OVERLOADS AND RELAYS

R.E. REPLACEMENT RELAYS & OVERLOADS TO SUIT BARBERIE-SUMMIT

RELAYS

CAT. NO.	MODEL	MANUF. NO.	RE NO.
324127	1/8HP I.S.M.	CX5	BE3R
3242	8S.U. 6S.U. 5S.U.	CX4	BE4R
3241	8D.U. 6D.U.	CX37	BE5R
3243	1/4HP I.S.M. (4 & 5)	CX6 (5.6)	BE6R
324126	1/4HP Pancake (4S.U.)	CX64	BE7R
324128	1/4HP Pancake K.M.	KX50	BE8R
3244	1/3HP I.S.M. (3 & 33)	CX7 (7.8)	BE9R
3245	1/2HP I.S.M. (2, 1, 51, 37)	CX8Q(10.5)	BE10R
3246	3/4HP I.S.M. (3/4, 6, 36)	CX9(15.0)	BE11R
3246	3/4HP Twin (6, 7, 20, 38)	CX9(15.0)	BE11R
3246	1HP Twin (29)	CX9(15.0)	BE11R
3247	1HP Twin (8, 11, 30, 41)	CX10(19.0)	BE12R
324129	1.1/2HP Twin (11)		BE14R

NOTE : FIRST 3 NUMERALS OF CAT. No. INDICATES PAGE No.

OVERLOADS

CAT. NO.	MODEL	MANUF. NO.	RE NO.
324151	1/8HP I.S.M. Domestic		BE3P
32412	1/8HP P'cake 8S.U. Dom.	X4	BE4P
32412	1/6HP P'cake 6S.U.	X4	BE4P
32412	1/5HP P'cake 5S.U.	X4	BE4P
324152	1/8HP P'cake 8D.U.	MRF63HX	BE5P
324153	1/6HP P'cake 6D.U.	MRF63HX	BE5P
32414	1/4HP I.S.M. (4, 5)	X6	BE6P
324154	1/4HP P'cake 4S.U.	MRH6829	BE7P
324155	1/4HP P'cake K.M.	MRA6851	BE8P
32415	1/3HP I.S.M. (3, 33)	X7	BE9P
32416	1/2HP I.S.M. (2, 1, 51, 37, 1C, 2C)	X8	BE10P
32417	3/4HP I.S.M. (36, 6, 3/4)	X9	BE11P
32418	3/4HP Twin (20, 7, 38)	X11	BE12P
32418	1HP Twin (29, 8)	X11	BE12P
32419	1HP Twin (41, 30)	X12	BE13P
324156	1HP Two Pole	X13	BE14P
324157	1.1/2HP Twin (43, 27)	X14	BE15P
32420	1.1/2HP Twin (11)	X16	BE16P
32422	2HP Twin (25)	X15	BE17P

R.E. REPLACEMENT RELAYS & OVERLOADS TO SUIT STERNE-TECUMSEH

RELAYS

CAT. NO.	MODEL	MANUF. NO.	RE NO.
324133	P1219	C6360-9587	ST2R
324134	AM12Z7, P91, P8112, P61, P6112	C6360-1977, R8.23	ST3R
32460	P6312, P5112, P5312	C6360-116	ST4R
324135	AP43, AP4111	C6360-1407	ST5R
32462	S4614, C4614	C6360-231	ST7R
32463	C3N16	C6360-145	ST8R
32464	C2T16	C6360-159	ST9R
32465	B2616, B7616, B1616, B1T16, B1U18	CX180	ST11R
32468	B32T16, B32T18, B32U18	CX270	ST12R
324136	AT43	C9660-040-123	ST17R
324137	AT45	C9660-013-125	ST18R
324138	AT3512	C9660-013-140	ST19R
324139	CAT2612		MS50R
324140	AM43		MS74R

OVERLOADS

CAT. NO.	MODEL	MANUF. NO.	RE NO.
324158	P1219	MRA9918	ST2P
324159	P91	MRA9970	ST3P
324160	P8112, P6112, P61	MRA9966	ST4P
32469	P6312, P5312	MRA9941	ST5P
324161	AP43, AP4111 (Fan Cool)	MRA9937	ST6P
324162	AP43	MRA9927	ST7P
32471	S4614, C4614	MRA9969	ST8P
32472	S3N16, C3N16	MRA9979	ST9P
32473	S2T16, C2T16	MRA9943	ST10P
324163	B2616	MRA9876	ST11P
32474	C7616, B7616, B1616	CRM49JX	ST12P
32475	B32T16, B32T18	CRM40JX	ST13P
32475	B1T16	CRM40JX	ST13P
324165	K1U18, K32T16	MRK0E07	ST20P
324165	K32T18, K21U18	MRK0E07	ST20P

DANFOSS STARTING DEVICE

CAT. NO.	CODE No.	COMPRESSOR TYPE	DESCRIPTION
	104F0006	SC	Starting Device less Base & Plug
	104N0020	SC	Electrical Mounting Base & Plug
	—	SC	Electrical Retaining Clip
	103N0002	TL/FR/SC	Starting Device c/w Term. Screw Straight
	103N0011	TL/FR/SC	Starting Device c/w Term. Screw Angled
	103N1002	TL/FR/SC	Cord Relief
	103N1004	TL/FR/SC	Cord Relief
	103N2002	TL/FR/SC	Cover
	103N2003	TL/FR/SC	Cover
	112-0800	TL	Mounting Kit
	117U-5021	FR/SC	Start Capacitor
	117-7343	TL/FR/SC	3 Pin Plug

This electrical equipment, which gives the compressor a low starting torque, comprises a PTC starting device, a cord relief and a cover with locking clamp. The PTC starting device can be used on the following compressors.

TL2A, TL2.5A, TL3A, TL4A, TL5A, TL2.5B, TL3B, TL4B, TL5B, FR7.5A, FR10A, FR7.5B, FR8.5B, FR10B, SC12A, SC15A, SC10B, SC12B.

The compressors can be used in refrigeration systems with capillary tube regulation where pressure equalizing is attained between the suction and discharge sides of the refrigeration system in each standstill period.

The PTC starting device requires that the standstill time of the compressor is not under 5 minutes since this is the time necessary for the PTC to cool down before each new start.

Starting devices 103N0011 and 103N0002 are electrically identical. 103N0011 has side access screw connections which cannot be used on SC compressors owing to the location of the current lead-in.

324-a
RELAYS, OVERLOADS AND CAPACITORS

TERRY ACCESSIBLE SEALED COMPRESSORS
RELAYS, OVERLOADS, CAPACITORS & ELECT. KITS

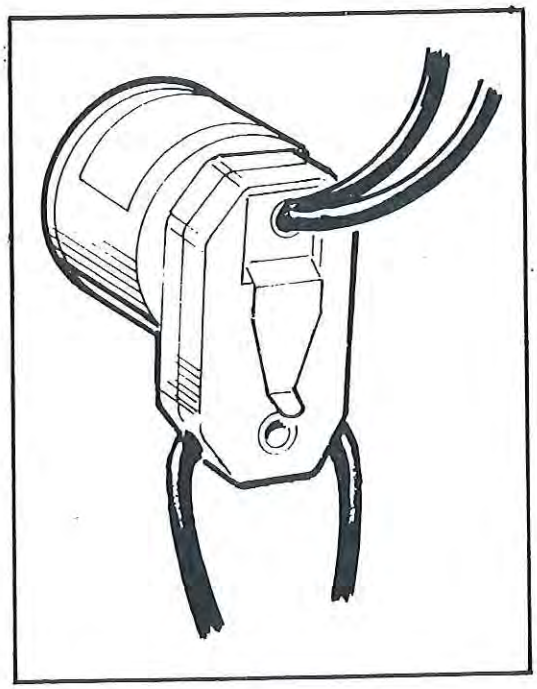
COMP.	APPLIC.	MOTOR CODE	RELAY CAT. NO.	RELAY TERRY P/N	RELAY MFG. P/N	OVERLOAD CAT. NO.	OVERLOAD TERRY P/N	CAPACITOR *	KIT CAT. NO.	KIT TERRY P/N
USING HOT WIRE RELAY WITH OVERLOAD										
SD	L	R	32433	1075- 5	MC35 AC1	—	—	Start 190-230mfd.150V		1415-13
SD	M—H	R	32434	1075- 6	MC39 AD1	—	—	Start " " " "		1415-14
USING KLIXON RELAYS										
SD	L—M—H	R	32446	1075-48	C6360-158	32437	1145-9	Start 190-230mfd.150V		1415-22
TM1	M	Q—V	32445	1075-15	6409-4-184		1145-6	Start 200mfd. 275V.		1415-24
TM1	H	Q—V	32445	1075-15	6409-4-184		1145-6	Start 200mfd. 275V. Run 30mfd. 330V.		1415-26
TL1	L—M—T	Q	32445	1075-15	6409-4-184		1145-6	Start 200mfd. 275V.		1415-24
USING RBM TYPE RELAYS (F128116 — 1345D with Capacitor Bleed Resistor)										
TM1	M	Q—V	32430	1075- 2	As above		1145-6	Start 200mfd. 275V.		1415-19
TM1	H	Q—V	32430	1075- 2	"		1145-6	Start 200mfd. 275V. Run 30mfd. 330V.		1415-20
TL1	L—M	Q	32430	1075- 2	"		1145-6	Start 200mfd. 275V.		1415-19
TL1	H	Q	32430	1075- 2	"		1145-5	Start 200mfd. 275V. Run 30mfd. 330V.		1415-20
TL1F	T	Q	32430	1075- 2	"		1145-5	Start 200mfd. 275V. Run 30mfd. 330V.		1415-20
TG1	L—M—H	X	32430	1075- 2	"		13 AMP	Start 200mfd. 275V. Run 20mfd. 415V.	—	—

APPLICATION :
L = Low Temperature Range
M = Medium Temperature Range
H = High Temperature Range
T = Truck Transport

*NOTE : Select above Capacitors from CORNELL-DUBILIER Range detailed on Page 326 - d.

REFRIGERATION (RE) ELECTRICALS PTY. LTD.

TYPE 'SR' RELAY/OVERLOAD COMBINATION



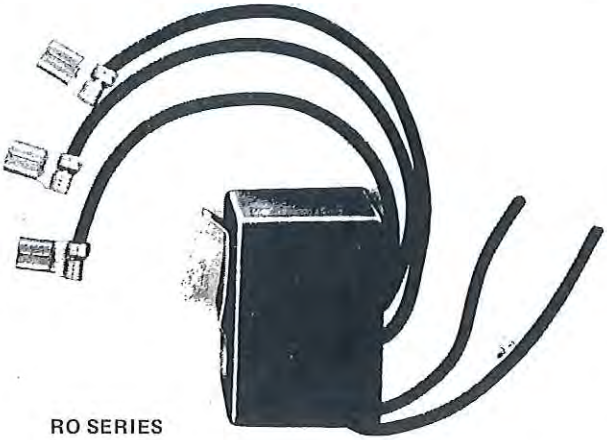
- Replaces almost every make relay and overload combination including hot wire relays and centrifugal starting switches from 1/12 H.P. to 3/4 H.P.
- Calibrated in Australia for Australian conditions in individual stages.
- Select by H.P. or Full Load Current.
- Quick clip-on or screw mount — multi-positional.
- No starting contacts to fit or wear.
- Vibration and shock resistant.
- Long operating life.
- Overload protection.
- Simple wiring connections.

CAT. NO.	MODEL	VOLTS	H.P.	F.L. AMPS
324201	SR12	240	1/12	0.6
324202	SR10	240	1/10	0.8
324203	SR8	240	1/8	1.0
324304	SR6	240	1/6	1.3
324305	SR5	240	1/5	1.5
324306	SR4	240	1/4	2.0
324307	SR3	240	1/3	3.0
324308	SR2	240	1/2	4.0
324309	SR7	240	3/4	5.5

NOTE: At least 45 seconds must be allowed between Starts.
Do not use with a Run Capacitor.

SOLID STATE
RELAYS, OVERLOADS AND CAPACITORS

RSC-20


RO SERIES


ICG-220

ALL UNITS
230/240 VOLTS AC

- ★ NO STARTING CONTACTS TO PIT OR WEAR.
- ★ MAY BE DIRECTLY SUBSTITUTED FOR CONTACT STARTERS SUCH AS CENTRIFUGAL, MAGNETIC AND THERMAL TYPE STARTING SWITCHES.
- ★ ACOUSTICALLY AND ELECTRICALLY NOISE FREE.
- ★ VIBRATION AND SHOCK RESISTANT.
- ★ LONG OPERATING LIFE AND LOW COST.

CAT. NO.	DESCRIPTION
	SOLID STATE RELAY ICG-220
32451	APPLICATION: **One size for all compressors from 1/12 H.P. thru 1/2 H.P.** Will replace most current type relays. FEATURES: Easy to install . . . can be mounted on the fence of the compressor with quick "snap-on-bracket" . . . or installed in any convenient location by using screws through the mounting holes. Can be used with or without a start capacitor.
	SOLID STATE RELAY PO-230
32458	APPLICATION: **One size for all compressors from 1/12 H.P. thru 1/2 H.P.** Replaces ALL push-on current type relays. For use on compressors with "pin-type" terminals. Can be used on ALL capacitor and non-capacitor start motors. FEATURES: Lowest resistance solid state relay. FASTEST COOL DOWN TIME of ALL solid state relays. Will restart balanced system WITHIN ONE MINUTE. Quick and easy to install.
	SOLID STATE RELAY & OVERLOAD RO SERIES
	APPLICATION: **Replaces ALL Hermetic refrigerator compressor relay and overload units from 1/12 H.P. thru 1/3 H.P.** Can be used in conjunction with a start capacitor. FEATURES: Relay and Overload . . . in One Combination Unit. Pre-wired for FAST, SIMPLE installation. Attached mounting clip makes installation easy. Superior locked rotor protection eliminates start winding overheating.
32454	MODEL RO-82 **1/12, 1/10, 1/8 H.P.**
32459	MODEL RO-62 **1/6, 1/5 H.P.**
32455	MODEL RO-42 **1/4, 1/3 H.P.**
	SOLID STATE STARTING RELAY & CAPACITOR RSC-20 . . . "The Big Relay"
32459A	APPLICATION: **One size for all compressors from 1/12 H.P. thru 1/2 H.P.** for both domestic and commercial Refrigerators and Freezers. The installation of a start capacitor in series with the start winding in order to overcome starting problems was common practice. Then manufacturers started using push-on relays which left no practical way to install a start capacitor.. NOW . . . this problem has been solved with a NEW Combination Relay and Start Capacitor — **"The Big Relay".** FEATURES: A Combined Solid State Starting Relay and Capacitor. . . Completely Pre-wired for a fast, simple hook-up . . . Installs quickly and easily by just pushing the three female pin terminals on to the compressor terminals. Replaces current type relays. Provides added boost for hard start and unbalanced systems. Prevents low voltage starting problems. NO ADDITIONAL Wires Required.

5

CAPACITORS

A REFERENCE GUIDE TO THE USE OF AC MOTOR START AND RUN CAPACITORS

(EXTRACTS FROM CORNELL–DUBILIER BULLETINS)

Servicing and Replacing AC Motor Start Capacitors

Capacitor Design and Reliability

Cornell-Dubilier Motor Starting Electrolytic Capacitors are designed to operate for a minimum of 50,000 starts. They are manufactured with high purity aluminum foils, separated by electrolyte saturated, chemically pure paper for low power factors. Units are protected against vibration stresses internally and are provided with a cover-seal made up of a rubber phenolic laminate with a positive-pressure safety vent and are furnished in high-impact phenolic cases.

Temperature Ratings

The maximum ambient temperature rating at the recommended duty cycle is +65°C (+150°F). Cornell-Dubilier Capacitors will function satisfactorily at temperatures up to +85°C (+185°F), provided the duty cycles and voltage conditions are adjusted accordingly.

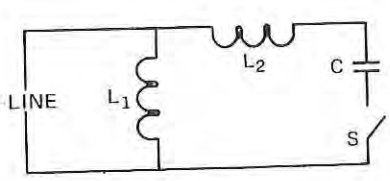
Sub-zero temperatures do not affect the operation of the capacitors. Changes in characteristics due to low temperature are temporary. At below zero temperatures, the capacitors will lose capacitance and increase in power factor, but these changes do not seriously affect their ability to start the motor at temperatures as low as -40°C (-40°F). The higher power factor at low temperatures represents power lost in the capacitor, which creates heat, warming the capacitor almost instantaneously.

Application

Capacitor start motors are designed for high starting torque but require an extra "push" provided by the capacitor in order to start. The function of the capacitor is to provide out-of-phase starting current to the starting winding, forcing the motor to operate as a two-phase motor during the starting period. The starting capacitor is not intended for continuous duty and should not be used more frequently than 60 one-second, 30 two-second, or 20 three-second starts per hour. These duty cycles are based on the necessity for proper heat dissipation to insure maximum life.

As the motor reaches full operating speed, the starting winding and capacitor are taken out of the circuit by either a centrifugal switch or a voltage or current-sensitive relay.

The average time for a motor to reach full operating speed is approximately one second. Rarely does it require more than three seconds to reach full operating speed, even for motors as large as 6 or 7 horsepower.



L_1 – Main Winding
L_2 – Starting Winding
C – Starting Capacitor
S – Centrifugal Starting Switch or Relay.

Figure A

Failure Modes

Motor starting capacitors have proven to be very reliable if recommended operating ratings are not exceeded. Conditions which shorten life and increase failure rate are:

a. Duty cycle greater than recommended
b. High operating temperatures
c. Application of voltages in excess of ratings
d. Overloading, preventing motor from reaching running speed promptly
e. Physical damage to case or terminals
f. Failure of starting switch to open promptly when motor reaches running speed
g. Worn or frozen motor bearings causing excessive loads on the start cycles
h. Low line voltage preventing motor from reaching running speed
i. Incorrect capacitance rating (seldom encountered except where previous replacement was incorrect)
j. Improper voltage rating (again seldom encountered except where previous replacement was incorrect). A higher voltage rating may be used, but never a lower rating.

Motor Start Replacement

Replacement of a defective capacitor should be made by using an equivalent unit. When this is not available, the new unit should have the same capacitance rating and a voltage rating equal to or higher than the defective unit. The motor nameplate voltage bears little or no relationship to the required voltage rating of the capacitor, because the motor designer has several options at his disposal which can determine the rating required.

If the original capacitance and voltage ratings appear on the capacitor, replacement is a simple matter. If only a part number appears, it will probably be found under the appropriate manufacturer's listing. If the part numbers and ratings are obliterated, as occasionally occurs during service, the replacement task becomes a little more difficult.

Whenever replacement is attempted, an AC voltmeter should be used to monitor the voltage across the capacitor.

(Continued next page)

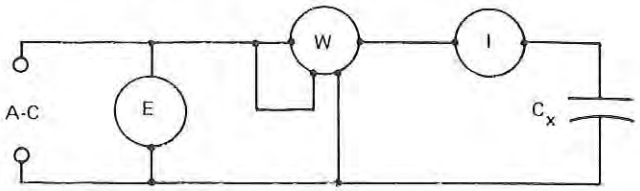
CAPACITORS

SERVICING AND REPLACING AC MOTOR START CAPACITORS – Continued

Testing Motor Start Capacitors

When motor start capacitors are tested to determine their serviceability, the values of two characteristics are desired: the capacitance and power factor.

Measurements should not be attempted with the use of capacitor bridges, normally used for DC capacitors, as erroneous values will be obtained. For accuracy, all tests must be conducted with the capacitors at +25°C (+77°F). Capacitors shipped or stored during cold weather should be allowed to reach this temperature before measurements are performed. Voltage should be applied for the minimum time required to obtain a reading (less than 10 seconds) in order not to distort the measurements with an internal temperature rise. A satisfactory measurement method is shown in Figure B.



E – AC Voltmeter
W – AC Wattmeter
I – AC Ammeter
C – Capacitor

Figure B

If only capacitance measurements are desired, the wattmeter may be omitted and the capacitance calculated with the formula:

$$\frac{2650 \times \text{amperes}}{\text{volts}} = \text{mfd.}$$

For convenience, the measurement voltage may be 110 volts.

In order to measure power factor, three instruments (See Fig. B) are required and care must be exercised to insure all are first-class. Power factor must be measured at full rated voltage and may be calculated with the formula:

$$\frac{\text{watts}}{\text{volts} \times \text{amperes}} \times 100 = \%\ \text{PF}$$

Typical power factors are less than 10%.

Servicing AC Motor Running Capacitors

Capacitor Design and Reliability

One of the most reliable components used in electrical equipment is the motor running capacitor. The heart of this device is made with the finest dielectric papers and oil impregnants available, carefully processed by vacuum-heat treatment and then hermetically sealed in a sturdy metal container. The shelf-and-operating life of the running capacitor is generally well in excess of ten years.

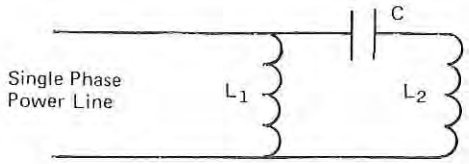
Description: CDE Motor Running Capacitors are constructed with oil impregnated paper dielectric, and hermetically sealed in drawn metal cases. They are designed for continuous duty at 60 hz AC for temperatures up to 70°C. Capacitors are oval or rectangular in shape and have U.L. approved gray enamel paint finish. Standard tolerance is ± 10%. Some units are internally fused and can be identified by suffix "-F" after the catalog stock number. Outside foil section is marked by an embossed (-) in the cover of the can.

Terminals: Standard terminals are dual quick-connect, furnished with molded phenolic insulating cups. Terminals are adaptable to the standard ¼" female quick-connect used on wiring harnesses but also have eyes and notches for making solder connections.

Mounting: CDE Motor Run Capacitors can be mounted interchangeably with any original mounting for units of equivalent or smaller size.

Running Capacitor Application

Different than the start capacitor which is used only 3 to 10 seconds during each motor operation, the running capacitor is designed to withstand continuous voltage for many thousands of hours. Its primary function is to reduce the line current while greatly improving the torque characteristics of a motor. This is accomplished by using the 90° phase relationship between the capacitor current and voltage in conjunction with the motor windings so that the motor will give two phase operation when connected to a single phase circuit. The capacitor also reduces the line current to the motor by improving the power factor of the load.



L_1 – Phase 1 winding
L_2 – Phase 2 winding
C – Running Capacitor

Service Applications:

These units are used in continuous duty application such as air conditioning, refrigeration, fans, business machines and wherever motor run or small power factor correction capacitors are needed.

Failure Modes

Field results have shown very infrequent failure of well designed, properly manufactured oil-paper capacitors. Conditions which shorten the life and increase the failure rate are shown below:

(a) Excessively high power line voltages.
(b) High operating temperatures.
(c) Application of voltages in excess of ratings.
(d) Overloading motor.
(e) Physical damage to case or terminals.

The main failure mode found in running capacitors is short circuit between terminals due to dielectric breakdown. Occasionally open circuit units may be found, also short circuit to case. It is rare that capacitance change is a cause of failure in running capacitors.

(Continued next page)

CAPACITORS

SERVICING AC MOTOR RUNNING CAPACITORS – Continued

Identification of Failed Capacitors

Difficulty in starting a motor, high line current, and cutout of the overload switch may indicate a faulty capacitor. These conditions may also be caused by other factors. The methods listed below, in the absence of sophisticated test equipment, may be used to check running capacitor performance. Caution should be taken to avoid direct contact with terminals. Disconnect the capacitor from the circuit and check as follows:

Short Circuit: Any capacitor found to have a bulging of the terminal cover or excessive deformation of the metal container probably has become short circuited. While this does not happen in all cases, short circuits usually may be detected by the following tests described in the test section:

(a) Capacitance test at either 115 VAC or 230 VAC
(b) Ohmmeter test
(c) Discharge test at 115 or 230 VAC

Open Circuit: This type of defect results from mechanical damage to internal connections. Capacitors in this category are usually found on the capacitance test, lamp test, or ohmmeter test.

Grounded: Use lamp continuity test between each terminal and the case. Shorted capacitors are also frequently found to be grounded due to damage of internal insulation.

Capacitance: Most running capacitors will not fail because of capacitance change. Oval cased units are usually made with a single capacitor element so that no change is possible. Rectangular cased units are frequently made with multiple capacitor elements which may become disconnected individually from the circuit to the terminals. A simple capacitance check can readily determine if this condition exists. Running capacitors should be within ± 10% of the marked capacitance rating.

Oil Leaks: All running capacitors are permanently hermetically sealed against oil leakage or penetration of moisture from the atmosphere. Any capacitor found to leak any substantial amount of oil should be replaced. A small oil slick near the terminal or at the seam is generally not harmful.

Test Procedures

These test methods are not as effective as using a capacitance meter, dielectric strength tester and a megger, but will generally detect faulty running capacitors.

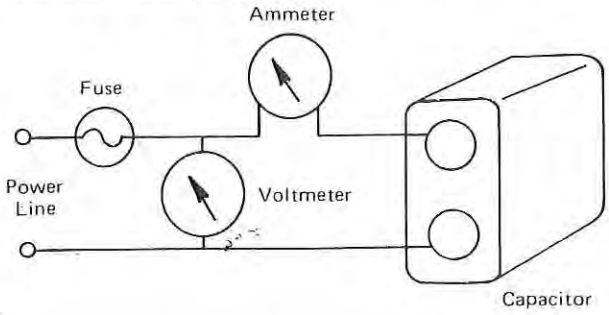
Capacitance Test

This may be conducted on running capacitors by using the circuit shown below. A simple calculation using the current and voltage obtained will give the value of capacitance with sufficient accuracy.

When testing for shorted capacitors, use a circuit breaker in place of the fuse. Shorted capacitors will give an excessively high current reading and will trip the circuit breaker. Use an ammeter and current limiting devices higher than the current rating of the capacitor as shown. Of course a fuse may be used — but it will be destroyed if the capacitor is shorted.

Ohmmeter Test

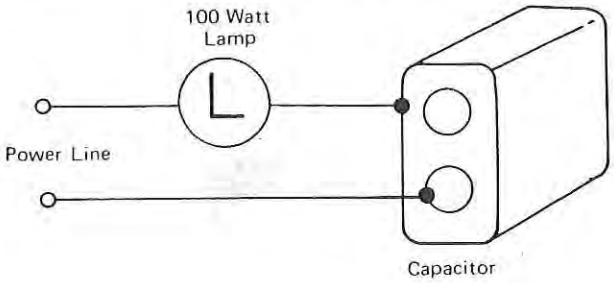
Shorted capacitors may frequently be detected by the use of an ohmmeter. Adjust ohmmeter to highest resistance scale and connect prods to capacitor terminals. Indicator should move to zero then will increase to infinity in a few minutes for a satisfactory capacitor. When the indicator remains at zero or reads less than 1,000,000 ohms, the capacitor may be considered to be shorted. The capacitance test will more effectively detect shorted capacitors because of the higher voltage applied.



Capacitance in MFD	Amps 115V Line	Amps 230V Line
5	.22	.44
10	.44	.88
15	.66	1.32
20	.88	1.72
25	1.1	2.2
30	1.32	2.64
40	1.76	3.52

Lamp Continuity Test

This may be used to detect grounded and open-circuited capacitors. When the test prods are connected between each terminal and the case, no lamp indication signifies a satisfactory capacitor. A lighted lamp, however dim, identifies a grounded unit. The test for open circuit is just the reverse. When the prods are connected between terminals, no light indicates an open circuited unit, but any light in the lamp shows continuity in the circuit. Tests may be made at 115 or 230 VAC but lamp must have a corresponding rating. Do not use this test to check short circuits between terminals as the results may be misleading.



Discharge Test

This is a very crude test but may be used successfully in many cases where other test equipment is not available. Apply power line voltage to capacitor terminals through lamp continuity test. Remove voltage and discharge capacitor with a screwdriver looking closely at the point where the screwdriver first makes contact with the terminals being tested. A small spark should be seen at least once in ten repetitive tests if the capacitor is neither open or short circuited. Absence of a spark may indicate the capacitor is open or short circuited. Caution should be taken to avoid direct contact with terminals.

(Continued next page)

CAPACITORS

CAPACITOR REPLACEMENTS

Replacement of a defective Capacitor should, of course be made by using an identical unit - not necessarily the same brand, but a replacement which has the same capacitance rating with a voltage equal to or higher than the failed unit. The replacement of a dual capacitor may be made by using two separate units of the equivalent ratings.

Any deviation from the original capacitance values should be avoided as this will alter the operating characteristics of the motor and may result in early failure.

When the required capacitance values are not available, it is possible in an emergency to connect several capacitors in series or parallel to obtain the desired microfarads. This applies to both start and run capacitors to provide the desired characteristics if the voltage and MFD are properly selected.

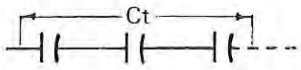
SERIES CONNECTION

When two capacitors having the same MFD rating are connected in series, the resulting total capacitance will be one half the rated capacitance of a single capacitor.

The voltage rating of similar capacitors connected in series is equal to the sum of the voltage of the two capacitors. However, since the voltage across individual capacitors in series will vary with the rating of the capacitor, for emergency field replacements, it is recommended that only capacitors of like voltage and capacitance be connected in series to avoid the possibility of damage due to voltage beyond the capacitor limits.

The formula for determining capacitance (MFD) when capacitors are connected in series is as follows :—

$$Ct = \frac{1}{\frac{1}{C1} + \frac{1}{C2} + \frac{1}{C3} + \dots}$$



where Ct = Total capacitance in a circuit.
C1, C2, C3 etc. are the values of individual Capacitors.

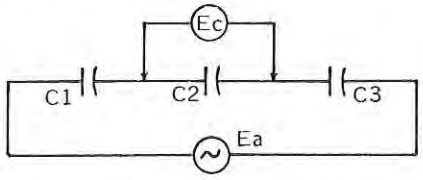
Example : Required - 15 MFD 370 VAC Capacitor.
Available - Quantity of 30 MFD 370 VAC Capacitors.

Series connection - $Ct = \frac{1}{\frac{1}{30} + \frac{1}{30}} = \frac{1}{\frac{2}{30}} = \frac{30}{2}$

$= 15$ MFD

The formula for determining Voltage Rating when Capacitors are connected in series is as follows :—

$$Ec = \frac{Ea \times Ct}{C}$$



where Ec = Voltage across individual capacitor in series.
Ea = Applied voltage
Ct = Total capacitance of the series combination.
C = Capacitance of the individual capacitors

Same Example : $EC = \frac{370 \times 15}{30} = 185$

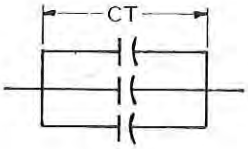
PARALLEL CONNECTION

When capacitors are connected in parallel, their MFD rating is equal to the sum of the individual ratings.

The voltage is equal to the smallest rating of the individual capacitors.

Capacitors in Parallel formula :

$$CT = C1 + C2 + C3 +$$



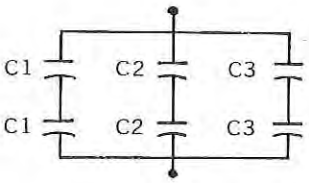
where CT = the total capacitance in a circuit.
C1, C2, C3 etc. are the values of the individual capacitors.

Example : Required - 40 MFD 370 VAC
Available - 5 MFD 370 VAC, 15 MFD 370 VAC, and 20 MFD 370 VAC.

Ct = 5 + 15 + 20 = 40 MFD
VAC = 370

SERIES AND PARALLEL CONNECTION

Example : Required - 45 MFD 440 VAC
Available - Quantity of 30 MFD 370 VAC.



Series $\frac{1}{\frac{1}{30} + \frac{1}{30}} = 15$

Therefore 3 Sets in parallel = 15 + 15 + 15 = 45 MFD.

Voltage : Since Cornell-Dubilier Capacitors may be used up to 740 VAC., this combination is satisfactory for 45 MFD 440 VAC.

SERVICE CHECK

After installing a replacement running capacitor, as a final check, test the voltage developed across the capacitor while the motor is operating. The voltage measured should not exceed the rating of the capacitor installed. Where abnormal line voltage or other conditions cause the capacitor to operate a higher than rated voltage, use next higher voltage rated capacitor.

CAPACITORS WITH BLEED-RESISTORS

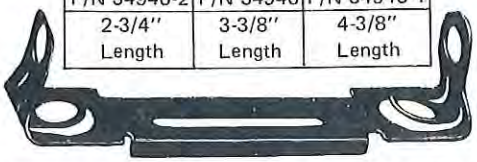
Start capacitors are sometimes fitted with bleed-resistors to prevent sticking relay contacts and/or erratic relay operation — especially where short cycling is likely to occur. This is due to the starting Capacitor discharging through the relay contacts as they close, following a very short running cycle. The resistor will permit the capacitor charge to bleed down at a much faster rate, preventing arcing and overheating of the relay contacts.

CAPACITORS

CDE CORNELL-DUBILIER

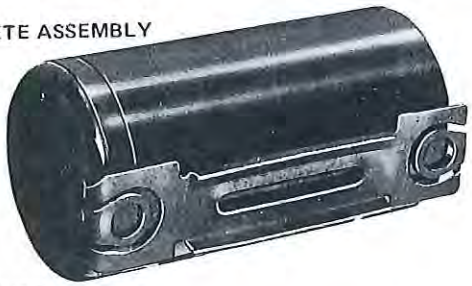
SNAP-IN MOUNTING BRACKET

P/N 34946-2	P/N 34946	P/N 34946-1
2-3/4" Length	3-3/8" Length	4-3/8" Length



COMPLETE ASSEMBLY

ETWCB Capacitor with plastic end cap and snap-in mounting bracket.



MOTOR START CAPACITORS

CAT. NO.	CDE PART No.	MFD	VOLTS AC	CASE SIZE		BRACKET	
				DIAM.	LENGTH	P/N	LENGTH
326176	ETW 25-250A	25 - 30	250	36.5 mm (1-7/16")	69.9 mm 2-3/4")	34946-2	2-3/4"
326177	ETW 30-250A	30 - 36	250				
326178	ETW 36-250	36 - 43	250	36.5 mm (1-7/16")	85.7 mm (3-3/8")	34946	3-3/8"
326179	ETW 43-250	43 - 53	250				
326180	ETW 53-250A	53 - 64	250				
	ETW 56-250	56 - 72	250	46 mm (1-13/16")	85.7 mm (3-3/8")	34946	3-3/8"
326181	ETW 64-250	64 - 77	250				
326182	ETW 72-250	72 - 88	250				
326183	ETW 88-250A	88 - 108	250				
326184	ETW 108-250A	108 - 130	250				
326185	ETW 124-250A	124 - 149	250				
326186	ETW 130-250A	130 - 156	250				
326187	ETW 145-250A	145 - 174	250	52.4 mm(2-1/16")	85.7 mm(3-3/8")	34946	3-3/8"
326188	ETW 161-250A	161 - 193	250	46 mm (1-13/16")	111.1mm(4-3/8")	34946-1	4-3/8"
326189	ETW 189-250A	189 - 227	250	52.4mm(2-1/16")	111.1mm(4-3/8")	34946-1	4-3/8"
326192	ETW 216-250A	216 - 259	250				
326193	ETW 243-250A	243 - 292	250				
326190	ETW 145-330A	145 - 174	330/400	52.4mm(2-1/16")	111.1mm(4-3/8")	34946-1	4-3/8"
326197	ETW 108-165	108 - 130	150/165	36.5mm(1-7/16")	85.7mm(3-3/8")	34946	3-3/8"
326198	ETW 145-165A	145 - 174	150/165				
326199	ETW 161-165	161 - 193	150/165	46 mm(1-13/16")	85.7mm(3-3/8")	34946	3-3/8"
326200	ETW 189-165	189 - 227	150/165				

* Dubilier Capacitors are suitable for use 10% over rated voltage capacity.

END CAP

P/N 30066 1-7/16" Diam.	P/N 34618-2 2-1/16" Diam.
P/N 34618-3 1-13/16" Diam.	P/N 34618-4 2-9/16" Diam.

MOTOR RUN CAPACITORS

"Soggy Foil" Metallized Capacitors

Types KKSF, KTSF and KBSF

Cornell Dubilier's new type "SOGGY FOIL" AC Capacitor represents a unique type of construction using a polypropylene dielectric and metallized electrodes vacuum deposited on both sides of a paper substrate. This new product is smaller in size, lighter in weight and of significantly improved performance over conventional paper-dielectric oil or metallized film types.

SELF HEALING – The new capacitor has Self-Healing properties in the event of dielectric breakdown due to excessive voltage stress result from vapourizing the electrode material around the point of failure. The self-healing operation is accomplished in milliseconds without damage to the dielectric structure. Soggy Foil capacitors may have many self-healing operations without affecting their operation in most circuits. Pressure activated circuit interrupters are also built into the capacitors to give maximum assurance the cases will not rupture at end-of-life.

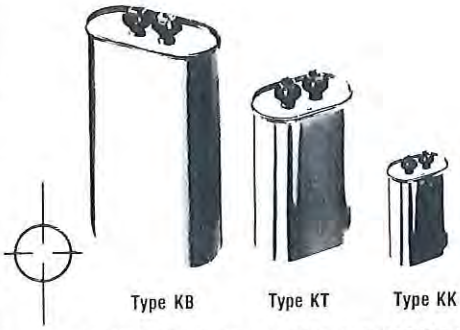
CAPACITOR TOLERANCE – ± 10%.

NON-PCB DIELECTRIC FLUID – Corona free operation with environmental compatibility.

OPERATING TEMPERATURE RANGE – –55°C to 70°C.

LEAK-PROOF QUICK CONNECT TERMINALS – Phenolic cup insulated terminals compression welded with silicone bushings assures permanent oil tight seal.

CAT. NO.	CDE PART No.	MFD	VOLTS AC	DIMENSIONS – INS.	
				BASE (Oval)	HEIGHT
326201	KKSF 44U405 QPI	4.0	440	2.16 x 1.31	2.00
326202	KKSF 44U505 QAPI	5.0	440	2.16 x 1.31	2.00
326203	KKSF 44U605 QAPI	6.0	440	2.16 x 1.31	2.00
326204	KKSF 44U755 QAPI	7.5	440	2.16 x 1.31	2.25
326205	KKSF 44U106 QAPI	10.0	440	2.16 x 1.31	2.75
326206	KKSF 44U156 QAPI	15.0	440	2.16 x 1.31	3.75
326207	KTSF 44U206 QAPI	20.0	440	2.91 x 1.91	2.75
326208	KTSF 44U256 QAPI	25.0	440	2.91 x 1.91	3.25
326209	KTSF 44U306 QAPI	30.0	440	2.91 x 1.91	3.75
326210	KBSF 44U356 QPI	35.0	440	3.66 x 1.97	4.25
326211	KBSF 44U406 QPI	40.0	440	3.66 x 1.97	4.75
326212	KBSF 44U456 QPI	45.0	440	3.66 x 1.97	5.50
326213	KBSF 44U506 QPI	50.0	440	3.66 x 1.97	6.00
326214	KBSF 44U556 QPI	55.0	440	3.66 x 1.97	6.50
326215	KBSF 44U606 QPI	60.0	440	3.66 x 1.97	7.00



Type KB Type KT Type KK

MOUNTING BRACKETS & RUBBER BOOTS
Available on application

IMPORTANT NOTE

THE USE OF PCB (POLYCHLORINATED BIPHENYLS) IN THE MANUFACTURE OF MOTOR RUN CAPACITORS HAS BEEN BANNED BY THE AUSTRALIAN GOVERNMENT – (Notice No. 73/65).

REPLACEMENT CAPACITORS (NON-PCB) SHOULD BE USED
USE EITHER ABOVE "SOGGY FOIL" CAPACITORS
OR THOSE SHOWN ON NEXT PAGE (326-e).

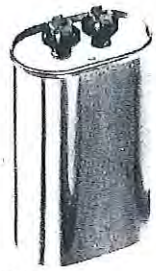
CDE CORNELL-DUBILIER

CAPACITORS

DYKANOL

NON-PCB AC CAPACITORS
Types KKN, KTN, KBN, KNN
Motor Run, Air Conditioning Replacement Line

TYPE KK



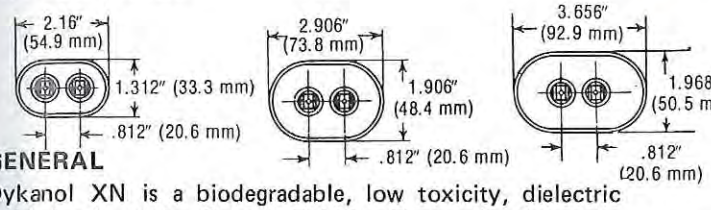
TYPE KT

TYPE KB

FEATURES

- Drawn Seamless Case
- Welded Terminal Assembly
- Extensive Line
- Leak-Proof, Cone Cup Insulator Terminal Bushings
- Quick-Connect Terminals
- Operating Temperature +55°
- Tolerance ±10%
- Cases are Unpainted
- Terne Plate Steel
- Dykanol XN Dielectric Fluid

BASE DRAWINGS



GENERAL

Dykanol XN is a biodegradable, low toxicity, dielectric fluid developed by Cornell Dubilier Electronics for paper and film-paper dielectric capacitors. It meets all requirements for environmental compatibility. Dykanol XN has an excellent field service record for use in many applications during the past four years.

FLAMMABILITY CHARACTERISTICS

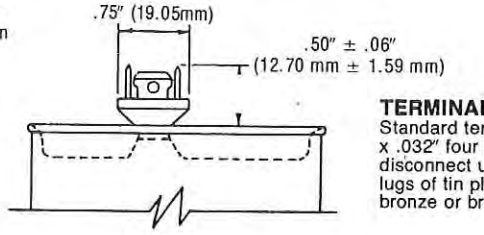
Dykanol XN does not have Dykanol XL's nonflammable properties. It does, however, have a flash point temperature of 210°C, which is higher than XL, and a fire point temperature of 221°C.

INTERNAL PROTECTIVE DEVICE

All capacitors listed in this bulletin are furnished with an internal protective device. Flat oval cased capacitors are listed under Underwriters Laboratories File No. E56959 Project No. 77CH601. The protective device virtually eliminates the occurrence of case rupture and expulsion of internal materials from capacitors at end-of-life.

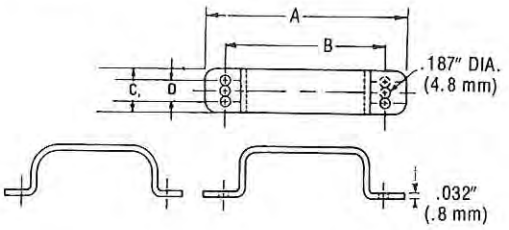
Proper functioning of the protective device depends upon outward movement of the terminals from the case. At least 3/8 inch minimum clearance above the capacitor terminals must be provided in the installation.

TERMINALS



TERMINAL TYPE
Standard terminal .25" wide x .032" four blade quick disconnect universal type lugs of tin plated silicone bronze or brass.

Wrap-around Mounting Brackets



Case Style*	CDE Part No.	DIMENSIONS (Inches)			
		A	B	C	D
KK	30393-5	3.046	2.546	.75	—
KT	30393-9	3.812	3.312	.75	—
KB	30393-10	4.562	4.062	.75	—

CAT. NO.	CAP Mfd.	Part Number	Base	Max. Case Height	
				Inches	(mm)
	440 Volts AC — Single Section				
326277	2	KKN2-44PI	KK	2.062	52.37
326278	3	KKN3-44PI	KK	2.500	63.50
326279	4	KKN4-44PI	KK	3.125	79.38
326280	5	KKN5-44PI	KK	3.750	95.25
326281	6	KKN6-44PI	KK	4.250	107.95
326282	7.5	KKN7.5-44PI	KK	5.125	130.18
326283	10	KTN10-44PI	KT	3.750	95.25
326284	12.5	KTN12.5-44PI	KT	4.500	114.30
326285	15	KTN15-44PI	KT	5.250	133.35
326286	17.5	KTN17.5-44PI	KT	6.000	152.40
326287	20	KTN20-44PI	KT	6.750	171.45
326288	30	KBN30-44PI	KB	7.500	190.50
326289	35	KBN35-44PI	KB	8.500	215.90
326290	25	KBN25-44PI	KB	6.250	158.75

370 Volt AC Capacitors available on application.

CAPACITORS

KIRBY

START CAPACITORS

CAT. NO.	PART No.	REPLACES PART No.	MFD	VOLTS	REMARKS	OBSOLETE
3265	ME825-1*	ME740-1	25	240	With Resistor	ME110-9
3269	ME825-5*	ME740-3	40	240	With Resistor	ME114-14 & -15
3263	ME825-7	ME740-4	40	240	No Resistor	ME110-1 & -5
3266	ME825-9*	ME740-5	60	240	With Resistor	ME110-10
3264	ME825-4	ME740-6	60	240	No Resistor	ME110-2 & -6
3268	ME825-13*	ME740-7	120	240	With Resistor	ME110-12
3267	ME825-3	ME740-2	25	240	No Resistor	ME110-11

* Indicates fitted with 15kΩ 2W discharge resistor.

RUN CAPACITORS

CAT. NO.	PART No.	Includes Clamp P/N	MFD	VOLTS	Replaces P/N	OBSOLETE
32615	ME822-71	MUA423-1	10	440	ME822-31	ME782-1, ME335-19 & -27
32617	ME822-72	MUA423-1	15	440	ME822-33	ME782-3, ME335-1, -2 & -28
32618	ME822-73	MUA423-1	20	440	ME822-34	ME782-9, ME335-24 & -32
32620	ME822-75	MUA423-2	30	440		ME782-6, ME335-29
32621	ME822-76	MUA423-2	35	440	ME822-7	ME782-7, ME335-30

START & RUN CAPACITORS FOR KELVINATOR MODELS

MFD	VOLTS	TYPE	SUITS MODELS
35	440	Start	RAC A23R1
40	220	Start	S5050P, S7550P, T16, T20, CC5050, 50/400, K17M from Ser. No. 3742
40 — 46	220	Start	S5050H, S5050L, S7550L, KM17M to Ser. No. 3741
45	240	Start	S5033L
45 — 55	250	Start	S5033P
50 — 60	220	Start	S44C, S34C
55	275	Start	A3D3CS
55 — 60	275	Start	RAC 1661
55 — 65	250	Start	S44C, S34C, S7575H, S7575L, S1075L, S7575P, S1075P
60	275	Start	1HP Acc. Herm. 1 Phase
60 — 70	220	Start	S33C
75	275	Start	A4D4CS, N4D4CS, A4D4H, A3D3H, 4HSR, 6HDR, 8HDR
76 — 92	220	Start	RAC H1000, BC2/60, S1010H
80	220	Start	S1010P, TP2
90	275	Start	A3D2CS, A2D2HS, NDRC, BC1, BC2, KA12, KA15, RA625
100	250	Start	S1015FH
100	275	Start	1½HP Acc. Herm. 1 Phase
130	275	Start	RAC 750
150	150	Start	¼HP Motor
160	275	Start	¾ to 3HP Acc. Herm. 1 Phase
160	350	Start	RAC 1750
5	400	Run	¾ to 1HP Acc. Herm. 1 Phase
8 — 9	440	Run	S5033FL
10	350	Run	S5050H, S5050L, S7550L, S7575H, S7575L, S1075L, K17M to Ser. No. 3741
			S5033P, S5050P, S7550P, S7575P, S1075P, T16, T20, K17M from Ser. No. 3742
10	400	Run	CC5050, 50/400, RAC0822, ARJ0822S
10	440	Run	1HP to 3HP Acc. Herm. 1 Phase
15	370	Run	RAC H1000, BC2/60, S1010H, HA/B/C/D/E/F — 1000, 1002, 1005, 1008, 1021,
			1031, 1032, 1042, 1051, 1081, 1082, 2503, 2531, 51C2, 51C3, 51C4, 51D2,
			RAC 1750 (Sterne CSCR Comp), 2503 (Comp. No. 2)
			S1010P, TP2

Continued next page.

SELECT CAPACITORS FOR ABOVE KELVINATOR MODELS FROM CORNELL-DUBILIER, PAGE 326-d

CAPACITORS

START & RUN CAPACITORS FOR KELVINATOR MODELS

MFD	VOLTS	TYPE	SUITS MODELS
15	400	Run	RAC 51D3, 51D4, 51E2, 51E4, 51F1, 51F1E, ARA, ARB, ARV, ARAG,
			51E090, 51E090R, AK093M, AK096M, AW093M, AW096M, CN185C, CN185D,
			EN185C, EN185D, KC2555Q, LC2555Q, SD2555Q
15	440	Run	RAC750
20	370	Run	RAC1500, 1502, 1508, 1521, 1531, 1542, 1581, 1582, 1661, 2531, 51C6,
			51D6, 51F6, 51F6E, 51F2, 1758, 2503 — Comp. No. 1
20	400	Run	RAC51F4, ARC, ARD, ARK, ARL, ARM, ARN, ARW, ARX, ARY, ARAA,
			MDJ115, MDJ115R, AK123M, AK126M, AW123M, AW126, AW126M, CT235C,
			CT235D, EN235C, EN235D, EN320C, EN320D, ER235C, ER235D, RF235C,
			RF235D, RF320C, RF320D
20	440	Run	RAC1750 (B32 — T18 Comp.), S1015FH
25	440	Run	RAC1750, 1758, 51C7 (B74 — T18 — B312 Comp.)
30	370	Run	RAC1721, 1742, 1752, 1758, 1781, 1782, 2042, 2082, 51C7, 51D7, 51E7E,
			51E8E, 51F7, 51F7E, 51F8, 51F8E, 51E165, 51E165R, 51E190, 51E190R,
			AK173M, AK176M, AK203M, AK206M, AW173M, AW176M, AW203M, AW206M,
			MDJ165, MDJ165R, ARE, ARF, ARG, ARH, ARP, ARR, ARAB, ARAC, ARAD,
			ARAE, CF450D, EN450C, EN450D, EN515D, RF450C, RF450D,
			RF515D (B74 — T18 — B304 Comp.)
2	440	Fan	1 HP to ¾ HP. Acc. Herm. 1 Phase
2.5 & 5	330	Fan	RAC H1000
3.5	440	Fan	RAC 1661, 1661/3
4	440	Fan	RAC 1002, 1005, 1008, 1021, 1051, 1081, 1502, 1508, 1521, 1581, 51C2, 51C3,
			51C4, 51D2, 51D3, 51D4, 51C6, 51D6, MDJ115, MDJ115R
			RAC 1500 (for RC251 Motor only)
			RAC 1031, 1032, 1042, 1531, 1542, 1582, 1742, 1742/3, 1782, 2042, 2082,
			0822, 51E2, 51E4, 51E6E, 51E7E, 51E8E, 51E090, 51E165, 51E165R,
			51E190, 51E190R, 51F1, 51F1E, 51F2, 51F4, 51F6, 51F6E, 51F7,
			51F7E, 51F8, 51F8E, AK093M, AK123M, AK126M, AK173M, AK176M,
			AK203M, AK206M, AW093M, AW096M, AW123M, AW126M, AW173M,
			AW176M, AW203M, AW206M, ARA, ARB, ARC, ARD, ARE, ARF, ARG,
			ARH, ARJ, ARK, ARL, ARM, ARN, ARP, ARR, ARV, ARW, ARX, ARY,
			ARAA, ARAB, ARAC, ARAD, ARAE, ARAG, EN185C, EN185D, EN235C,
			EN235D, EN320C, EN320D, EN450C, EN450D, EN515D, ER235C,
			EL450D, CN185C, CN185D, CT235C, CT235D, CF450D, RF235C, RF235D,
			RF320C, RF320D, RF450C, RF450D, RF515D
			RAC 2503, 2531 (Cond. Fan — Double spades)
			RAC 2503, 2531 (Evap. Fan — Eyelets)
			Peerless Coolers for M199 Motor
6	440	Fan	RAC HA/B/C/D/E/F 1000
			RAC 1500 (For RC181 Motor only)
			RAC 1500, 1750
8	400	Fan	RAC A23R1
15 x 3	440	Fan & Run	RAC K3825
20 x 3	400	Fan & Run	RAC K41235, K41235A, KAC41255, LAC41255, SD41255
20 x 3	440	Fan & Run	RAC K41255
25 x 3	400	Fan & Run	RAC KAC41455
35 x 3	400	Fan & Run	RAC KAC41755

SELECT CAPACITORS FOR ABOVE KELVINATOR MODELS FROM CORNELL-DUBILIER, PAGE 326-d

OUR STOCK OF COMPONENTS, EQUIPMENT AND SYSTEMS FOR AIR CONDITIONING, HEATING, COMMERCIAL AND INDUSTRIAL REFRIGERATION IS UNSURPASSED THROUGHOUT AUSTRALIA

IF IT IS NOT LISTED IN THIS CATALOGUE — ASK US ANYWAY
WE HAVE MANY ITEMS AND ACCESSORIES TOO NUMEROUS TO LIST
WE CAN PROBABLY HELP YOU

Danfoss

MOTOR STARTERS, CONTACTORS & RELAYS

C10

CT10

T16

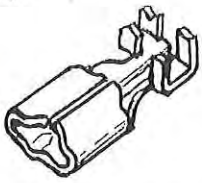
CAT. NO.	DESCRIPTION	CODE NO.	DETAILS
327226	CHT16 Motor Starter	47L1230	220V. 16A O/reset.
327230	CT10 " "	47B1227	10A "
327244	CT10 " "	47B1207	10A I - O/reset
327245	CT10 " "	47B1208	10A "
327246	CT10 " "	47B1209	10A "
327242	CHT16 Mot. Start Case	47L0017	2 PB (Start-Stop/Reset).
327240	CT10 " " "	47B0017	" " " "
327241	CT10 " " "	47B0018	1 PB (Stop/Reset)
327231	CT10 Contactor	37B0171	
327229	CH16 "	37L0021	
327243	CH10 Contactor Case	37B0261	
327232	C6 Control Relay	37B0151	
327233	T16 Thermal Relay	47L0070	
327235	240 Volt Coil	37B6473	For C6, CH6, C10, CH10, CH16, CH25
327234	415 Volt Coil	37B6479	" " " " " " "

IK.40.A2.02

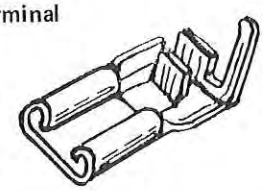
Other Danfoss Motor Control Gear available on application.

R.E. QUICK CONNECT TERMINALS

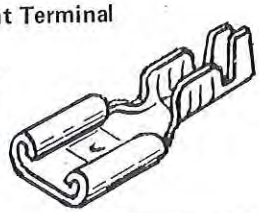
RE 1T Fusite Pin Terminal
Packet of 30
CAT. NO. 32750



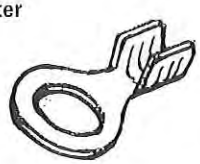
RE 2T Female Flag Terminal (right angle)
Packet of 30
CAT. NO. 32751



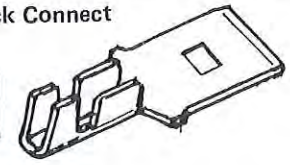
RE 3T Female Straight Terminal
Packet of 30
CAT. NO. 32752



RE 4T Eyelet 5/32" Diameter
Packet of 30
CAT. NO. 32753



RE 9T Male Tab Quick Connect
Packet of 30
CAT. NO. 32757



RE 5T Eyelet 3/16" Diameter
Packet of 30
CAT. NO. 32754

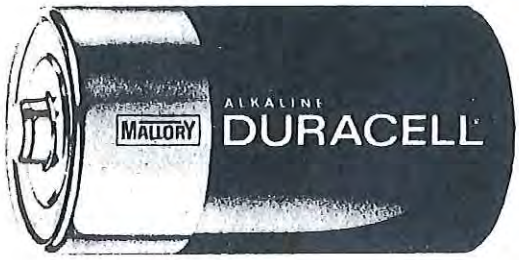
RE 1-2T Mixed Terminals
Packet of 30
CAT. NO. 32755

RE 1B Terminal Seal Bushes
Packet of 15
(Can be used as charging hose bushes)
CAT. NO. 32761

RE 1-2-3T Mixed Terminals
Packet of 30
CAT. NO. 32756

MALLORY DURACELL® Popular Alkaline Batteries

Suffix "B" denotes Blister Card



MN1300

MN1400

MN1500

MN1604

Blister Card Types

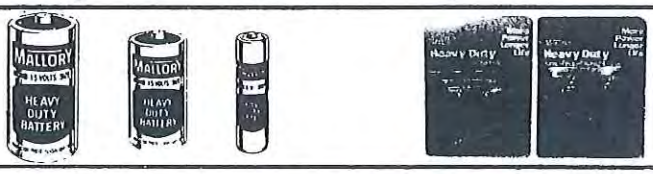
CAT. NO.	CODE No.	DESCRIPTION
327163	MN1300B2	D Size — 2 Pack
327166	MN1400B2	C Size — 2 Pack
327169	MN1500B2	AA Size — 2 Pack
327168	MN1500B4	A4 Size — 4 Pack
327170	MN1604B	9 Volt

MALLORY General Purpose Batteries

CAT. NO.	CODE NO.	DESCRIPTION
327150	M13FB2	1.5V D Size — 2 Pack
327152	M14FB2	1.5V C Size — 2 Pack
327154	M15FB4	1.5V AA Size — 4 Pack

CAT. NO.	CODE NO.	DESCRIPTION
327158	M1604B	9 Volt — 1 Pack
327156	M908	6 Volt Lantern
327157	M918	6 Volt Lantern

MALLORY Heavy Duty Batteries



CAT. NO.	CODE NO.	DESCRIPTION
	M13HD-2	1.5V D Size — 2 Pack
	M14HD-2	1.5V C Size — 2 Pack

CAT. NO.	CODE NO.	DESCRIPTION
	M15HD-4	1.5V AA Size — 4 Pack
	M1604HD-1	9 Volt — 1 Pack

Battery Cross Reference Guide

VOLTS-TYPE	MALLORY	EVEREADY	JAPANESE
1.5 D	MN1300	E95	AM-1
1.5 C	MN1400	E93	AM-2
1.5 AA	MN1500	E91	AM-3
9	MN1604	—	—

VOLTS-TYPE	MALLORY	EVEREADY	JAPANESE
1.5 AAA	MN2400	E92	AM-4
N	MN9100	E90	AM-5
1.5 Button	PX825	EPX825	PX825

327-b

TECHNICAL BOOKS — PUBLICATIONS

 CAT. NO. 327297	**SAMS ABC's OF AIR CONDITIONING** Covers the theory and operation of air conditioners, common applications, the electrical system, tools and equipment, and repairing of air conditioners. It deals with principles, components, and practises which are common to all air conditioners. Also covers laws governing temperature, heat transfer, behaviour of liquids and gases, cooling by evaporation, effects of pressure and vacuum, and types of air conditioning systems. 128 pages. 5½" x 8½" with soft cover. Fully illustrated.
 CAT. NO. 327298	**SAMS ABC's OF ELECTRICITY** Starts with the basic principles of electricity and covers subjects like electrons, simple laws of electricity, how electricity is generated, and how basic electrical and electronic circuits are constructed. Has chapters on Electricity, Batteries, Magnetism, and Alternating Current Theory. Easy to understand, is completely illustrated. 96 pages. 5" x 8½" with soft cover.
 CAT. NO. 327296	**SAMS ABC's OF ELECTRIC MOTORS AND GENERATORS** A basic introduction to motors and generators, describing how they operate and what they do. Starting with magnetic fields and electric currents it covers AC and DC motors and generators. 126 pages. 5½" x 8½" with soft cover.
 CAT. NO. 327294	**SAMS ABC's OF CAPACITORS** Written in easy to understand language it explains how various types of capacitors are constructed, their typical characteristics and applications, how to select replacements, and practical methods of testing and measuring capacitors. Has chapters on What Is A Capacitor, Capacitor Theory, Capacitor Construction, Capacitor Application, Capacitor Replacement, and Capacitor Testing. Complete with illustrations and electrical circuits. 96 pages. 5½" x 8½" with soft cover.
 CAT. NO. 327295	**SAMS FIX YOUR SMALL APPLIANCES** These books go into detailed directions to repair small appliances with wiring diagrams of connections and photographs of parts No. 27422 Vol. 1 includes table ovens, rotisseries, skillets, waffle irons, coffee makers, irons, toasters, bottle warmers, heaters, hair dryers, and blankets. No. 27423 Vol. 2 includes fans, carving knives, can openers, knife sharpeners, shoe polishers, sewing machines, mixers, blenders, grinders, hair dryers, vacuum cleaners, and shavers. Paper back 5-3/8" x 8½", 160 Pages. 27422 Vol. 1 Fix Your Small Appliances. 27423 Vol. 2 Fix Your Small Appliances.
 CAT. NO. 327299	**SAMS HOW TO REPAIR MAJOR APPLIANCES** Describes the repair and maintenance of major home appliances, including refrigerators, freezers, washing machines, clothes dryers,, ranges, dish washers, garbage disposers, air conditioning, water heaters, and electric appliance motors. Fully illustrated. 216 pages. 5½" x 8½" with soft cover.
 CAT. NO. 327285	**USING SI UNITS IN HEATING, AIR CONDITIONING AND REFRIGERATION** Professor W.F. Stoecker shows how the Standard International (SI) metric system applies to the HVAC and refrigeration fields with 56 examples. Included are the psychrometric chart and P-H diagrams for R-12, R-22 and R-717, all in SI units. 48 pp. 14 ills. 21 tables. 8½ x 11. soft cover.
 CAT. NO. 327279	**IMPERIAL AUTOMOTIVE AIR CONDITIONING SERVICE MANUAL** Covers all phases of servicing automobile air conditioners. Has chapters on Basic Theory; Description of Systems Components; Testing Equipment; Performance Testing & Specifications; Testing the System; Compressor and Clutch Servicing; GM Air Assembly Servicing; Temperature Control Systems. Complete with illustrations and charts. Over 162 pages. With soft cover. Size 7" x 11"
 CAT. NO. 327293	**ROBINAIR SERVICE MANUAL NO. 10561**
 CAT. NO. 327286	**MODERN REFRIGERATION AND AIR CONDITIONING**
 CAT. NO. 327287	**BASIC REFRIGERATION – Guy King**

TECHNICAL BOOKS — PUBLICATIONS

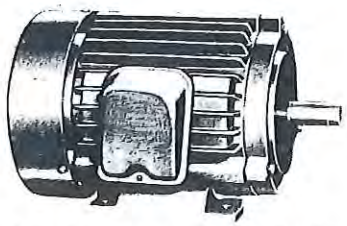
RE HANDBOOK OF REFRIGERATION SEALED UNIT ELECTRICALS This handbook, compiled by Refrigeration Electricals Pty. Limited, is provided specifically for the refrigeration service mechanic, to assist him in the day to day problems he encounters in the rapidly growing field of sealed unit refrigeration service. If a replacement relay, overload or capacitor is required, merely identify it alongside the appropriate motor compressor and order by the 'Refrigeration Electricals Pty. Limited' part number.	CAT. NO. 327292
KIRBY REFRIGERATION SERVICE BOOK — 1980 EDITION The purpose of this Service Book is to provide the Refrigeration and Air Conditioning Engineer with helpful information concerning the installation and servicing of Kirby-Tecumseh Compressors. The information in this Kirby Service Book is generally related to the Compressor and to items and conditions affecting the installation, operation and servicing of the Compressor. Useful Technical Data and Tables are included.	CAT. NO. 327291
HOW TO DESIGN HEATING-COOLING COMFORT SYSTEMS Applying the 1972 ASHRAE Comfort Standards, Joe Olivieri shows you five ways to solve a typical design problem — heat and cool a large, one-storey medical clinic — using a fancoil, throughwall, baseboard, multizone or double duct system. 320 pp. 289 ill. 63 tables. cloth.	CAT. NO. 327276
HOW TO HAVE AIR-CONDITIONING AND STILL BE COMFORTABLE Herb Laube evaluates the merits and demerits of air conditioning systems — based on 40 years of executive level experience with the economics, design and operation of comfort systems. 254 pp. 14 tables. cloth.	CAT. NO. 327284
HOW TO MAKE IT IN THE SERVICE BUSINESS Read Ray Schneider and you'll agree that you need intelligence, persistence and an unfailing sense of humour to last out the first year in your own air conditioning and refrigeration service business. 192 pages. cloth bound.	CAT. NO. 327278
NEW WAYS TO SOLVE YOUR REFRIGERATION AND AIR CONDITIONING SERVICE PROBLEMS Let Carl Geist show you the "thinking man's" approach to solving problems. 256 pages. 126 ill. 4 tables. cloth.	CAT. NO. 327277
GETTING STARTED IN HEATING AND AIR CONDITIONING SERVICE — REVISED Allen Russell updates service training with a book that analyzes controls and systems, introduces you to the serviceman's tools and instruments and gives you a detailed view of components. 224 pp. 353 ills. 13 tables. cloth.	CAT. NO. 327283
LICENSED OPERATOR'S KEY TO REFRIGERATION For the reader who needs to know ammonia refrigeration systems — with their cycle and safety controls — and the man studying for his 3rd class Refrigeration Operator's License. 218 pp. 123 ills. 9 tables. 5½ x 8¼. cloth bound.	CAT. NO. 327282
MARINE REFRIGERATION AND FISH PRESERVATION John Mead shows you which systems to use, what temperatures to hold, and what a system for these 50 to 100 foot boats should cost. 256 pp. 137 ill. 17 tables. cloth.	CAT. NO. 327281
PRINCIPLES OF REFRIGERATION by R.J. Dossett.	CAT. NO. 327280
ACTROL PARTS 1983 CATALOGUE & TECHNICAL MANUAL No. 4. If you are reading this item - you already know how valuable, useful and almost indispensable the role this Manual plays in the Refrigeration and Air Conditioning Industry. **Recommend it to your friends and associates.**	CAT. NO. 327288

WE ARE ADDING TO THE RANGE CONTINUALLY — COME AND "BROWSE"

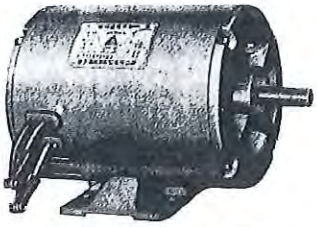
ELECTRIC MOTORS

TECO

STANDARDISED METRIC RANGE
TOTALLY ENCLOSED FAN COOLED SQUIRREL CAGE
THREE PHASE INDUCTION MOTORS



TEFC, Foot-mounted Three-phase, Squirrel-cage Motor



Drip-proof Single-phase Squirrel-cage Motor

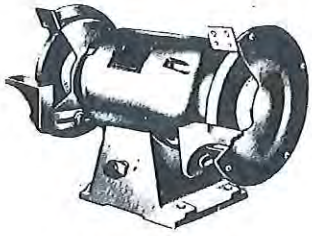
CAT. NO.	kW	HP	SPEED RPM	FRAME	SHAFT Diam. mm
327351	0.18	1/4	1400	63	11
327352	0.37	1/2	1400	71	14
327353	0.75	1	1410	80	19
327354	1.5	2	1435	90L	24
327355	2.2	3	1430	100L	28
327356	3.7	5	1430	112M	28
327357	5.5	7.1/2	1460	132S	38
327358	7.5	10	1460	132M	38
327359	11	15	1465	160M	42
327360	15	20	1470	160L	42
327361	18.5	25	1470	180M	48
327362	22	30	1455	180L	48
327363	0.18	1/4	935	71	14
327364	0.37	1/2	945	80	19
327365	0.75	1	930	90S	24
327366	1.5	2	935	100L	28
327367	2.2	3	955	112M	28
327368	3.7	5	950	132M	38
327369	5.5	7.1/2	970	132M	38
327370	7.5	10	960	160M	42
327371	11	15	960	160L	42
327372	15	20	960	180L	48
327373	18.5	25	970	200L	55
327374	22	30	975	200L	55
327401	0.18	1/4	2800	63	11
327402	0.37	1/2	2800	71	14
327403	0.75	1	2800	80	19
327404	1.5	2	2780	90S	24
327405	2.2	3	2800	90L	24
327406	3.7	5	2860	112M	28
327407	5.5	7.1/2	2900	132S	38
327408	7.5	10	2900	132S	38
327409	11	15	2900	160M	42
327410	15	20	2880	160M	42
327411	18.5	25	2900	160L	42
327412	22	30	2950	180M	48

TECO 240 VOLT SINGLE PHASE MOTORS
CAPACITOR START.

327376	0.18	1/4	1500	DQW-B4	
327377	0.25	1/3	1500	DQW-B4	
327378	0.37	1/2	1500	DQW-B4	
327379	0.55	3/4	1500	DQW-B4	
327380	0.75	1	1500	DQW-B4	

TECO BENCH GRINDERS

6 inch & 8 inch 230 Volt Single Phase



Bench Grinder

CAT. NO.	SIZE
327390	8"
327391	6"

NOTE : FIRST 3 NUMERALS OF CAT. No. INDICATES PAGE No.

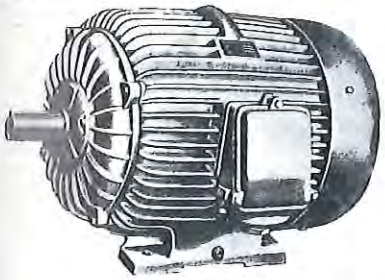
WE BELIEVE IN CONTINUALLY STUDYING THE LOCAL AND INTERNATIONAL MARKETS TO MAKE AVAILABLE THE MOST MODERN TYPE OF EQUIPMENT

ELECTRIC MOTORS

MECHTRIC

TYPE "SE"
STANDARDISED METRIC RANGE THREE PHASE SQUIRREL CAGE MOTORS TOTALLY ENCLOSED FAN COOLED

INSULATION: Class "E" insulation with maximum temperature rise of 75°C above ambients of 40°C is used in the range of standard "SE" motors.
COOLING: The "SE" motors are cooled by air stream forced along side the external frame-ribs by a fan mounted on shaft at the non-drive end of motor. Air stream is independent from the direction of rotation.
VOLTAGE VARIATION : The "SE" motors will operate satisfactorily with voltage variations up to plus or minus 10% but providing that the frequency remains constant.



CAT.NO.	kW	HP	SPEED RPM	FRAME	SHAFT SIZE mm
327326	0.75	1.0	1380	80	19
327327	1.1	1.5	1410	90S	24
327328	1.5	2.0	1415	90L	24
327329	2.2	3.0	1415	100L	28
327330	3.0	4.0	1405	100L	28
327331	4.0	5.5	1420	112M	28
327332	5.5	7.5	1440	132S	38
327333	7.5	10.0	1445	132M	38
327334	11.0	15.0	1450	160M	42
327335	15.0	20.0	1445	160L	42

2 POLE, 6 POLE AND 8 POLE MOTORS AVAILABLE ON APPLICATION

ELECTRIC MOTOR HINTS

QUICK DIAGNOSIS OF MOTOR AILMENTS

(From Brook Motors Publication - "Installation and Maintenance of Electric Motors").
Inspection at regular intervals and full use of testing instruments are chapter and verse of efficient motor maintenance.
And between inspections, alertness to the first signs of motor ailments can nip a great deal of trouble in the bud. Common trouble symptoms — for which it pays to be on the look-out — are listed below.
Remember, if you lack the time or facilities to handle your own inspection and service properly — or if your motors fail to respond to your own servicing — it is best to consult a reputable motor servicing shop.

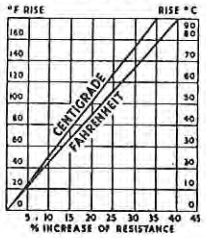
Symptom	Possible Causes	Cure
SYMPTOMS YOU CAN SEE		
1. Motor won't start.	Usually line trouble—single phasing at starter.	Correct. Check source of power supply. DON'T merely try to make it go—while motor sits there and "fries"!
	Load too heavy. Disconnect motor to see if it starts without load	Reduce load—or replace motor with unit of greater capacity.
SYMPTOMS YOU CAN HEAR		
2. Excessive hum.	Uneven air-gap. Measure with feelers.	Replace bearings—before introduction of scraping noise indicates rotor is rubbing against stator.
	Unbalanced rotor. Check on parallel bars.	Balance with solder on band — or weight attached by cap screw and lock washer.
3. Regular clicking.	Foreign matter in air gap	Take out rotor; remove matter.
4. Rapid knocking.	Misalignment — probably causing shoulder of shaft to pound periodically against bearing end.	Realign set until knocking disappears.
5. Brush "chatter".	Extreme motor vibration.	See items 6 and 7 below.
SYMPTOMS YOU CAN FEEL		
6. Vibration	Misalignment.	Realign set.
	Vibration in driven machine. Run motor disconnected for check.	Eliminate source in machine, if possible. Or change to a flexible belt drive may be in order.
7. Vibration —following motor repair.	Rotor out of balance due to holes drilled or weights shifted ... new rotor coil or coils.	Balance rotor.
8. Motor over-heating (Check with thermometer — don't depend on hand).	Overload. Measure load; compare with nameplate rating.	Check for excessive friction in motor, drive or machine. Reduce load, or replace motor with unit of greater capacity.
	Dirt in motor. Check flow of ventilating air.	Blow out motor. Use solvent on wound section if necessary.
	Rotor rubbing on stator.	Replace bearings.
	Shorted stator windings.	Test with wattmeter and correct.
	Earth.	Locate with test lamp or growler and repair.
9. Bearing over-heating.	Misalignment.	Realign set. And in this — as in all cases of bearings over-heating —keep shafts turning until bearing is cooled... to prevent "freezing".
	Too much tension in chain or belt drive.	Reduce tension to point of adequacy.
	Excessive end thrust.	Reduce thrust from drive or machine. (Shaft should be permitted reasonable "axial" float). Or if motor is off level, shim-up lower end to take thrust off its bearing.

TEMPERATURE TESTS

If the motor becomes hot, take temperature tests as follows — Hang one thermometer (reading 0—110°C. or 0—230°F.) in the room near the machine, if possible in the current of cooling air being drawn into the machine: this will give the ambient temperature.
Place one or more thermometers in contact with the hottest stationary parts of the machine, such as bearing bushes, field coils, stator, etc. The correct method is to place the bulb of the thermometer firmly against the machine and then wrap a piece of cotton-wool firmly round the bulb against the part of the machine surrounding the bulb.
Leave these in position until temperatures cease to rise, also leave them in position after stopping machine, as temperature may rise after machine has been stopped.

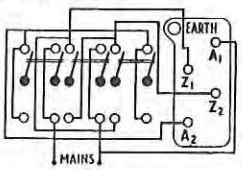
CHECKING WINDING TEMPERATURES

Should a maintenance engineer have doubts about the temperature rise of a motor, the following method will be found an accurate check on temperature in the hottest part of the winding, and does not require a thermometer or dismantling of the machine. Using a battery D.C. ammeter and volt meter the resistance of the motor winding can be taken when cold. If it is again measured at the maximum motor temperature, the temperature rise can be taken by reference to the chart.
Thus, if a stator winding has a resistance of 26 ohms cold and 30.2 ohms after the motor has been on load, this gives an increase of 16% in resistance, which by the chart indicates a rise in temperature of 22°C (72°F).



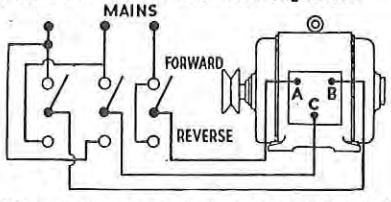
REVERSING SINGLE PHASE MOTORS

In the case of single phase motors it is necessary to reverse the starting winding relative to the running winding. Consequently any links between the starting and running winding should be removed.



REVERSING THREE-PHASE MOTORS

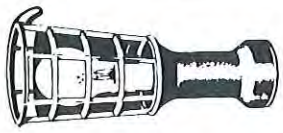
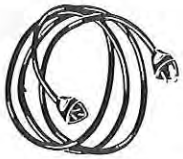
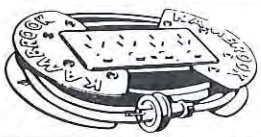
It is common knowledge that to reverse a three-phase machine it is only necessary to reverse two of the incoming lines.



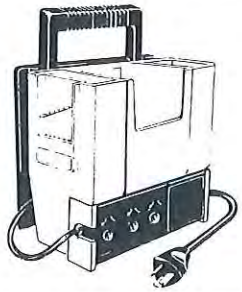
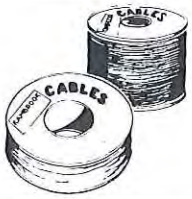
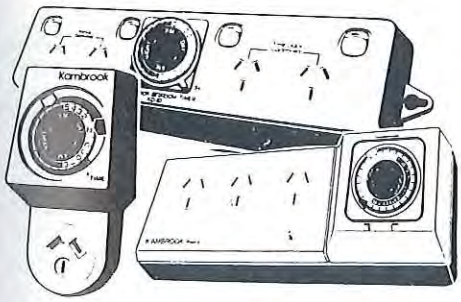
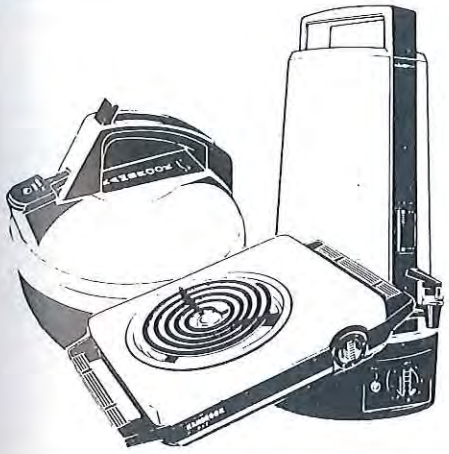
The use of a triple-pole change-over switch enables this to be done frequently, and without damage to the motor, by simply throwing the handle over from one position to the other.

5

KAMBROOK*
ELECTRICAL PRODUCTS

	PART No.	CAT. NO.	DESCRIPTION
	TF1	32725	**TROUBLE FINDER LAMP** Super practical Poly Trouble Lamp with 3-pin socket moulded into base. Just plugs in to existing extension lead.
	X3 (3 metres)	32726	**EXTENSION LEADS** Standard 10 Amp Extension Leads complete with 3-pin plug and socket. **(1.5, 5, 10, 15, 20 and 30 metre lengths available on application).**
	EX7 (7 metres)	32727	
	EL1 (7 metres)	32738	**EXTENSION LEAD PACK** Portable roll-it-away power point. Use whatever length of cord you need to plug-in your drill, electric saw or whatever and when you're finished, roll it up !. **Two sizes: EL1 – 7 metres flex and EL3 – 12 metres flex.**
	EL3 (12 metres)		
	KD14		**POWER ADAPTOR** For the Tradesman and the Handyman. Tough and rugged the Kambrook Power Adaptor converts an extension lead into four separate power points.
	KD18	32739	**FLAT PACK POWER BOARD** Australia's most widely used multiple power point. The portable power board with four outlets each controlled by Double Pole Switches with Safety Shutters. Neon light indicates when the power is on. Just plug it in to your existing power point.
	KD17	32742	**SAFETY FOUR OUTLET** Convert your single or double power points into four convenient outlets. There's no cutting or drilling necessary – the Safety Four uses the same fixing centres as your old powerpoint. Double pole switches include safety shutters.
	KD30	32778	**LIGHT AND POWER REEL** The 3-IN-ONE from Kambrook. It's an extension lead with two power outlets and light. Perfect for workshops, handymen and tradesmen.
	KD20	32779	**POWER REEL** It's 7 metres of flex on a reel with the famous Kambrook 4 outlet Flat Pack. Every tradesman and handyman needs one of these.

KAMBROOK*
ELECTRICAL PRODUCTS

	PART No.	CAT. NO.	DESCRIPTION
	KD33		**DRILL TIDY WITH 3 OUTLETS** A Portable, Lightweight unit designed to hold an electric drill plus a lot of work tools and drill bits. Complete with 3 point powerboard and 5 metres of flex. An extremely useful unit for tradesmen and servicemen.
		32749	**3 - CORE FLEX** Sold per metre
	S2	32746	**SAFETY PLUG** Prevents young children tampering with live power points. All you do is push safety plug into power point. To remove, insert key, turn and pull.
	KD44	32780	**PLUG - IN TIMER** The super-simple Kambrook 24 hour timer that just plugs-in to your powerpoint. Ideal for security lighting in the office, workshop or home. Swivel action plug makes it easy to fit any powerpoint, anywhere.
	PB3		**3 OUTLET POWER BOARD & TIMER** The solution to the annoying problem of not enough power points. One outlet only is time switched for added convenience and security. Complete with handy length of flex and plug.
	KD41	32781	**MULTI - PURPOSE TIMER** Specially designed for wall mounting. Features two time switches. These time-switched outlets turn alarm circuits, lights etc. on and off three times each 24 hours.
	K6	32773	**ELECTRIC URN** Unique, practical and with 50 cup capacity. Very functional for busy people. All the boiling water you need for a day full of cuppa's.
	KD50	32774	**HOT PLATE** Your extra cook-top. Superbly practical and functional styling. Ideal for table top cooking, caravans, patios or even for those small heating jobs in the workshop or factory. Finger-tip simmerstat for instant heat control and powerful 2100 Watt element.
	K9/9	32775	**WHISTLER KETTLE** Australia's favourite electric kettle. It whistles continuously at boil. Safety cut-out for boil-dry protection. Detachable cord and 2.5 litre capacity.

5

327-h

FROSTEX™

One heater for all jobs
- Cut to length
- Simple and easy to install
- No transformer
- No thermostat
- Splice it—Tee it
- Cross over safely
- Cannot burn out
- Safe on plastic

for Drain Lines
Fan Cowlings
Display Casings
Drip Trays

FreezGard
Self-regulating
Heating Tape

INTRODUCTION

FreezGard Heating Tape is designed to be permanently secured to metallic or thermoplastic piping systems and equipment to prevent freezing and frost build-up. For use in dry, ordinary areas only. This heating tape differs from other pipe heating systems due to the physical construction of the heating element. Electrical properties of the FreezGard heating element are such that a thermostat is not necessary for use with this system. The unique self-regulating heating element controls its own heat output in response to temperature changes. As the temperature drops, the heating element increases its output; as the temperature rises, the heating element decreases its output at every point along its length. FreezGard parallel circuit construction allows the heating tape to be cut to length without affecting its heating properties.

Limitation of Use

The heating tape is intended for installation on metallic or thermoplastic pipe. It can be used for indoor or outdoor applications where the system will be covered by non-combustible thermal insulation. The heating tape is intended for freeze protection of piping systems that have a maximum pipe temperature of 90°C. Any one run is limited to a maximum heating tape length of 152 metres (500 ft.) for 240 volts.

FEATURES

Unique Construction: Heat is generated in the unique patented core between parallel conductors.

Cut to Length: Parallel circuit allows you to quickly custom-make the heater you need at the job with ordinary tools. No special voltage transformers or tools needed.

Self-Regulating: Controls its own thermal output in response to the surrounding temperature. No need for thermostats.

Safe: Self-regulation means no hot spots or burnouts, even where overlapped. No hot spots means it can be used with rubber foam insulation or with PVC pipe rated at 60°C.

Rapid Installation: Simple connection and termination components allow quick assembly.

Cost Saving: Replaces an entire inventory of fixed-length heaters. Eliminates service calls to pre-determine heater installation requirements. Stops call-backs related to heater failure. No waste: the remaining piece from one package can be easily spliced to heat tape from another package.

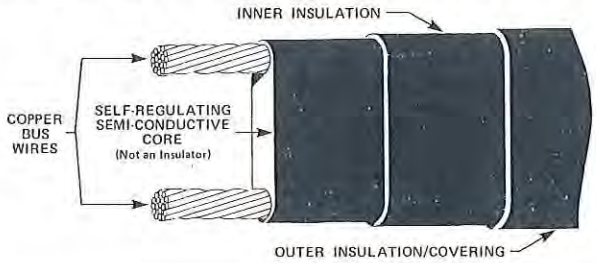
Flexible: Wraps easily around pipe and fittings even at the lowest temperatures.

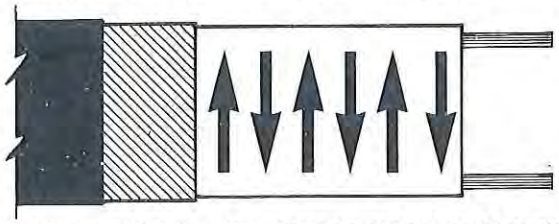
HOW DOES IT WORK

Electricity flows from one conductor to the other wherever the graphite core network permits. While the core material is cold and dense there are many paths through the network, the current flow is large and much heat is produced.

The core material expands as it heats. In expanding the graphite core network is drawn thin, disrupting some electrical paths. As the heating and expansion continue, more paths are disrupted. The heat output falls off and the system reaches a state of self-controlled thermal stability.

If the ambient temperature drops, the core responds by cooling, contracting and reconnecting electrical paths and producing more compensating heat. This is the self-limiting phenomenom. It occurs independently at each point along the heating tape.





DIAGRAMMATIC ILLUSTRATION OF ELECTRICITY FLOW BETWEEN COPPER CONDUCTORS

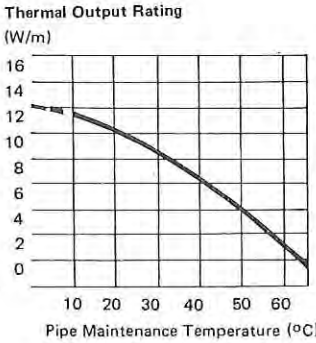
CAT. NO.	DESCRIPTION	SIZE - P/N
32740	FreezGard Self-Regulating Heating Tape 15.2 m (50 ft)	P/N RS-2 Sold per metre
32736	ATUM Heat Shrinkable tubing, meltable adhesive inner wall	SIZE 3/1 * Sold per metre
32737	ATUM Heat Shrinkable tubing, meltable adhesive inner wall	SIZE 12/4 * Sold per metre
32741	Power Connection Kit and End Seal	P/N FCT-5**

* SIZE (expanded/recovered - Diam. in mm)

** Contents of FCT-5 Kit:

2 x 50 mm lengths of ATUM 12/4
1 x 75 mm length of ATUM 12/4
2 x 25 mm lengths of ATUM 3/1
4 x insulated crimp sleeves

TECHNICAL DATA	
Service Voltage	240V.AC
Nominal Thermal Rating @ 10°C (50°F) *	13 Watts/m (4 Watts/ft)
Maximum Circuit Length	152 metres (500 ft)
Circuit Breaker Sizing: If started at — 10°C (50°F)	.1 Amp/m (.03 Amp/ft)
If started at — —20°C (0°F)	.13 Amp/m (.04 Amp/ft)
If started at — —30°C (—20°F)	.16 Amp/m (.05 Amp/ft)
Exposure Temperature: Continuous — Power On	65°C(150°F)



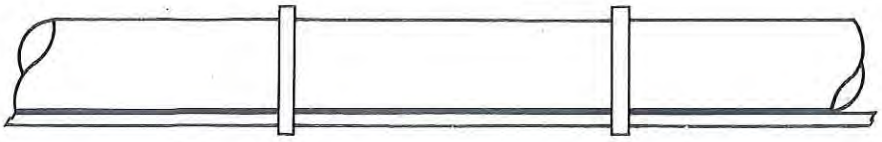
-10°C +30% heat

FROSTEX™ FreezGard Self-regulating Heating Tape

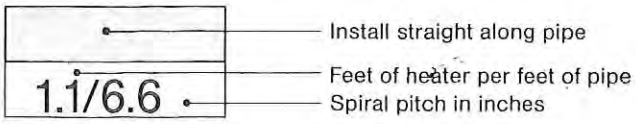
SELECTION PROCEDURE

1. Determine the pipe or tubing size to be used, insulation thickness, and lowest ambient temperature.

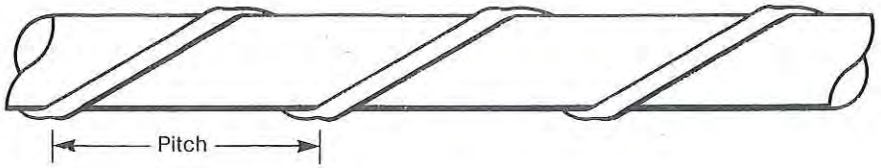
2. Refer to the following tables to calculate the footage and spiral pitch of FreezGard heater required for each foot of pipe.



Note: When only 1.0 foot of FreezGard heating tape is needed per foot of pipe, spiralling is not required. In such cases, install a straight length of heating tape. Locate the heating tape on the bottom of the pipe whenever possible.



Warning: The FreezGard heating tape and the thermal insulation must remain dry at all times during installation and use. The insulation should be waterproofed with all joints and seams thoroughly sealed.



3. Find the total footage of FreezGard heating tape needed by multiplying the measured pipe length by the amount of heating tape per foot of pipe found in the table.

Pipe Size / Tubing Size	Nominal, Inches	3/8" / 1/2"	1/2" / 3/4"	3/4" / 1"	1" / 1 1/4"	1 1/4" / 1 1/2"	1 1/2" / 2"	2" / 2 1/2"	2 1/2" / 3"
No Insulation* (To be used for indoor applications only.) Ambient Temperature °F	10				1.2/6.8	1.5/5.0	1.7/4.6	2.7/3.1	3.8/2.6
	0			1.3/4.4	1.7/3.3	2.2/2.9	2.5/2.8	3.8/2.1	
	−10	1.5/2.2	1.7/2.2	2.1/2.0	2.5/2.0	3.2/1.8	3.8/1.7		
	−20	2.1/1.4	2.4/1.4	2.9/1.4	3.5/1.3				
	−30	3.4/.8							
	−40								
3/8" Thick Insulation. Ambient Temperature °F	10						1.1/13.8	1.3/9.5	1.5/8.4
	0					1.1/12.2	1.4/6.5	1.6/6.3	1.9/5.8
	−10				1.2/6.8	1.3/6.7	1.6/5.1	2.0/4.5	2.3/4.5
	−20			1.2/5.5	1.4/4.6	1.6/4.5	1.9/3.9	2.3/3.8	2.7/3.8
	−30		1.1/6.6	1.3/4.4	1.5/4.0	1.8/3.7	2.2/3.2	2.6/3.3	3.0/3.3
	−40		1.2/4.5	1.5/3.3	1.7/3.3	2.0/3.2	2.5/2.8	2.9/2.9	3.4/2.9
1/2" Thick Insulation Ambient Temperature °F	10							1.1/17.1	1.3/11.3
	0						1.2/9.6	1.4/8.0	1.7/6.8
	−10					1.1/12.2	1.4/6.5	1.7/5.7	1.9/5.8
	−20				1.2/6.8	1.3/6.7	1.6/5.1	1.9/4.9	2.2/4.8
	−30			1.2/5.5	1.3/5.4	1.5/5.0	1.9/3.9	2.2/4.0	2.5/4.1
	−40		1.1/6.6	1.3/4.4	1.5/4.0	1.7/4.1	2.1/3.4	2.5/3.4	2.8/3.6
3/4" Thick Insulation Ambient Temperature °F	10								
	0							1.1/17.1	1.2/14.2
	−10						1.1/13.8	1.3/9.4	1.5/8.4
	−20					1.1/12.2	1.3/7.6	1.5/7.0	1.7/6.8
	−30				1.1/9.8	1.2/8.4	1.5/5.7	1.7/5.7	2.0/5.4
	−40			1.1/8.0	1.2/6.8	1.4/5.7	1.6/5.1	1.9/4.9	2.2/4.8

Tables are based on the use of glass fiber or rubber foam insulation with a K factor of 0.26 Btu/hr-°F-ft²/in. @ 50°F.

*The No Insulation Table is for temporary, indoor situations only. Permanent installation without thermal insulation is not recommended. A non-insulated system requires excessive heating tape and uses more wattage.

CONVERSION °F to °C						
°F	10	0	−10	−20	−30	−40
°C	−12.2	−17.8	−23	−29	−34	−40

ADDITIONAL SELF-REGULATING HEATER TAPES

A large range of additional Self-Regulating Heater Tapes are available with higher Thermal Ratings and construction to suit a wide variety of industrial process heating and temperature maintenance applications.

Details available on request

Installation Instructions – Refer next page

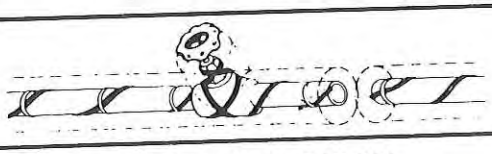
FROSTEX™

FreezGard Self-regulating Heating Tape

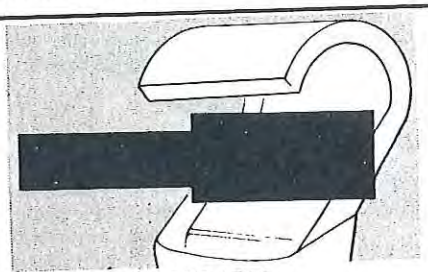
Frostex Installation Instructions

Installation Instructions using FCT-5 Kit or Contractor Cut-to-length Heat Shrinkable Tubing

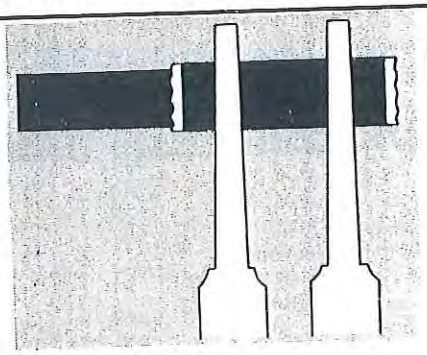
1. SELECT LENGTH OF FROSTEX – Refer Previous Page.
Fix heating tape to bottom of pipe or spiral if necessary. Loop several times around valves.



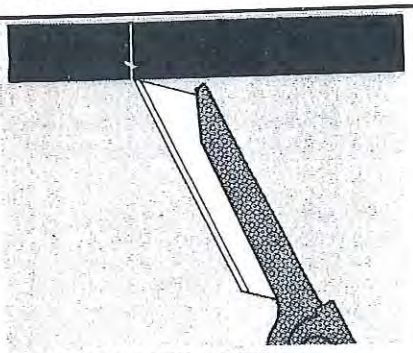
END SEAL : NOTE: WATER INGRESS THROUGH IMPERFECT SEALS MAY LEAD TO FAILURE



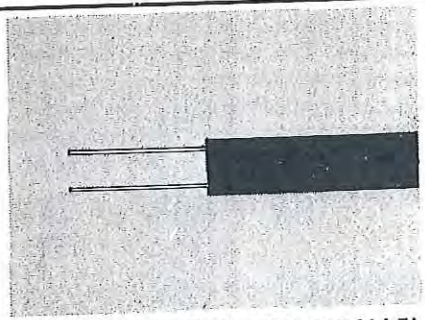
2. SHRINK ON END SEAL
NOTE: Never connect the conductors together.
Slip a 50 mm heat shrinkable sleeve over the strip so that about 15 mm projects beyond the cut end. Heat the sleeve with cigarette lighter until it shrinks tightly around strip.



3. SEAL END SEAL
Using a pair of pliers, squeeze the sleeve at the ends until adhesive appears at the edges.

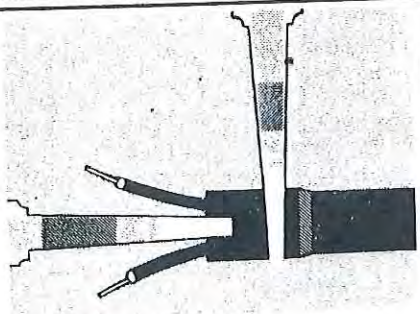


4. REMOVE INSULATION
Remove outer and inner insulation 20 mm from the end.

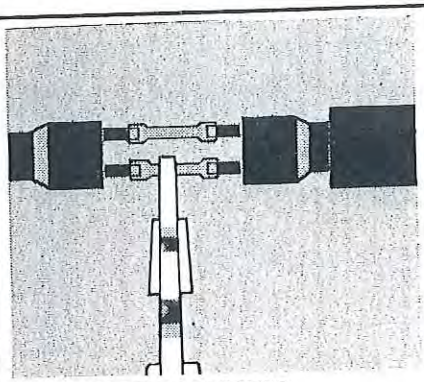


5. CLEANLY EXPOSE THE PARALLEL CONDUCTORS
This may be achieved by making a cut either side of the conductors and pulling the conductors away from the core using pliers. Cut out the centre web.

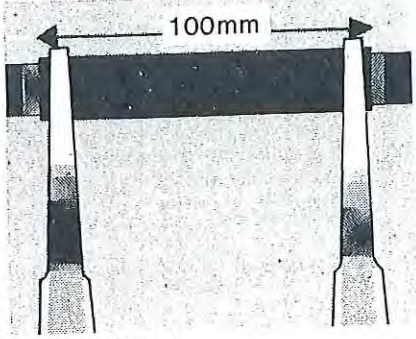
6. INSULATE CONDUCTORS
Slip the small diameter heat shrinkable sleeves over the conductors. Heat the sleeves until they shrink tightly around the conductors.



7. SEAL THE CRUTCH
Slide a 50 mm heat shrink tube over the end. Heat and shrink. Whilst still hot, use pliers to squeeze the sleeve at the positions shown to seal the area between the conductors and make the strip water-tight.



8. APPLY CRIMP SLEEVES
Slide the 75 mm heat shrinkable sleeve over strip. Position the crimp sleeves over the conductors and crimp the barrels firmly into place.



9. COMPLETION
Position the 75 mm heat shrinkable sleeve centrally over the connection. Starting from the middle, shrink firmly into place. Squeeze the ends of the sleeve with pliers until adhesive appears at the edges.

10. INSULATION
Frostex must always be insulated to be safe and cost effective.

PRECAUTIONS

During installation, do not bare the wires and twist them together as this will result in an electrical short circuit.

During installation or use, if the heat tape is damaged, it should be replaced not repaired. Once the conductors are damaged they cannot be repaired.

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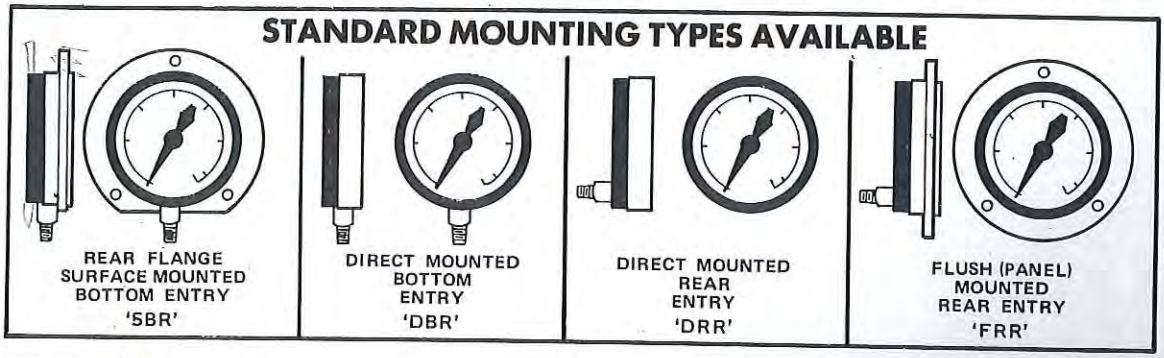
GAUGES - PRESSURE AND COMPOUND
FOR R12, R22, R502, AND R717 (AMMONIA)

STANDARD MOUNTING TYPES AVAILABLE

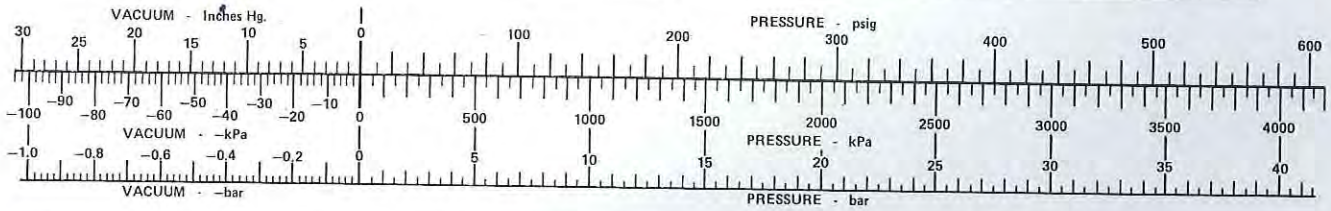


REAR FLANGE SURFACE MOUNTED BOTTOM ENTRY 'SBR'

DIRECT MOUNTED BOTTOM ENTRY 'DBR'

DIRECT MOUNTED REAR ENTRY 'DRR'

FLUSH (PANEL) MOUNTED REAR ENTRY 'FRR'



FLOYD

SPECIFICATIONS

CASE:	Metal
FINISH:	Satin Black Case—Chrome Bezel. (R717 - Hammertone Grey - Chrome Bezel)
DIAL:	White. Scales - Pressure - Black, Temperature - Red
BOURDON:	Phosphor Bronze (R717 - Stainless Steel)
MOVEMENT:	Brass, Adjustable Stainless Steel Linkage (R717 - N.P. Brass or Stainless Steel)
ACCURACY:	To AS 1349 - 1973.

AMMONIA

COMPOUND
4" (100mm) DIAMETER
BRITISH UNITS

CAT. NO.	RANGE

(SBA) REAR FLANGE SURFACE MOUNTED BOTTOM ENTRY 3/8" M.BSP

330176	30" - 0 - 350
330177	30" - 0 - 150

(FRA) FLUSH (PANEL) MOUNTED, FRONT FLANGE, REAR ENTRY 3/8" M. BSP

330178	30" - 0 - 300
with °F Temp. Scale.	

S.I. METRIC

CAT. NO.	RANGE

(SBA) REAR FLANGE SURFACE MOUNTED BOTTOM ENTRY 3/8" M. BSP

330182	−100 - 0 - 2500
330183	−100 - 0 - 1000

(FRA) FLUSH (PANEL) MOUNTED, FRONT FLANGE, REAR ENTRY 3/8" M. BSP

330184	−100 - 0 - 2000
with °C Temp. Scale.	

R12 — R22 — R502

TYPE	BRITISH UNITS — PSI & °F			S.I. METRIC kPa & °C.		
	CAT.NO.	RANGE PSI	TEMP.°F	CAT. NO.	RANGE kPa	TEMP. °C
2½" (63mm) DIAMETER						
(DBSR) DIRECT MOUNT, BOTTOM ENTRY 1/8" BSP STEEL CASE						
PRESSURE	33089	0 — 300	R12	330151	0 — 2000	R12
		0 — 200	Oil Gauge	330152	0 — 1600	Oil Gauge
COMPOUND		30" - 0 - 150	R12	330153	−100 - 0 - 1000	R12
		30" - 0 - 150	R22	330154	−100 - 0 - 1600	R22
PRESSURE *	33069	0 — 500	R12/22/502	33077	0 — 3000	R12/22/502
COMPOUND *	33070	30" - 0 - 250	R12/22/502	33076	−100 - 0 - 1600	R12/22/502
(SBSR) REAR FLANGE SURFACE MOUNTED BOTTOM ENTRY 1/8" BSP						
PRESSURE	3302	0 — 350	R22	330155	0 — 2500	R22
(FRR) FLUSH (PANEL) MOUNTED, FRONT FLANGE REAR ENTRY 1/4" FLARE						
PRESSURE	3301	0 — 300	R12	330156	0 — 2000	R12
	3305	0 — 350	R22	330157	0 — 2500	R22
	33090	0 — 200	Oil Gauge	330158	0 — 1600	Oil Gauge
COMPOUND	33010	30" - 0 - 150	R12	330159	−100 - 0 - 1000	R12
	33011	30" - 0 - 200	R22	330160	−100 - 0 - 1600	R22

* (FRR TYPE)

4" (100mm) DIAMETER

(FRR) FLUSH (PANEL) MOUNTED, FRONT FLANGE, REAR ENTRY 1/4" FLARE

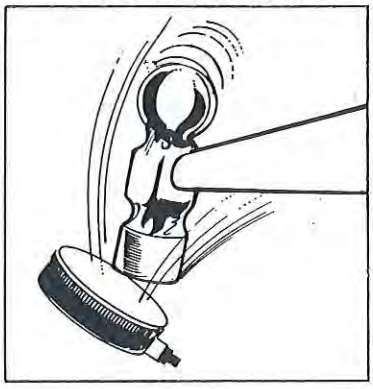
PRESSURE	33018	0 — 300	R12	330161	0 — 2000	R12
	33019	0 — 350	R22	330162	0 — 2500	R22
	33016	0 — 300	R502	330163	0 — 3000	R502
	33017	0 — 200	Oil Gauge	330164	0 — 1600	Oil Gauge
COMPOUND	33026	30" - 0 - 150	R12	330165	−100 - 0 - 1000	R12
	33027	30" - 0 - 200	R22	330166	−100 - 0 - 1600	R22
	33028	30" - 0 - 200	R502	330167	−100 - 0 - 1600	R502
(SBR) REAR FLANGE SURFACE MOUNTED REAR ENTRY 1/4" FLARE						
PRESSURE	33014	0 — 300	R12	330168	0 — 2000	R12
	33015	0 — 350	R22	330169	0 — 2500	R22
	33024	0 — 300	R502	330170	0 — 3000	R502
	33013	0 — 200	Oil Gauge	330171	0 — 1600	Oil Gauge
COMPOUND	33021	30" - 0 - 150	R12	330172	−100 - 0 - 1000	R12
	33022	30" - 0 - 200	R22	330173	−100 - 0 - 1600	R22
	33023	30" - 0 - 200	R502	330174	−100 - 0 - 1600	R502

330-a

GAUGES - PRESSURE AND COMPOUND
FOR R12, R22, R502

IMPERIAL
DIRECT MOUNTED GAUGES

NEW UNBREAKABLE CRYSTALS
LEXAN * CRYSTALS ON
REFRIGERATION GAUGES



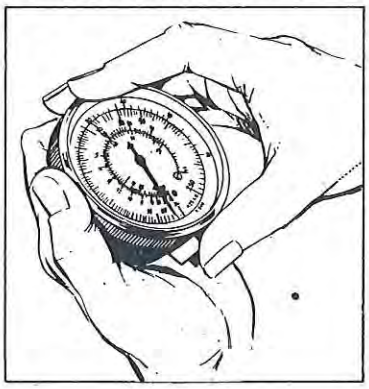
Now you get all the advantages of an unbreakable crystal on most Imperial refrigeration gauges.

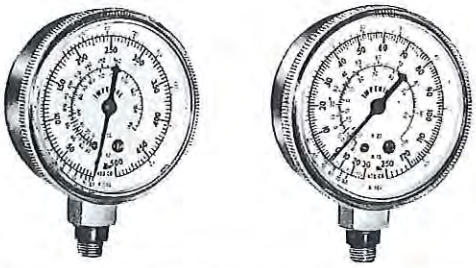
The unbreakable feature protects face of gauge from damage because of a broken crystal . . . eliminates the nuisance of having to replace the ordinary glass crystal. (While the crystals will withstand abuse, gauges are sensitive instruments and should be handled with care.)

The new unbreakable crystal is threaded to gauge case. Simply unscrew crystal for access to calibration screw on face of gauge. (Chrome plated gauges have glass crystals.)

* Reg. Trade Mark General Electric Co.

EASY
CALIBRATION
JUST UNSCREW CRYSTAL

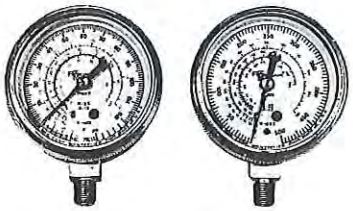




CAT. NO.	MODEL	SIZE	TYPE	RANGE kPa	TEMP. °C REFRIG.	FINISH
33034	423-CK	2½"	Pressure	0 - 3400	R12,22,502	Red Paint
33035	425-CK	2½"	Compound	—100-0-1700	R12,22,502	Blue Paint

QUEEN GAUGES

DUAL SCALE — kPa / PSI — PRESSURE & COMPOUND GAUGES



CAT. NO.	TYPE	SIZE	RANGE	TEMP. °C REFRIG.
33037	Pressure	2¾"	0 - 3400 kPa 0 - 500 PSI	R12, R22, R502
33038	Compound	2¾"	—100 - 0 - 1700 kPa 30" - 0 - 240 PSI	R12, R22, R502

WE BELIEVE IN CONTINUALLY STUDYING THE LOCAL AND INTERNATIONAL MARKETS TO MAKE AVAILABLE THE MOST MODERN TYPE OF EQUIPMENT

WE BELIEVE IN GOOD QUALITY PARTS AND EQUIPMENT MANUFACTURED BY REPUTABLE AND TRUSTWORTHY COMPANIES. WE BACK THIS BY LARGE STOCK HOLDINGS AND RELIABLE SERVICE