To be ordered separately.

Fig. 6. Four extra screws and washers. To be used for mounting on the existing bracket. To be ordered separately.
NOTE! If other screws are used, take care that these do not project more than 1.5 mm into the control.

Mains connection
Fig. 8 and 9. Depending on the function chosen connection is made to terminals 2–1 or 2–3.

Fig. 10. Plastic cable entry. Can be used for 6–14 mm cable.

Fig. 11. Pg 13.5 screwed cable connection with special nut. To be ordered separately. Can be used for 6–14 mm cable.
A standard screwed cable connection can be used for 8–16 mm cable.

Fig. 12. Extra nut for 13.5 screwed cable entry. To be ordered separately.

Testing
Fig. 13. Tilt the main arm (3).
To test controls with reset, the "RESET" button should be actuated, the main arm (3) being tilted at the same time.
NOTE: Only the method shown should be used for testing!

Setting
Fig. 14.
"START" = start pressure
"STOP" = stop pressure
"DIFF" = differential
Depending on the function chosen and the terminal connections, the stop or start pressure is set on the range scale.

Unit without reset
Fig. 15 and 16. Example: It is desired to stop the compressor motor at a rise in pressure. (High pressure safeguard). Set the stop pressure on the "STOP" scale. One turn of the range spindle (1) ~ 2.3 bar.
The differential = the stop pressure minus the start pressure.
Set the differential on the "DIFF" scale. One turn of the differential spindle (2) ~ 0.28 bar.
Check the start and stop pressure with a gauge.

Fig. 17. Example of setting KP 5 without reset
Stopping pressure required = 12 bar (171 psig)
Starting pressure required = 9 bar (128 psig)
The differential will be 12 − 9 = 3 bar (171 − 128 = 43 psi).
The stopping pressure = 12 bar (171 psig) is set on the "STOP" scale.
The differential = 3 bar (43 psi) is set on the "DIFF" scale.
The compressor motor/pilot current is connected to terminal 1.
Phase is connected to terminal 2. See Figs. 9 and 14.

Controls with maximum reset
Fig. 18. Set the stopping pressure on the «STOP» scale. The differential is fixed at 3 bar (43 psi). The compressor motor is restarted after stopping by depressing the "RESET" button. Restarting cannot be done until the pressure has decreased to approx. 3 bar (43 psi) below the set stopping pressure.

Locking the setting
Units without reset
Fig. 19. The range setting spindle (1) and differential setting spindle (2) can be locked by means of the locking plate (18).

Fig. 20. If sealing with wire and lead is required, use the sealing screw. See fig. 22.

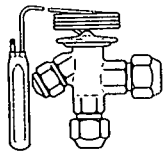
Units with max. reset
Fig. 21. The range setting spindle (1) can be locked with the aid of the locking plates supplied.

Fig. 22. Sealing screw. Order separately.

INSTRUCTIONS

T 2/TE 2

N - NM - NL - B



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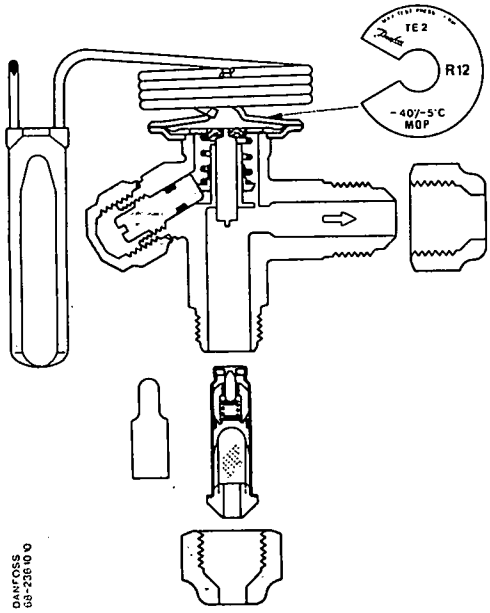
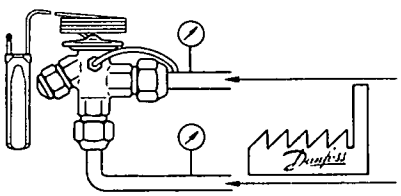


N = −40 → +10°C (−40 → +50°F)
B = −60 → −25°C (−75 → −15°F)
N = −40 → +10°C (−40 → +50°F) MOP ∼ +15°C (+60°F)
NM = −40 → − 5°C (−40 → +25°F) MOP ∼ 0°C (+32°F)
NL = −40 → −15°C (−40 → + 5°F) MOP ∼ −10°C (+15°F)
B = −60 → −25°C (−75 → −15°F) MOP ∼ −20°C (− 5°F)

				Nr.	kW (kJ/s)	kcal/h	TR (tons)
N NM NL	T 2 TE 2	R 12 R 502	No. 1	**68-2004**	1.0	900	0.3
			No. 2	**68-2005**	1.7	1500	0.5
			No. 3	**68-2006**	3.5	3000	1.0
			No. 4	**68-2007**	5.2	4500	1.5
			No. 5	**68-2008**	7.0	6000	2.0
			No. 6	**68-2009**	10.5	9000	3.0
	T 2 TE 2	R 22	No. 1	**68-2004**	1.7	1500	0.5
			No. 2	**68-2005**	2.8	2400	0.8
			No. 3	**68-2006**	5.2	4500	1.5
			No. 4	**68-2007**	8.0	6900	2.3
			No. 5	**68-2008**	10.5	9000	3.0
			No. 6	**68-2009**	15.7	13500	4.5
B	T 2 TE 2	R 22 R 502	No. 1	**68-2004**	1.0	900	0.3
			No. 2	**68-2005**	1.7	1500	0.5
			No. 3	**68-2006**	2.8	2400	0.8
			No. 4	**68-2007**	4.2	3600	1.2
			No. 5	**68-2008**	5.2	4500	1.5
			No. 6	**68-2009**	7.0	6000	2.0

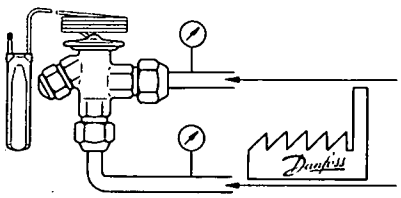
N/NM/NL: t_o = + 5°C, t_k = +32°C (t_o = +40°F, t_k = +90°F)
B: t_o = −30°C, t_k = +32°C (t_o = −22°F, t_k = +90°F)

TE 2

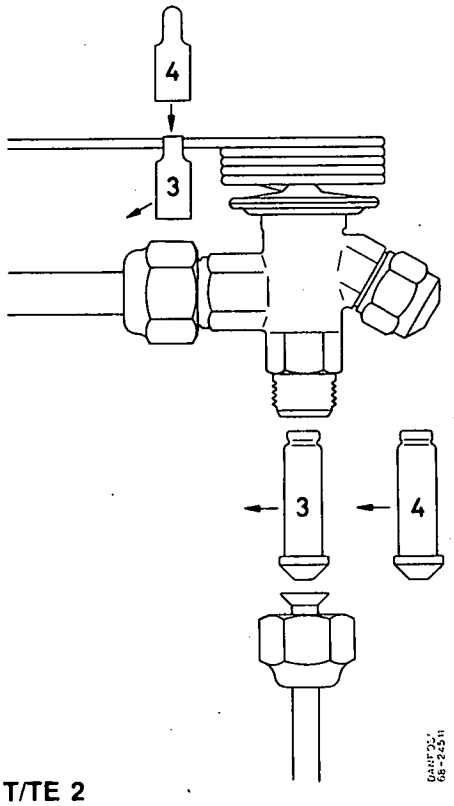


p_{test} max. 26 bar p_e (375 psig)

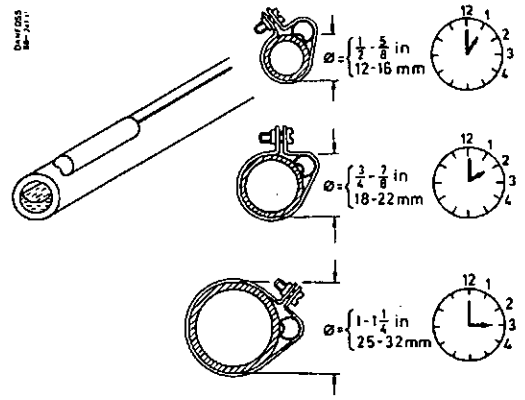
T 2

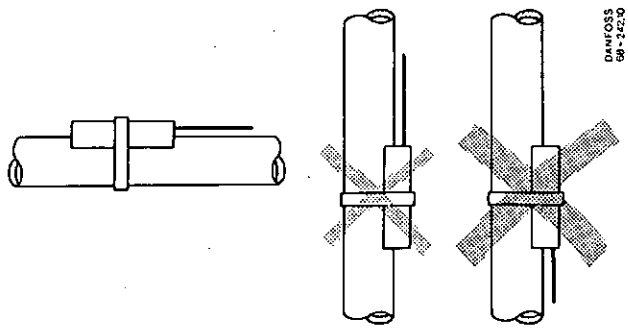


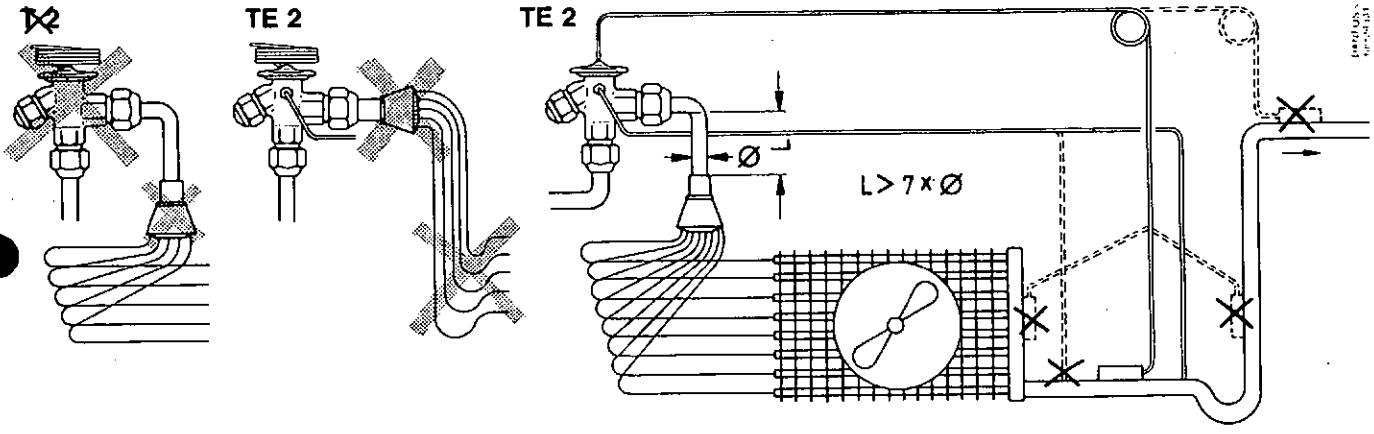
p_{test} max. 26 bar p_e (375 psig)

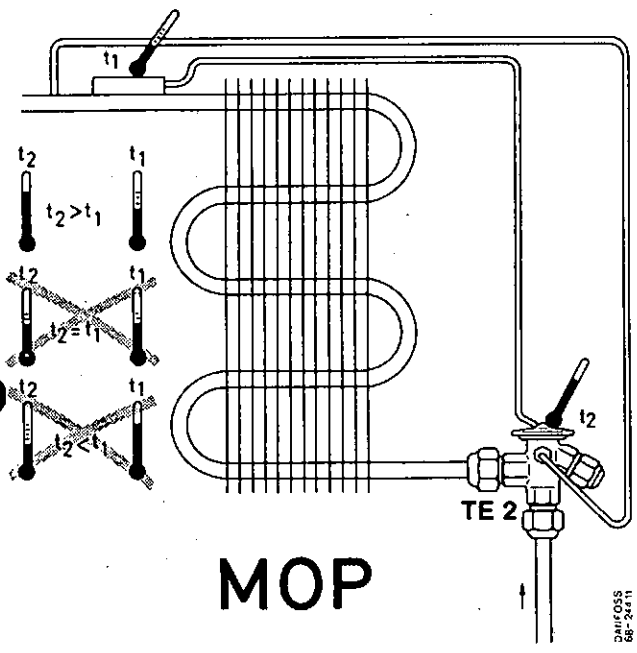


T/TE 2

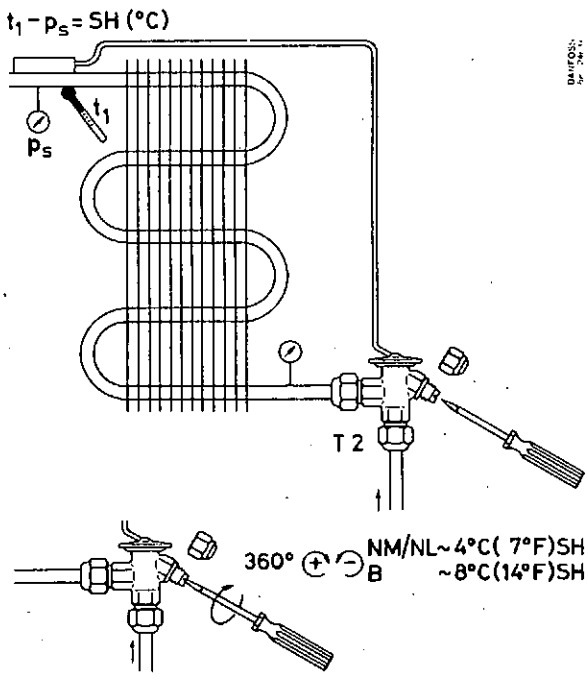


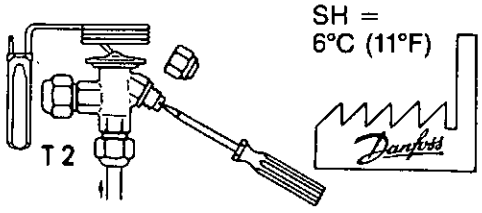




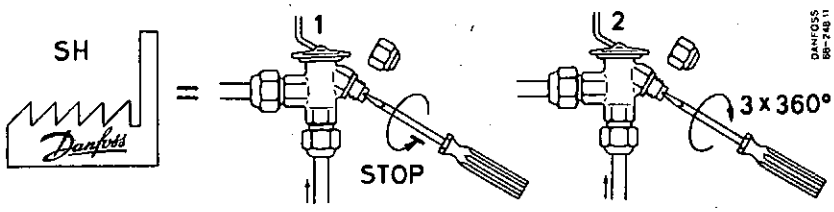


MOP





SH =
6°C (11°F)



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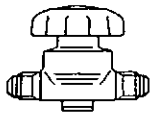
INSTRUCTIONS

BM



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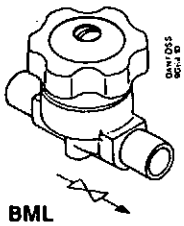
R 12, R 22, R 500, R 502



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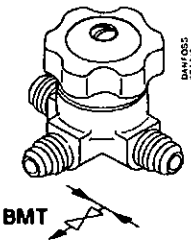

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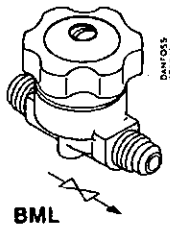
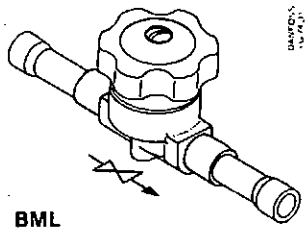
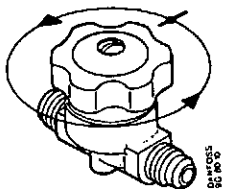


BML



BML

Fig. 1



Min. medium temperature: -55°C (-70°F)
Max. medium temperature: 100°C (210°F)
Min. working pressure: -1 bar/30 in Hg
PB = 21.5 bar / MWP = 310 psig

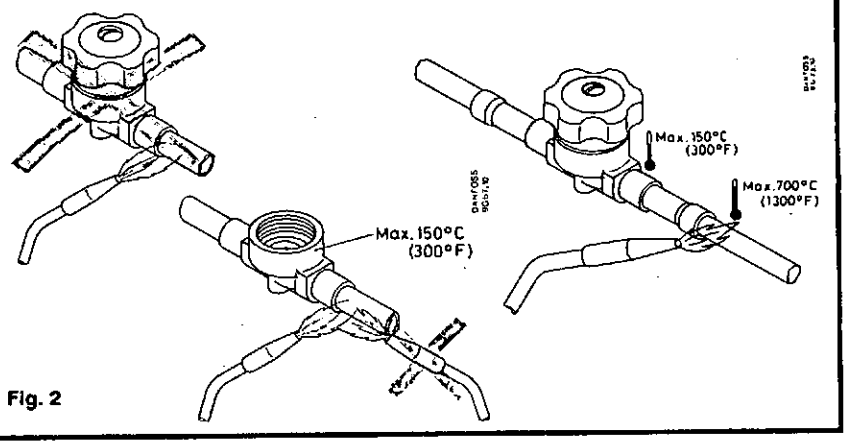
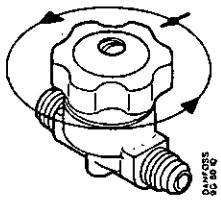
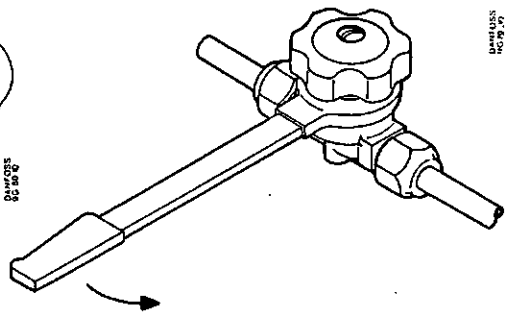


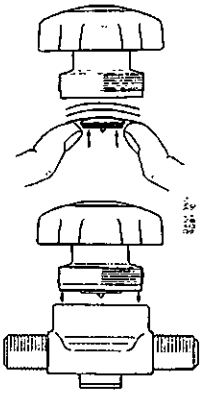
Fig. 2

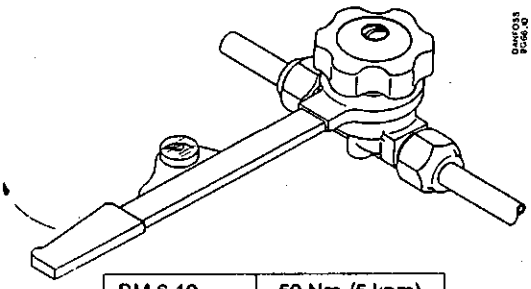
009R9663



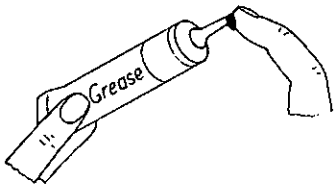


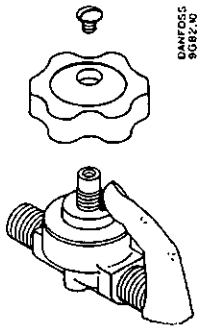
BM 6	9G0025
BM 10	9G0026
BM 12	9G0027
BM 15	9G0028
BM 18-22	9G0029





BM 6-10	50 Nm (5 kpm)
BM 12	60 Nm (6 kpm)
BM 15-22	80 Nm (8 kpm)





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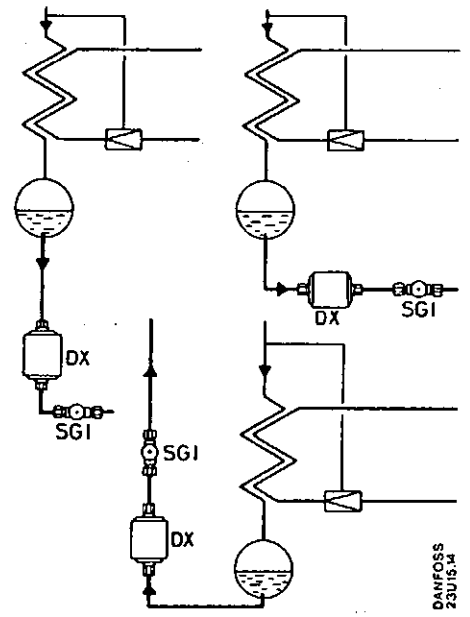
INSTRUCTIONS

DX

Filter drier
Acid adsorbent

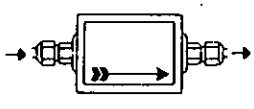
23A0450

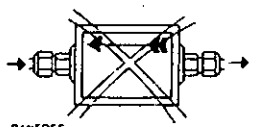
DX – solid core:
R 12, R 22, R 500, R 502

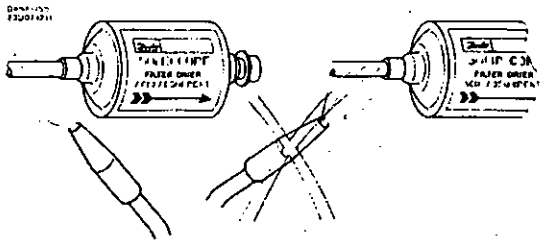


23A0450

~~KCS1.B8.00~~ → **RI.10.G1.00** 4-1983







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INSTRUCTIONS

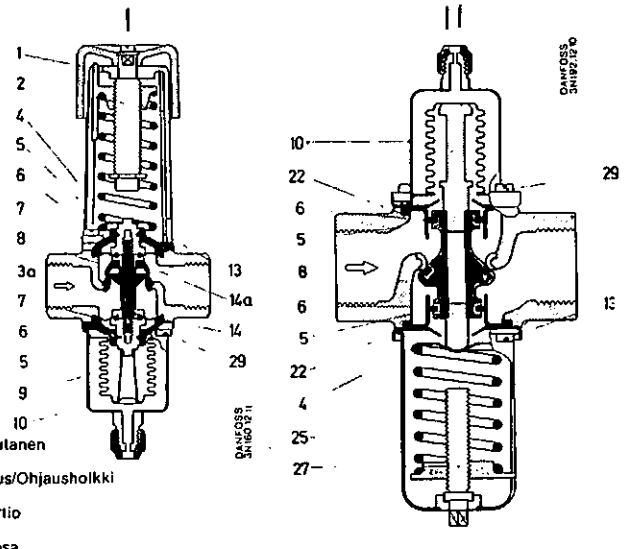
WVFX 10-40

3N0481

3N0481

RESERVEDELE/SPARE PARTS/ERSATZTEILE/PIÈCES DE RECHANGE/ ONDERDELEN/PIEZAS DE REPUESTO/VARAOSAT

No.	WVFX 10-15	WVFX 20	WVFX 25	WVFX 32-40
3a	3N0337	3N0337	3N0338	
5	633B1183	633B1183	633B1183	633B1009
6				3F0507
7	3N0427	3N0428	3N0429	
8	3N0342	3N0343	3N0344	
9	3N0401	3N0401	3N0401	
13	681X2170	681X2170	681X2170	681X1119
14	3N0348	3N0369	3N0370	
14a	3N0345	3N0346	3N0347	
22				3F0508
29	681X1089	681X1089	681X1089	681X1119



1. Håndhjul/Hand wheel/Handrad/Roue à main/Volante manual/Handwiel/Asettelukahva
2. Overpart/Top part/Oberteil/Partie supérieure/Parte superior/Bovendeel/Yläosa
3a. Spindel/Spindle/Spindel/Tige/Vástago/Spindel/Kara
4. Fjederstyr/Spring retainer/Federführung/Guide du ressort/Muelle guía/Veerborging/Jousiautanen
5. O-ring/O-ring/O-Ring/Bague torique/Anillo-O/O-ring/O-rengas
6. Styrebøsning/Guide bushing/Führungsbuchse/Douille de guidage/Manguito guía/Geleidebus/Ohjausholkki
7. Membran/Diaphragm/Membrane/Membrane/Membrana/Membraan/Kalvo
8. Ventilkegle/Valve cone/Ventilkegel/Cône de la vanne/Cono de cierre/Klepschotel/Venttiilikartio
9. Trykfod/Spring holder/Druckfuss/Pied de pression/Impulsor/Veerhouder/Paineputki
10. Bælgelement/Bellows unit/Wellrohrelement/Élément de soufflet/Fuelle/Balgelement/Paljoeosa
13. Skrue for fjederhus/Screw for spring housing/Schraube für Federgehäuse/Vis pour boîtier à ressort/Tuerca para la caja del muelle/Schroef voor veerhuis/Jousikotelon ruuvi
14. Membranskive/Diaphragm plate/Membranscheibe/Disque de membrane/Segmento de la membrana/Membraanplaat/Kalvolevy
14a. Spændebosning/Retaining bushing/Spannhülse/Douille de serrage/Casquillo de retención/Borgbus/Kiristysholkki
22. Pakning for styrebøsning/Guide bushing gland/Dichtung für Führungsbuchse/Joint pour douille de guidage/Empaquetadura para el manguito guía/Pakkingbus voor geleidebus/Ohjausholkin tiiviste
25. Fjederhus/Spring housing/Federgehäuse/Boîtier du ressort/Cajera del muelle/Veerhuis/Jousikotelo
27. Reguleringsspindel/Regulating spindle/Verstellspindel/Tige de réglage/Vástago de regulación/Regelspindel/Säätökara
29. Skrue for bælgkapsel/Screw for bellows housing/Schraube für Wellrohrkapsel/Vis pour cuve contenant le soufflet/Tornillo para la cápsula del fuelle/Schroef voor balghuis/ Paljekotelon ruuvi

DANSK

Tekniske data
Max. prøvningstryk (bælgelement: 26,5 bar (p_e)
Max. vandtryk: Udf. I = 16 bar (p_e)
Udf. II = 10 bar (p_e)
Ventilen kan indstilles til at begynde at åbne ved følgende kondenseringstryk
Udf. I: Min. 3,5 bar (p_e). Max. 16 bar (p_e)
Udf. II: Min. 4 bar (p_e). Max. 17 bar (p_e)

Montering
Udf. I kan monteres i vilkårlig stilling. Udf. II monteres altid med bælgelementet opad.
Elementet 10 tilsluttes trykrøret efter olieudskilleren. Forbindelsesrøret tilsluttes oven på trykrøret, så tilbageløb af snavs og olie undgås.
Indskyd desuden et smudsfilter før ventilen.
En konsol (best.nr.: 3N0388) kan ved montering af Udf. I **anbringes mellem overpart og ventilhus.**

Indstilling
Ventilen indstilles, så det ønskede kondenseringstryk overholdes ved normal drift.
Udf. I: Drejning af 1, så indikatoren går mod »1«, giver lavere tryk og omvendt.
Udf. II: Drejning af 27 højre om (med uret) giver lavere tryk og omvendt.

Service
Snavspartikler kan fjernes fra ventilens indre ved gennemskylning. En skruetrækker føres gennem åbningen i 2 hhv. 25 ind under fjederstyret 4. Når styret trykkes væk fra ventilhuset, åbner ventilen.
NB.: Bælgelementet 10 må ikke demonteres, medens der er tryk på anlægget. Bælgen kan da blive deformeret.
Før adskillelse aflastes fjederen ved, at ventilen »indstilles« til laveste kondenseringstryk.
Udskift slidte O-ringe, indsmør cylinder og styrebøsning i syrefrit fedtstof og smør skruer/spindel før samling af ventilen.
Udf. I: »RA« på ventilhus skal vende mod 2.

ENGLISH

Tecnical data
Max. test pressure (bellows unit): 26.5 bar (p_e)
Max. water pressure: Design I = 16 bar (p_e)
Design II = 10 bar (p_e)
The valve can be set to start opening at the following condensing pressures
Design I: Min. 3.5 bar (p_e). Max. 16 bar (p_e)
Design II: Min. 4 bar (p_e). Max. 17 bar (p_e)

Fitting
Design I can be fitted in any position. Design II should **always** be fitted with the belows unit facing upwards.
The unit 10 is connected to the pressure line after the oil separator. Fit the connecting pipe on the top of the pressure line to avoid the return of dirt and oil.
A strainer should be fitted ahead of the valve.
A bracket (code No. 3N0388) for the installation of design I **can be located between the top part and the valve housing.**

Setting
Set the valve to maintain the condensing pressure required during normal operation.
Design I: Turning 1 so that the indicator moves towards "1" results in a lower pressure, and vice versa.
Design II: Turning 27 clockwise results in a lower pressure, and vice versa.

Service
Impurities can be removed from the inside of the valve by flushing. Introduce screwdriver under the spring retainer 4 through the openings in 2 and 25, respectively. Forcing the retainer away from the valve housing opens the valve.
NOTE: The bellows unit 10 must not be dismantled while the system is under pressure, since the bellows may become distorted.
The spring should be relieved before dismantling the valve by "setting" the valve for minimum condensing pressure.
Replace worn O-rings, smear the cylinder of the guide bushing with acid-free grease, and lubricate the screws and spindle before assembling the valve.
Design I: "RA" on the valve housing must face towards 2.

DEUTSCH

Technische Daten
Max. Prüfdruck (Wellrohrelement): 26,5 bar (p_e)
Max. Wasserdruck: Ausf. I = 16 bar (p_e)
Ausf. II = 10 bar (p_e)
Das Ventil ist auf beginnendes Öffnen bei folgenden Verflüssigungsdrücken einzustellen
Ausf. I: Min. 3,5 bar (p_e). Max. 16 bar (p_e)
Ausf. II: Min. 4 bar (p_e). Max. 17 bar (p_e)

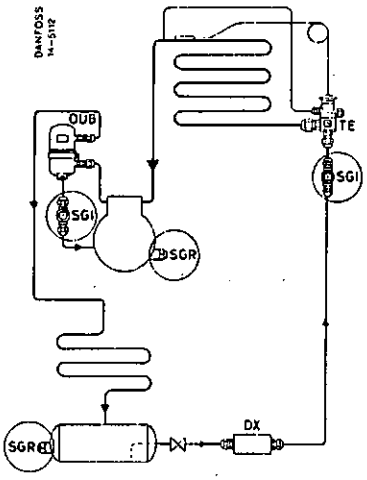
Montage
Ausführung I kann in beliebiger Lage angeordnet werden, Ausführung II stets mit dem Wellrohrelement nach oben.
Das Wellrohrelement 10 an das Druckrohr hinter dem Ölausscheider, die Verbindungsleitung an der Oberseite des Druckrohrs anschliessen, um ein Zurückfliessen von Schmutz und Öl zu vermeiden.
Vor dem Ventil ein Schmutzfilter anordnen.
Für die Montage von Ausführung I kann eine Konsole (Artikel-Nr. 3N0388) **zwischen Oberteil und Ventilgehäuse** verwendet werden.

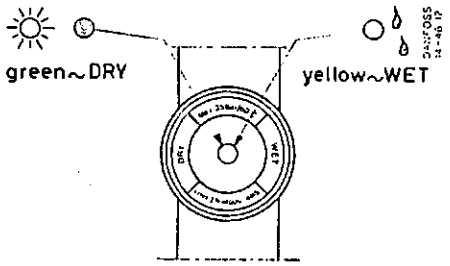
Einstellung
Ventil so einstellen, dass der gewünschte Kondensationsdruck bei normalem Betrieb erreicht wird.
Ausf. I: Ein Drehen von 1, so dass der Anzeiger gegen »1« geht, ergibt einen niedrigeren Druck, und umgekehrt.
Ausf. II: Ein Drehen von 27 im Uhrzeigersinn (rechts herum) ergibt einen niedrigeren Druck, und umgekehrt.

INSTRUCTIONS

SGI, SGR

014R9572

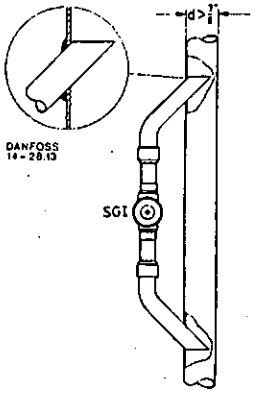


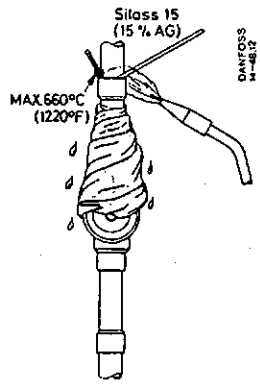


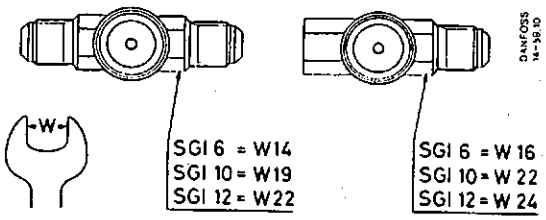
R12, R22, R500, R502

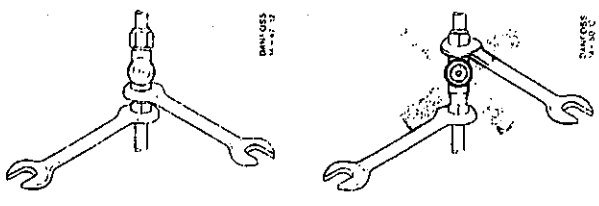
SGI 6, 10, 12, 15 max. 35 bar p_e (500 psig)

SGI 18, 22 max. 28 bar p_e (400 psig)









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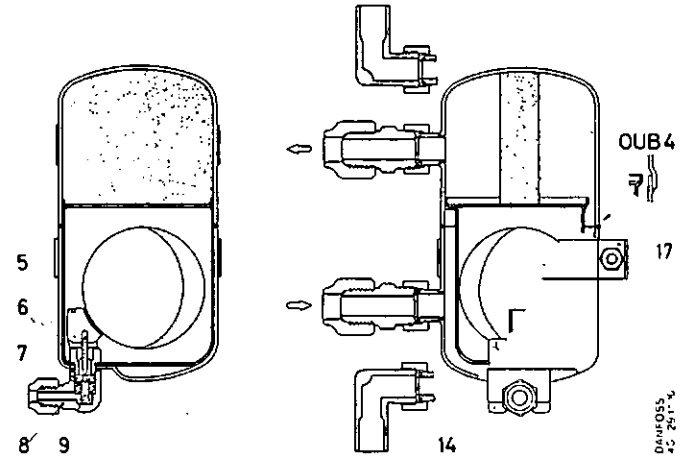
INSTRUCTIONS

OUB

40R9573



Pos. og reservedele/Position Nos. and Spare Parts/Pos. und Ersatzteile/Pos et pièces de rechange

Pos.		Antal/ No. req./ Anzahl/ Nombre	Best.nr./Code Nos./ Artikel-Nr./N° de code	
			OUB 1	OUB 4
5.	Pakning for 8/Gasket for 8/Dichtung für 8/Joint pour 8	1	040B1117	040B1117
6.	O-ring/O-ring/O-Ring/Joint torique	1	633B1326	633B1326
7.	Dyse/Nozzle/Düse/Orifice	1	040B2320	040B2320
8.	Returolietilslutning/Return oil connection/Anschluss für Ölrücklauf/Raccord de retour d'huile	1	040B1120	040B1120
9.	Dyseholder/Nozzle holder/Düsenhalter/Porte-orifice	1	040B0060	040B0060
14.	Fastgørelsesskrue for 8/Fixing screw for 8/Befestigungsschraube für 8/ Vis de fixation pour 8	2	681X1097	681X1097
17.	Fastgørelsesbøjle/Fastening strap/Befestigungsbügel/Collier de fixation	1	040B0050	040B0055

DANSK

Olieudskiller

TEKNISKE DATA

Max. arbejdstryk: 22 ato
Max. prøvningstryk: 33 ato
Kølemidler: R 12, R 22, R 502

MONTERING

Olieudskilleren monteres i køleanlæggets trykledning mellem kompressor og kondensator.
Alle typer skal anbringes lodret med returolietilslutningen (8) nedad.
Udskilleren tilsluttes trykledningen med gennemstrømning som vist med pilene.
OUB fastgøres v. hj. a. bøjlen (17).
Returolieledningen fra tilslutningen (8) forbindes med kompressorens krumtaphus.
Har anlægget tidligere arbejdet uden olieudskiller, tilrådes det i den første tid at holde krumtaphusets oliestand under observation og regelmæssigt aftappe overskydende olie, idet udskilleren vil trække den olie tilbage, som før var fordelt over hele anlægget. Kontrol af olieudskillerens funktion kan foretages v. hj. a. et skueglas type SGI i returolieledningen. Ved korrekt funktion vil en konstant oliestrøm herved kunne iagttages.
Monteres OUB på nye anlæg, vil det normalt ikke være nødvendigt at påfylde ekstra olie, da oliebeholderen kun kan rumme små mængder.

SERVICE

Fjernes tilslutningen (8) for returolie, bliver ventilens dyse (7) tilgængelig for rensning.

ENGLISH

Oil separator

TECHNICAL DATA

Maximum operating pressure: 22 atm.g. (315 psig)
Maximum test pressure: 33 atm.g. (470 psig)
Refrigerants: R 12, R 22, R 502.

FITTING

The oil separator is inserted in the delivery line of the refrigerating plant between the compressor and the condenser.
All types should be mounted vertically with the return oil connection (8) facing downwards.
The separator should be connected to the delivery line with the flow in the direction indicated by the arrows.
OUB is fixed by the fastening strap (17).
The return oil line from the connection (8) is connected to the compressor crankcase.
If the plant concerned has previously been operating without an oil separator, it is recommended that the oil level in the crankcase should be observed at the start and excess oil drained at regular intervals, since the separator will collect the oil which was previously distributed all over the plant.
A watch can be kept on the functioning of the oil separator by a sight glass Type SGI in the return oil line. During correct operation the sight glass will show a steady oil flow.
If OUB is installed in a new plant, it will normally not be necessary to top up with additional oil, since the oil container can hold only a very small volume.

SERVICING

When the return oil connection (8) is removed, access is given to the valve nozzle (7) for cleaning.

DEUTSCH

Ölabscheider

TECHNISCHE DATEN

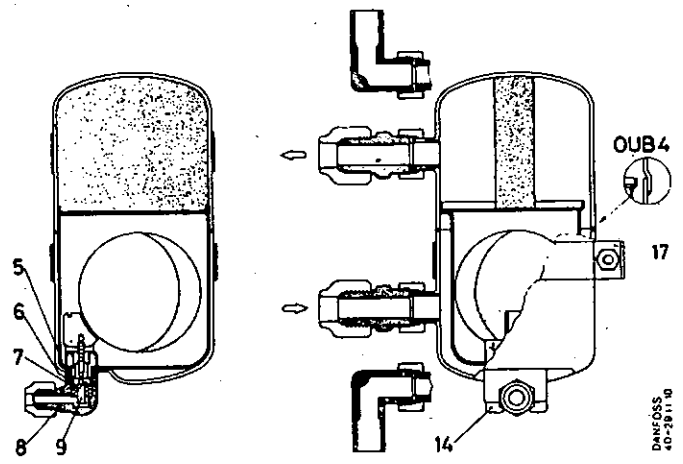
Max. Betriebsdruck: 22 atü
Max. Prüfdruck: 33 atü
Kältemittel: R 12, R 22, R 502

MONTAGE

Der Ölabscheider wird in die Druckleitung der Kälteanlage zwischen Kompressor und Verflüssiger montiert.
Alle Typen sind senkrecht und mit dem Rückölanschluss (8) nach unten anzubringen.
Der Ölabscheider ist mit Durchfluss in der Pfeilrichtung an die Druckleitung anzuschliessen.
OUB ist mit Hilfe des Bügels (17) zu befestigen.
Die Rückölleitung vom Anschluss (8) ist mit dem Kurbelgehäuse des Kompressors zu verbinden.
Hat die betreffende Anlage früher ohne Ölabscheider gearbeitet, wird empfohlen, die erste Zeit den Ölstand im Kurbelgehäuse laufend zu beobachten und überschüssiges Öl regelmässig abzulassen, da der Ölabscheider das Öl zurückziehen wird, das früher über die ganze Anlage verteilt war.
Eine Überwachung der Funktion des Ölabscheiders ist mit einem Schauglas Typ SGI in der Ölrücklaufleitung möglich. Bei korrekter Funktion kann dadurch ein konstanter Ölstrom beobachtet werden.
Bei der Montage des OUB an neuen Anlagen ist es normalerweise nicht erforderlich, zusätzliches Öl nachzufüllen, da der Ölbehälter nur kleine Mengen fassen kann.

WARTUNG

Nach Abbau des Ölrücklaufanschlusses (8) wird die Düse (7) des Ventils für Reinigung zugänglich.



Pos. og reservedele/Position Nos. and Spare Parts/Pos. und Ersatzteile/Pos et pièces de rechange

Pos.		Antal/ No. req./ Anzahl/ Nombre	Best.nr./Code Nos./ Artikel-Nr./N° de code	
			OUB 1	OUB 4
5.	Pakning for 8/Gasket for 8/Dichtung für 8/Joint pour 8	1	040B1117	040B1117
6.	O-ring/O-ring/O-Ring/Joint torique	1	633B1326	633B1326
7.	Dyse/Nozzle/Düse/Orifice	1	040B2320	040B2320
8.	Returolietilslutning/Return oil connection/Anschluss für Ölrücklauf/Raccord de retour d'huile	1	040B1120	040B1120
9.	Dyseholder/Nozzle holder/Düsenhalter/Porte-orifice	1	040B0060	040B0060
14.	Fastgorelsesskrue for 8/Fixing screw for 8/Befestigungsschraube für 8/ Vis de fixation pour 8	2	681X1097	681X1097
17.	Fastgorelsesbøjle/Fastening strap/Befestigungsbügel/Collier de fixation	1	040B0050	040B0055

FRANCAIS

Séparateur d'huile

CARACTÉRISTIQUES TECHNIQUES

Pression de travail max. 22 atm.eff.
Pression d'essai max. 33 atm. eff.
Fluides frigorigènes: R 12, R 22, R 502

MONTAGE

Monter le séparateur d'huile sur la conduite de refoulement de l'installation frigorifique, entre le compresseur et le condenseur.
Tous les types doivent être montés verticalement, le raccord de retour d'huile (8) étant dirigé vers le bas.

Relier le séparateur à la conduite de refoulement, avec passage du fluide dans le sens des flèches.
Fixer OUB au moyen du collier (17).
La conduite de retour d'huile venant du raccord (8) doit être reliée au carter du compresseur.
Si l'installation considérée a fonctionné antérieurement sans séparateur d'huile, il est conseillé d'observer pendant un certain temps le niveau d'huile du carter et de vidanger régulièrement l'huile excédentaire car le séparateur ramène au carter l'huile qui était jusqu'ici répartie dans toute l'installation.
Le contrôle du fonctionnement des séparateurs d'huile peut être réalisé en montant un voyant du type SGI sur la conduite de retour d'huile. Pour un fonctionnement correct, on observera alors un débit d'huile constant.
Si le OUB est monté sur des installations nouvelles, il n'est normalement pas nécessaire de faire une recharge d'huile étant donné que le réservoir ne peut contenir que de faibles quantités d'huile.

ENTRETIEN

En enlevant le raccord de retour d'huile (8), l'orifice (7) de la vanne est accessible pour nettoyage.

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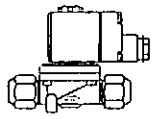
INSTRUCTIONS

EVR



32R9559

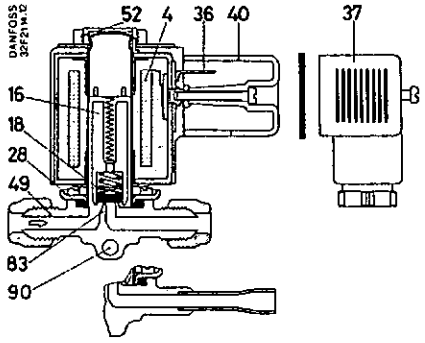


Fig. 1. EVR 2

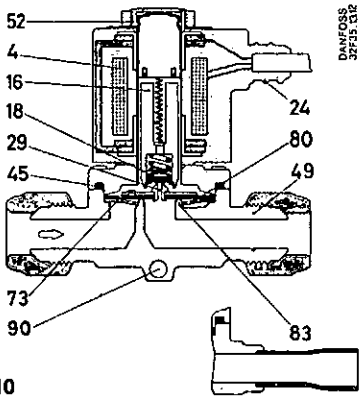


Fig. 2. EVR 10

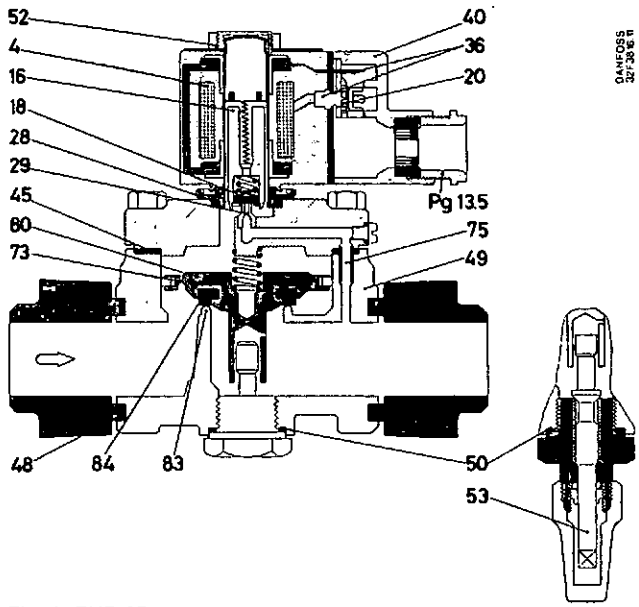


Fig. 3. EVR 25

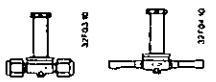


Fig. 4. EVR 2

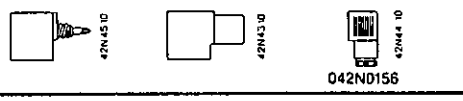


Fig. 5. EVR 2

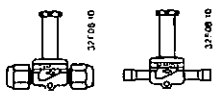


Fig. 6. EVR 3-10

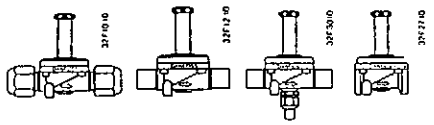


Fig. 7. EVR 15-20

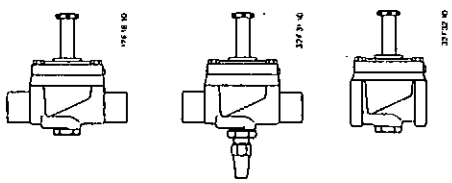


Fig. 8. EVR 25

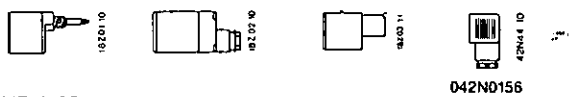


Fig. 9. EVR 3-25

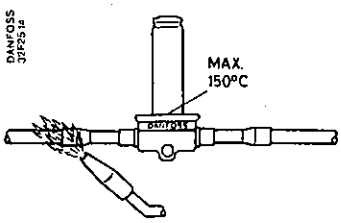


Fig. 10. EVR 2-10

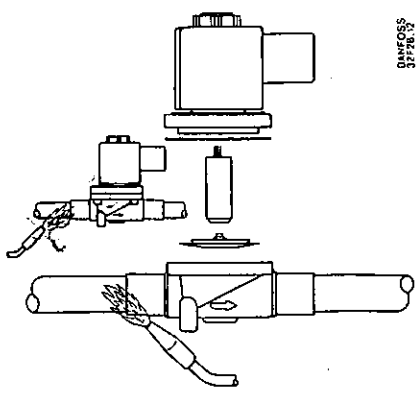


Fig. 11. EVR 15-25

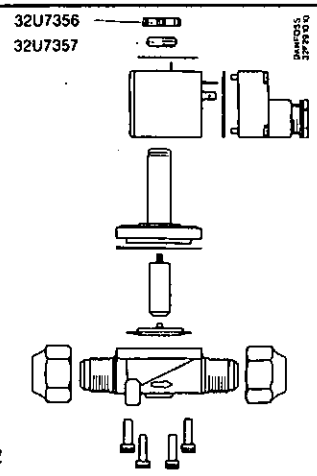


Fig. 12

DANSK

Magnetventil

Tekniske data
Ventilen er lukket, når spolen er strømløs.
Kølemidler: R 12, R 22 og R 502 i væske-, damp- eller gasform.
Ventilen kan også bruges til andre fluorerede kølemidler, undtagen R 21, når der tages hensyn til både min. og max. medietemperatur.
Min. medietemperatur: −40°C
Max. medietemperatur: +105°C
Max. driftstryk (p_e): 35 bar = 3500 kPa
Max. prøvningstryk (p_e): 46 bar = 4600 kPa
Max. tilladelig spændingsvariation

EVR 2: ±10% (a.c.,d.c.)

EVR 3-25: $^{+10}_{-15}$% (a.c.), ±10% (d.c.)

Max. åbningsdifferenstryk (MOPD), spolespænding, -frekvens og -effekt: Se spole- og topskilt.

Identifikation
De sidste fire cifre af bestillingsnummeret for underparten er stemplet i ventilhuset.
EVR 20 til d.c. har profileret anker.

Konstruktion
4. Spole
16. Anker
18. Pilotventilplade
20. Jordskrue
24. Tilslutning for stålslange
28. Pakning
29. Pilotdyse
36. AMP stikben
37. AMP stikdåse (i henhold til DIN 43650)
40. Dækhætte/Klemdåse
45. Pakning for ventildæksel
48. Flangepakning
49. Ventilhus
50. Pakning
52. Låseknap og topmøtrik
53. Spindel for manuel åbning
73. Udligningshul
75. Pilotkanal
80. Membran/Servostempel
83. Ventilsæde
84. Hovedventilplade
90. Monteringshul

Montering
Ventilen kan monteres i vilkårlig stilling; dog bør spolen ikke vende nedad af hensyn til eventuel snavssamling i ankerrøret.
Pilen på ventilhuset viser gennemstrømningsretningen.
Ventilen kan spændes fast ved hjælp af en skrue gennem monteringshullet 90. EVR 2-10 kan desuden monteres på en konsol. Konsollen kan leveres på bestillingsnummer *032F0086*.

EVR 2, 3, 6 og 10 med loddetilslutning (fig. 10):
Når disse ventiler loddes i rørledningen uden adskillelse af ventilhuset, må arbejdstemperaturen ikke blive højere end 700°C. Anvend derfor et sølvlod med lavt smeltepunkt. Hold loddeflammen væk fra ankerrøret da pakningen ikke tåler temperaturer over 150°C.

EVR 15, 20 og 25 med loddetilslutning (fig. 11):
Disse ventiler skal altid skilles ad inden ilodning.

El-tilslutning
Før spolen tilsluttes, kontrollér da, om spolens angivne spænding og frekvens er den samme som nettets.
Spoler med kabel er forsynet med en grøngul ledning, som skal forbindes til jord.
Ved spoler med AMP tilslutning skal spadestikket mærket ⏚ forbindes til jord.
Spoler med klemdåse er forsynet med en Pg 13,5 kabelforskruning for 6-14 mm kabel. Klemdåsens indvendige jordskrue 20 skal forbindes til jord.

Service
Servostemplet 80 i EVR 25 udtages lettest med en af dækselskruerne, der skrues ind i gevindet midt i servostemplet.
Før membranen/servostemplet 80 monteres efter eventuel rensning af ventilen, skal det kontrolleres, at udligningshullerne er helt fri for snavs.
Støtteskiven under membranen skal anbringes med den bukkede kant nedad.
Hvis EVR skilles ad efter længere tids drift, bør pakningen 28 altid udskiftes. Bestillingsnr., se skemaet.
Når en spole skal bestilles, bedes følgende angivet: Ventiltype, spænding, frekvens og tilslutningsart (enten 1 m kabel, AMP tilslutning eller klemdåse).
AMP stikdåse 37, IP 65, leveres på bestillingsnr. *042N0156*.
Enhed for manuel åbning af EVR 25 kan leveres på bestillingsnr. *032K1218*.

Ventil-type	Anker 16+ pakning 28/45	Membran/Servo-stempel 80 + pakning 45
EVR 2	032F0087	
EVR 3	032F0088	
EVR 6	032F0089	032F0090
EVR 10	032F0091	032F0092
EVR 15	032F0093	032F0094
EVR 20	032F0095	032F0096
EVR 25	032F0088	032F0098

ENGLISH

Solenoid valve

Technical data
The valve is closed when the coil is deenergized.
Refrigerants: R 12, R 22 and R 502 in liquid, vapour or gas form.
The valve can also be used for other fluorinated refrigerants, except R 21, providing the operating conditions are within the min./max. temperature conditions quoted for the valve.
Min. temperature of medium: −40°C (−40°F)
Max. temperature of medium: +105°C (+221°F)
Max. operating pressure (p_e): 35 bar = 3500 kPa = 498 psig
Max. test pressure (p_e): 46 bar = 4600 kPa = 654 psig
Max. permissible voltage variation:

EVR 2: ±10% (a.c.,d.c.)

EVR 3-25: $^{+10}_{-15}$% (a.c.), ±10% (d.c.)

Max. opening differential pressure (MOPD), coil voltage, frequency and power: See coil and top label.

Identification
The last four ciphers of the code No. for the valve body are stamped on the body.
The EVR 20 for d.c. has a ribbed armature.

Design
4. Coil
16. Armature
18. Pilot valve plate
20. Earth screw
24. Connection for steel hose
28. Gasket
29. Pilot orifice
36. AMP connector
37. AMP socket (to DIN 43650)
40. Protective cap/Terminal box
45. Valve cover gasket
48. Flange gasket
49. Valve body
50. Gasket
52. Lock button and top nut
53. Manual opening spindle
73. Equalizing hole
75. Pilot channel
80. Diaphragm/Servo piston
83. Valve seat
84. Main valve plate
90. Fixing hole

Fitting
The valve can be mounted in any position, except with the coil pointing downwards. This is to prevent any foreign matter collecting in the armature tube.
The arrow on the valve body indicates the direction of flow.
The valve can be securely mounted in position with a screw through the fixing hole, 90. The EVR 2-10 can also be mounted on a bracket which can be ordered under code No. *032F0086*.

EVR 2, 3, 6 and 10 with solder connection (fig. 10):
When the valves are soldered into pipelines without dismantling the valve body, the working temperature must not be higher than 700°C. Therefore, use a silver solder with a low melting point. Hold the soldering flame away from the armature tube since the gasket will not stand temperatures over 150°C.

EVR 15, 20 and 25 with solder connection (fig. 11):
These valves must always be dismantled before soldering.

Electrical connection
Before connection the coil, check that the stated coil voltage and frequency correspond to the mains values.
The green-yellow wire of coils with a cable must be connected to earth.
With AMP-connected coils, the spade connector marked ⏚ must be connected to earth.
Coils with a terminal box are fitted with a Pg 13.5 screwed cable entry for 6-14 mm cable. Connect the internal earth screw 20 in the box to earth.

Service
The servo piston, 80, in the EVR 25 is easiest removed with one of the cover screws which should be screwed into the thread in the centre of the servo piston.
Before the diaphragm/servo piston, 80, is fitted, after cleaning the valve for example, make sure that the equalizing hole is completely free of dirt.
The backing washer under the diaphragm must be fitted with its bent edge downwards.
If the EVR valve is dismantled after being in operation for some time, the gasket 28 ought always to be replaced. Code No., see table.
When ordering a coil, please state: valve type, voltage, frequency and type of connection (either 1 m cable, AMP connector or terminal box).
The AMP socket, 37, IP 65, can be obtained under code No. *042N0156*.
The unit for manual opening of the EVR 25 can be obtained under code No. *032K1218*.

Valve type	Armature 16+ gasket 28/45	Diaphragm/Servo-piston 80 + gasket 45
EVR 2	032F0087	
EVR 3	032F0088	
EVR 6	032F0089	032F0090
EVR 10	032F0091	032F0092
EVR 15	032F0093	032F0094
EVR 20	032F0095	032F0096
EVR 25	032F0088	032F0098

DEUTSCH

Magnetventil

Technische Daten
Das Ventil ist bei stromloser Spule geschlossen. Kältemittel: R 12, R 22 und R 502, flüssig, dampf- oder gasförmig.