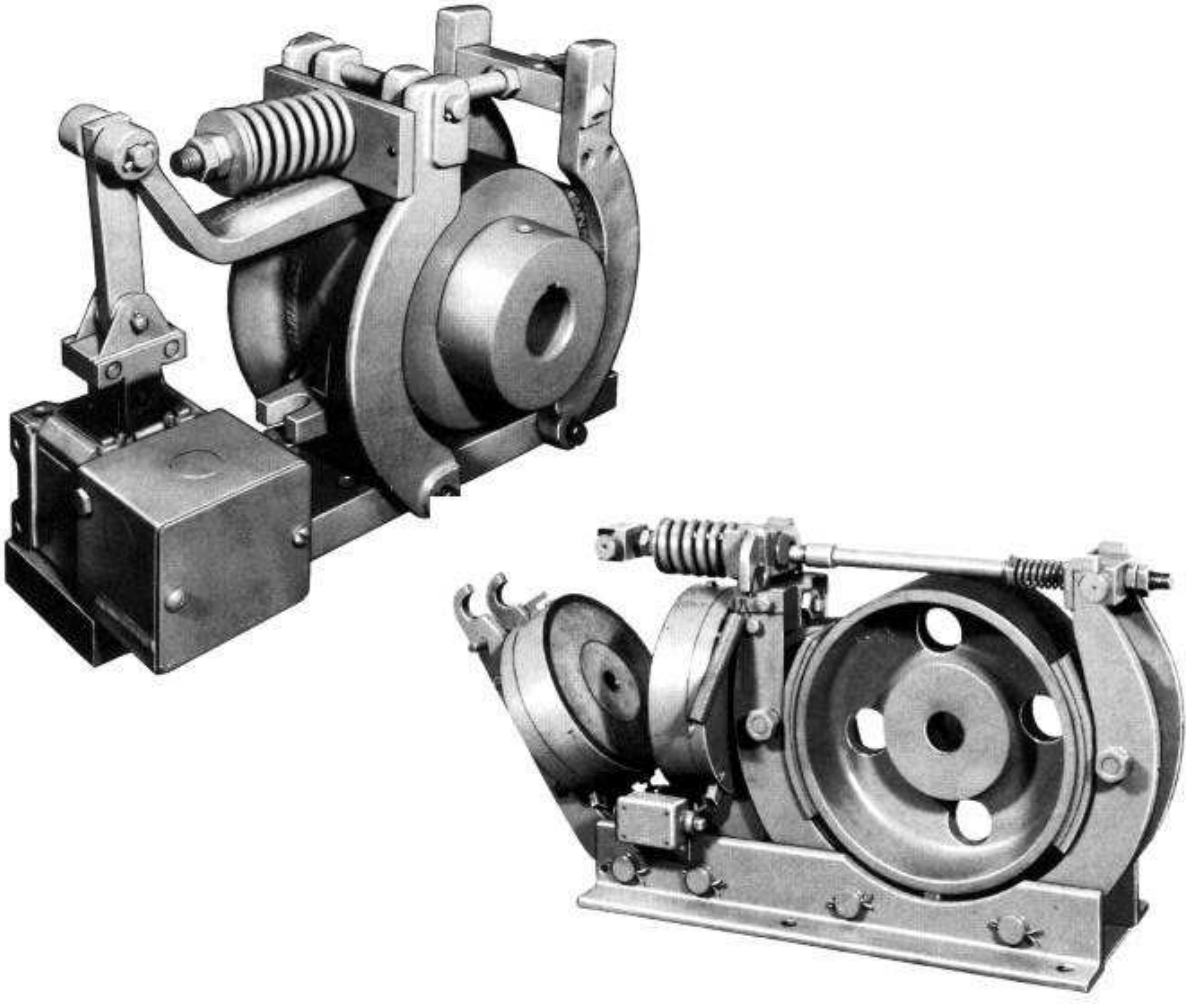
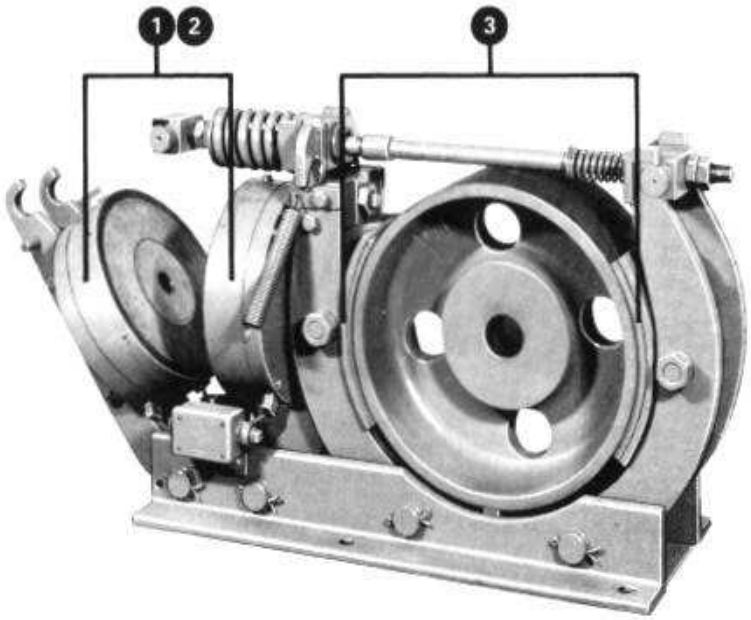
PATRIOT
Sensor Solutions

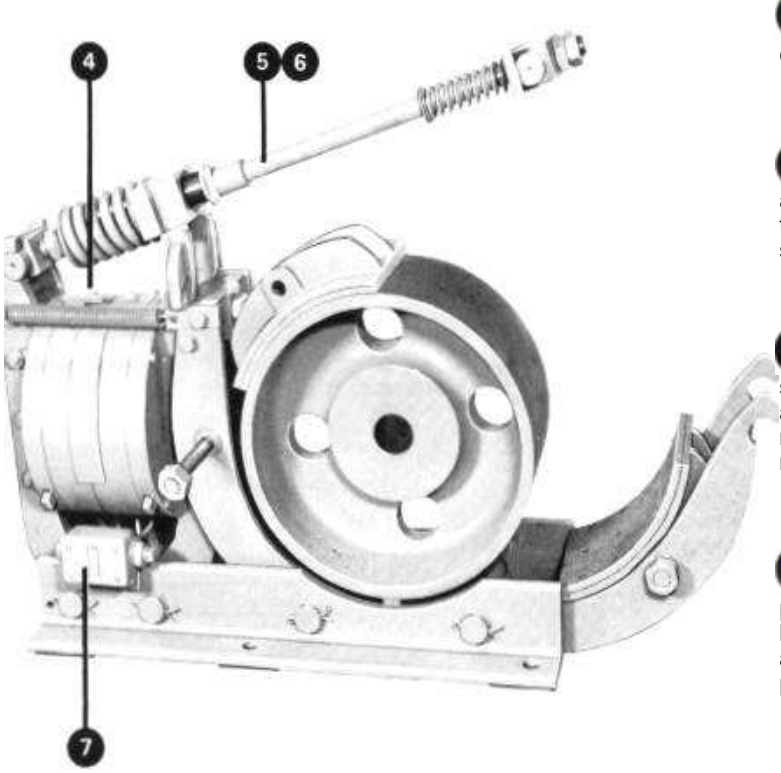
Gemco™ Industrial Brakes
Magnetic Shoe Brake Systems

Simple and Effective Spring Applied Electric Released AC and DC Brakes



MAGNETIC SHOE BRAKES





TM DC BRAKES

Shunt or Series Wound

Features:

1 Mechanically independent coils can be removed without releasing the brake shoes. The design of the twin-magnet system results in a real safety features: if the magnet coil should need replacement while the equipment is under load - for example, while a crane is in the middle of a lift - the magnetic assembly can be removed and replaced or repaired without releasing the braking action or disturbing the torque setting. In an emergency, short-time operation on a single coil is possible.

2 Twin-magnet coils are Epoxy-encapsulated for permanent protection against dust, water, grease, oil, chemicals and mechanical impact (except TM43 and 63 have single coil).

3 Self-aligning cast-iron brake shoes are lined with long-wearing molded linings secured with brass rivets. The interchangeable shoes are single-pivot mounted for positive self-alignment upon installation. Once the shoes are aligned, the pivot bolts are tightened, holding the shoes in position to prevent the shoe tips from dragging.

4 Shoe-travel indicator provides a positive visual check of lining wear for quick maintenance-inspection.

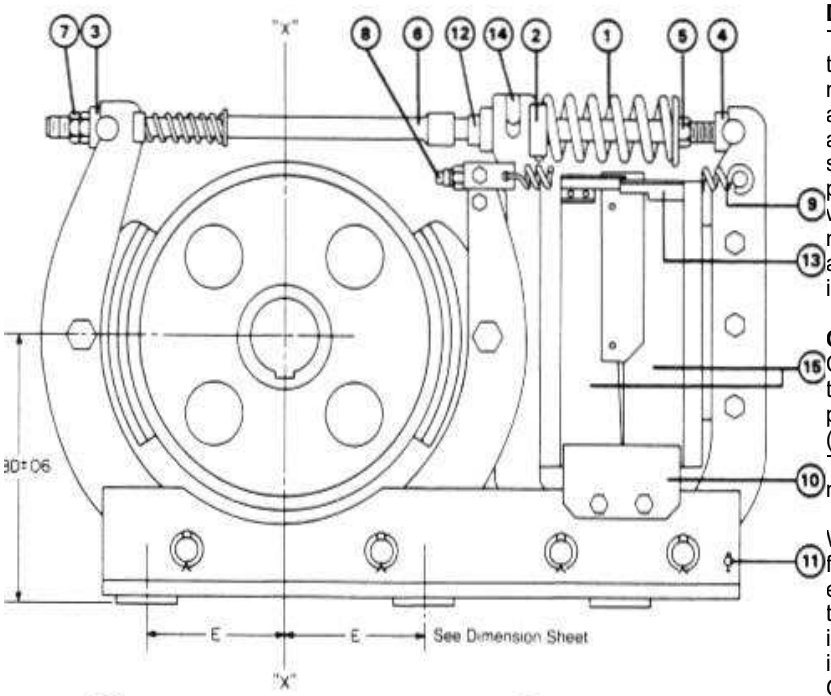
5 Over-the-wheel tie rod is a simple, rugged, easily accessible linkage, permitting all adjustments from the top. Only two easy adjustments for shoe wear and spring tension.

6 Unitized tie-rod-and-spring assembly facilitates shoe replacement. The complete assembly removes as a unit, making the shoes accessible for lining replacement in one quick step. The brake can be released manually, if required.

7 Left-or-right-mounted conduit box is an Integral part of the brake frame, allowing either right-hand or left-hand installation. On series coil brakes, Frame 1355 and larger, convenient accessible leads are furnished in place of the conduit box.

MAGNETIC SHOE BRAKES

INSTALLATION AND SERVICE INSTRUCTIONS - TYPE TM



1. Main Spring
2. Main Spring Trunnion
3. Shoe Arm Trunnion
4. Magnet End Trunnion
5. Torque Adjustment Nut
6. Main Tie Rod
7. Outside Shoe Adjustment
8. Inside Shoe Adjustment
9. Tension Springs
10. Magnet Travel Equalizer
11. Stop Pin
12. Manual Release Bushing
13. Travel Indicator
14. Lifting Lugs
15. Magnet

Figure 1

Description
The Type TM Brakes have a direct-current clapper type magnet and are designed so that when the magnet is energized, the shoes will clear the wheel and when de-energized, the shoes are pressed against the wheel by means of a compression spring. The force of the compression spring produces equal pressure of the shoes against the wheel and movement of the magnet results in equal movement of the shoes. Simple, rugged construction allows full accessibility of all parts for visual inspection or maintenance.

Operation (See Figure 1)
Compression spring (1) is contained between trunnion block (2) and nut (5) on tie rod (6) which passes through a clearance hole in trunnion blocks (2) and (3) and is threaded and pinned to block (4). The amount of spring force is adjusted by position of nut (5).

When brake is de-energized, main spring (1) exerts force on nut (5) and trunnion block (2) which, in effect, pulls trunnion (3) and the left shoe arm towards the wheel and pushes trunnion (2) and the inside armature which acts on bolt (8) and forces the inside shoe arms and shoes against the wheel. Geometry of the linkage is such that the shoe forces are exactly equal.

When brake is energized, magnet faces are pulled together by magnetic force, moving trunnion blocks (2) and (4) towards each other by the amount of magnet travel. Spring force is contained between trunnion block (2) and lock nut (5). Right magnet arm pushes outside shoe arm away from wheel and tension springs (9) cause inside shoe arms to follow movement of inside armature away from wheel.

Two adjustments are required during normal service. Nuts (7) and bolt (8) are turned clockwise to compensate for lining wear on outside and inside shoes respectively. Spring compression is adjusted for nameplate torque rating at factory. Readjustment at points (7) and (8) for lining wear will automatically bring spring compression back to initial setting.

Series Brakes
Series Brakes carry the full load current of the motor (specify when ordering). When series wound brakes are applied to torque rating for 1 or 1/2 HR duty to correspond with motor ratings, the brake will release on 40% of full load current and remain released on 10% of full load current. When series brakes are applied on continuous duty motors and so rated, these brakes will release at 80% of full load motor current and remain released on 20% or less.

Shunt Brakes
Shunt Wound Brakes are designed for 1 or 8 hour duty. The shunt coil is designed for 64 volts for 8 hours or 80 volts for 1 hour.
NOTE: TM 83 through TM 3014 Brake Assemblies are A.I.S.E. rated.

TM Torque Ratings

Brake Frame Number	Maximum Torque in Ft./Lbs.			
	Series Brake		Shunt Brake	
	1/2HR	1HR	1HR	8HR
TM 43	25	15	25	15
TM 63	50	40	50	40
TM 83	100	65	100	75
TM 1035	200	130	200	150
TM 1355	550	365	550	400
TM 1665	1000	650	1000	750
TM 1985	2000	1300	2000	1500
TM 2311	4000	2600	4000	3000
TM 3014	9000	6000	9000	6750

MAGNETIC SHOE BRAKES

INSTALLATION AND SERVICE INSTRUCTIONS - TYPE TM

Mounting
Brake must be mounted on a flat surface parallel to shaft whose distance from center line of shaft agrees with BD dimensions for given frame within limits of +/-.06". Center line X-X should pass midway between mounting holes within .06".

Frame	BD	Frame	BD
43	4.25	1665	12.13
63	5	1985	13.25
83	7	2311	15.88
1035	8.38	3014	20.75
1355	9.88		

To remove wheel from brake as received, turn manual release bushing (12) out of trunnion block (2) to jack against collar on tie rod. Continue to turn bushing until wheel is free. If desired, the complete tie rod assembly may be lifted from brake by loosening adjustment nuts (7) until trunnion block (3) may clear half bearing in outside shoe arms. Push tie rod towards outside magnet arms until trunnion block (2) is free of its bearing and lift out complete tie rod assembly. The brake may be mounted without removing the tie rod assembly depending on personal preference. Lift wheel from brake and mount on shaft using tapered key provided if wheel has straight bore and tapered keyway. Loosen shoe bolts and make sure bolt heads will be on side away from motor to allow future shoe removal for relining. Lift brake into position on bedplate using hooks or sling under lifting lugs on inside armature. Insert hold-down bolts hand tight and align brake square with wheel. If tie rod was previously removed, reinstall using reverse technique from that described for removal. With tie rod in place, turn manual release bushing (12) back into trunnion (2) and jam tight to lock in place. Force of main spring is now holding shoes on wheel. Tighten hold-down bolts. Tighten shoe bolts.

Remove conduit box cover on shunt brakes. Bring in two power leads and connect to two bare terminals in box and tape leads. For minimum current on shunt brakes, jumper connection is made at the factory to place coils in series for cumulative magnetic flux, and leads are taped. Connection need not be disturbed except if coil is to be removed from brake. After making power connection, leave sufficient slack in coil leads outside of conduit box and replace conduit box cover.

For brake with high current series coils, one set of coil leads is brought out to each side of the brake and clamped. Connect line to brake coil leads and tape to insulate. Series coils are connected at the factory so that one-half of the line current flows through each coil.

Adjustment - Frames 83 through 3014
Equalizer stop block (10) is intended to insure approximately equal movement of both shoes should the brake be mounted on a surface other than horizontal, or if undue friction should occur at one of the pivot points. Normally, when the brake is properly adjusted, and linkage is free from binding, stop block (10) has no function. Brake linkage is simple to understand and adjustments are not critical. With some practice, the average maintenance person should be able to adjust the brake completely by eye without aid of measuring instruments.

To adjust the brake, only setting of nuts (7) and bolt 8 need to be changed for the outside or inside shoe. When properly adjusted with brake de-energized, the air gap between the tops of the magnets should agree with the nameplate reading (may be observed by lifting part of rubber dust shield off magnet). Magnets should be approximately centered with stop (10). This may be done visually, or if in doubt, with a feeler gauge. Actual adjustment is accomplished as follows:

Lift one side of rubber dust shield off dowel pins, exposing top of magnets.

Loosen lock nuts at (7) and (8), and turn (7) and (8) to reduce air gap to approximately the amount given on the nameplate.

At this time, magnets should be approximately centered about equalizer stop block (10). Replace rubber dust shield on dowel pins and tighten lock nuts at (7) and (8). Compressed length of main spring has automatically been brought back to that given point on the nameplate. When energized, brake shoes should have adequate movement to clear wheel at operating temperature without dragging.

Frames 43 and 63
These smaller frame sizes have a single coil, as opposed to the larger frames which have two. The inside shoe adjustment for lining wear is the only difference between the smaller frames and larger frames; otherwise, the adjustments are identical. When adjusting the inside shoe, loosen the shoe bolt prior to making an adjustment at bolt (8). Re-tighten shoe bolts securely after making the adjustment.

Readjustment for Lining Wear
For optimum operation, brakes of any manufacture should be readjusted to normal magnet travel as often as a reasonable maintenance schedule will allow. Minimum travel will result in fastest, quietest operation with the least amount of shock and bearing wear. The TM brake will operate at a long travel, and if necessary, allows considerable lining wear between adjustments. In lieu of a maintenance schedule, travel indicator brackets (13) on top of the magnet may be used as a visual guide for maximum wear allowable between adjustments. When magnet gap opening progresses to the point where ends of indicator brackets line up, as in Figure 2, it is time to readjust for lining wear (see Adjustment, below).

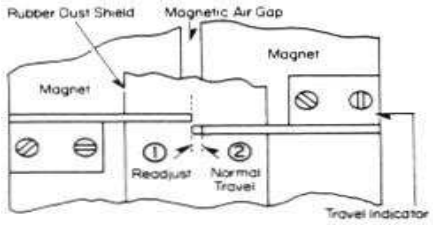


Figure 2: Magnet Travel Indicator

Torque Adjustment
Brake is adjusted at the factory for maximum torque rating for voltage as given on nameplate. With brake de-energized, and magnet air gap adjusted for normal travel, compressed length of spring should be per value in Table 1. Readjustment for lining wear will automatically return spring compression to original setting. If reduced torque is required, back off nut (5) until desired torque is obtained.

Table 1

Frame	Magnet Normal Travel	Compressed Length Spring	Free Length Spring
43	.06	2.81 2.63	3.26
63	.06	3.38 3.25	4.0
83	.06	4.31 4.25	5.0
1035	.06	4 4.31 4.25	5.0
1355	.13	4 5.44 5.38	6.0
1665	.13	5.12 5.38 5.31	6.0
1985	.13	5.13 6.44 6.31	7.0
2311	.16	6.13 8.38 8.31	9.0
3014	.19	8.13 9.69 9.63	10.26
		9.5	

MAGNETIC SHOE BRAKES

INSTALLATION AND SERVICE INSTRUCTIONS - TYPE TM

Manual Release and Relining Shoes

Brake may be released with a wrench for maintenance by turning release bushing (12) out of trunnion block (2) to jack against collar on tie rod until wheel is free. To return brake to normal operation, screw bushing (12) back into block (2) and jam tight to lock out of way.

To remove shoes for relining, release brake manually and remove tie rod assembly. Remove shoe bolts and slide shoes out around wheel. After relining shoes, reassemble shoes and tie rod and readjust brake. Stow manual release bushing back into block (2). Tighten shoe bolts.

To lift wheel and motor armature vertically, release brake manually and remove tie rod assembly. Remove bolts holding equalizer stop block (10) in place and lean magnets back against stop pin (11). Lift out wheel. After replacing wheel, move magnets back to normal position, replace equalizer block, center approximately between magnets and bolt up tight. Replace tie rod assembly and stow manual release bushing in trunnion block (2).

Coil Connection

The Type TM Brake has two identical coils integrally cast with the magnet outer ring and center core in epoxy resin. Damaged or defective coils are not repairable and must be replaced with the steel parts as a unit. Coils are attached to the brake armatures and each moves one-half of the length of the magnet air gap each time the brake operates. Coil leads are of highly flexible insulated cable. These leads are connected to the coil terminals and covered with Permatex gasket compound at bottom of coil and extend to terminal board or junction box at side of brake for customers connection. If broken or damaged, coil leads are easily replaced.

At installation, power leads are brought into conduit box or terminal board at side of brake and connected to two bare terminals. Two coil leads are already connected at the factory for cumulative magnetic flux. This connection need not be disturbed except when removing coil from brake. After making line connection, leave sufficient slack in leads between coil and conduit box to allow free movement of leads with magnet motion.

Shunt Coil Operation - Shunt brakes are usually supplied with low voltage coils for speedy action unless otherwise specified, and it is necessary to have a resistance in series with the coil. Coil voltage and value of series resistance is given in on page. Coils are connected per Figure 3 with full current flowing through both coils. In case of coil failure, brake may be operated on one coil for shorter time by shorting out defective coil.

Series Coil Operation - Series brakes are operated with coils connected directly in motor circuit. Due to high currents, coils are connected so that 1/2 of the motor current flows through each brake coil as per Figure 4. In case of coil failure, brake may be operated on one coil for shorter time by disconnecting defective coil.

Removing and Replacing Magnet Coils

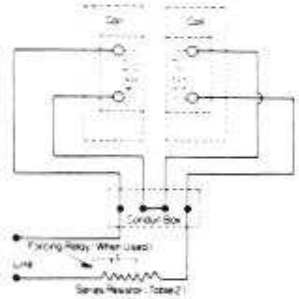
Either or both coils may be removed and replaced without disturbing brake adjustment or removing spring load from shoes. Each coil is cast directly in magnet half with epoxy resin and is not repairable except for replacement of flexible leads.

Remove rubber dust shield protecting magnet air gap. Disconnect coil leads inside conduit box and pull leads out of box through rubber grommets for shunt coils or disconnect and unclamp leads for series coils. Remove cotter pin from one end of stop pin (11) in magnet end of brake base and remove stop pin. Unhook tension springs (9) from pin on outside armature and swing outside armature assembly down to rest on floor. Remove (4) bolts holding outer magnet ring from outside of armature and one Allen head cap screw in counter bore in face of center magnet core. Lift coil from brake. Large frame magnets have tapped holes at top for use with eyebolt for lifting.

Leads are covered with insulating compound at the coil terminals. If new leads are required, scrape compound from terminal until hardware is exposed. Replace lead and cover terminals with coat of compound. When changing coils, transfer travel indicator to new magnet. Bolt new magnet in place and bring leads into conduit box through rubber grommets for shunt coils or to terminal board. Make connection to power leads per Figure 3 or 4 depending on type of coils being used, and tape leads.

Raise outside armature back up to normal position with bearings of trunnion block (4) engaged in half bearing in outside clapper arms. Hook springs (9) in grooves of spring pin. Replace stop pin (11). Replace rubber dust shield over magnet air gap using new roll pins in magnet if required.

When installing new magnets, magnet faces may not make even contact due to standard machining tolerances. To



avoid stresses and bearing wear

Figure 3: Shunt Coil Connection

resulting from such misalignment.

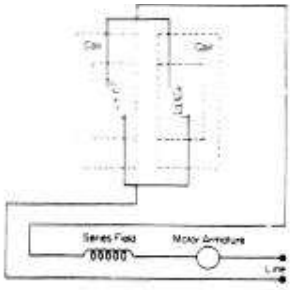


Figure 4: Series Coil Connection

MAGNETIC SHOE BRAKES
INSTALLATION AND SERVICE INSTRUCTIONS - TYPE TM

energize brake to close magnet faces. Loosen bolts holding lever arms to outside armature. This will allow magnets to seat properly. Tighten bolts securely. This operation is required only when replacing either one or both coils.

Right or Left Hand Mounting
Standard mounting is right hand, as in Figure 1, when facing commutator end of motor. Brake magnet is on right side with conduit box next to motor. Shoe bolts are inserted with heads away from motor to allow removal of shoes without dismounting brake.

Left hand or opposite standard mounting with magnet on left involves insertion of shoe bolts from opposite side and interchanging of conduit box and travel equalizer plate. Left hand brake may be ordered as opposite standard from factory or converted in field.

Lubrication
Pivot points in base and lower arms are fitted with porous bronze “oilite” type bearings. A few drops of oil around these bearings occasionally will maintain their lubricated quality. All pivot pins are stainless steel. Pivot pins at top of arms ride in half bearings and are easily accessible. These pins and wear pad contacted by adjusting screw (8) (see Figure 1) should also receive a few drops of oil occasionally.

Failure to Operate
The brake may fail to release for any of the following reasons:

• Lead wire to operating coil may be disconnected.

• Voltage may be below normal.

• Brake may not be adjusted properly. Lining may be worn causing magnet air gap to open beyond point where magnet operates sluggishly or not at all. Readjust per Adjustment paragraph.

• One or both coils may be defective. Check coil resistance against Table 2.

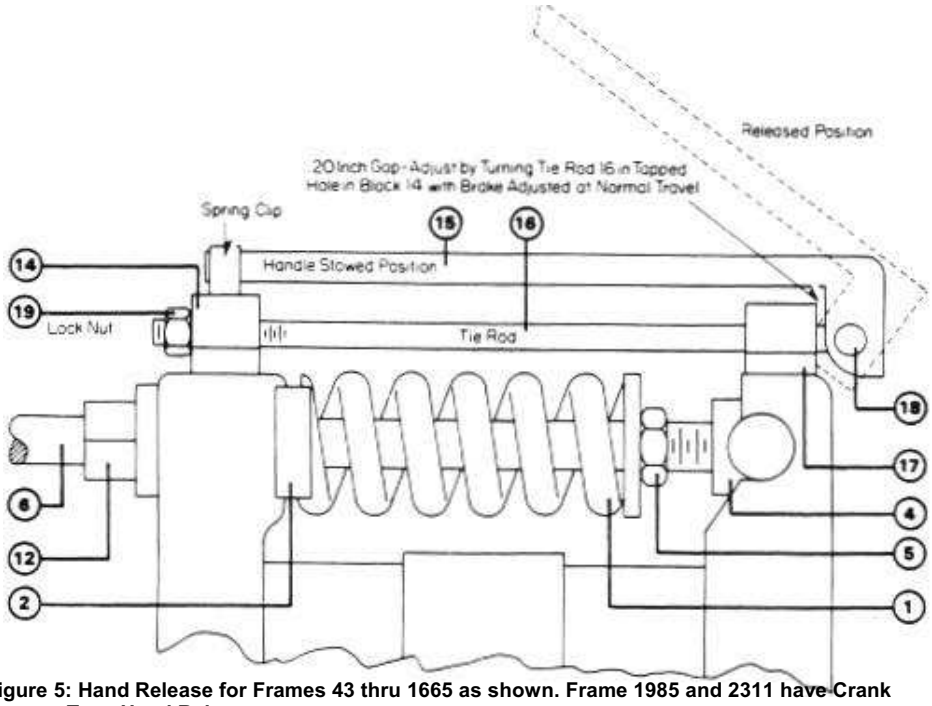


Figure 5: Hand Release for Frames 43 thru 1665 as shown. Frame 1985 and 2311 have Crank Type Hand Release.

Compensate for temperature if coil is hot. If one coil is defective, short time emergency operation is possible on one good coil.

• Coils may be improperly connected with resultant bucking instead of cumulative magnetic flux. Check wiring per Figure 3 or 4.

Brakes with Hand Release
When specified on order, a lever-type hand release is available as optional at extra cost. Figure 5 shows simple mechanism used on open brakes allowing quick release of brake torque as for lowering a load in case of power failure. The standard hand release is non-latching and allows only the minimum amount of shoe clearance to allow the wheel to turn. When brake must be released for longer time or with more shoe clearance as for maintenance or installation, release brake with bushing item (12).

Addition of the hand release complicates brake maintenance since block (14) must be removed in order to remove main tie rod assembly from the brake. Overall dimensions of brake are also slightly increased by the hand release linkage. For enclosed brakes, hand release parts and cam action are basically the same except that cam linkage is modified to suit enclosure.

Adjustment of Hand Release - Since blocks, items (14) and (17), move apart with the magnets as brake lining wears, clearance must be allowed between block (17) and cam on handle (15) to avoid restricting normal brake operation. With brake de-energized and adjusted for normal magnet gap, clearance between items (15) and (17) should be approximately .20 inches and may be measured with feeler. Gap may be varied by removing link pin (18), loosening lock nut (19), and turning rod (16) in block (14) in 180° increments to attain proper clearance.

RECTIFIER OPERATION

DC Magnetic Shoe Brakes

Before checking voltages on the rectifier panel, fully adjust brake.

Input power to the rectifier can be 380, 480, 550 or 600 volts AC. When the rectifier is energized 220 volts DC is applied to the + and - terminals, which are connected to the brake coils. After a time factor of approximately .8 seconds, a holding voltage is applied to the brake to maintain the brake in the released position.

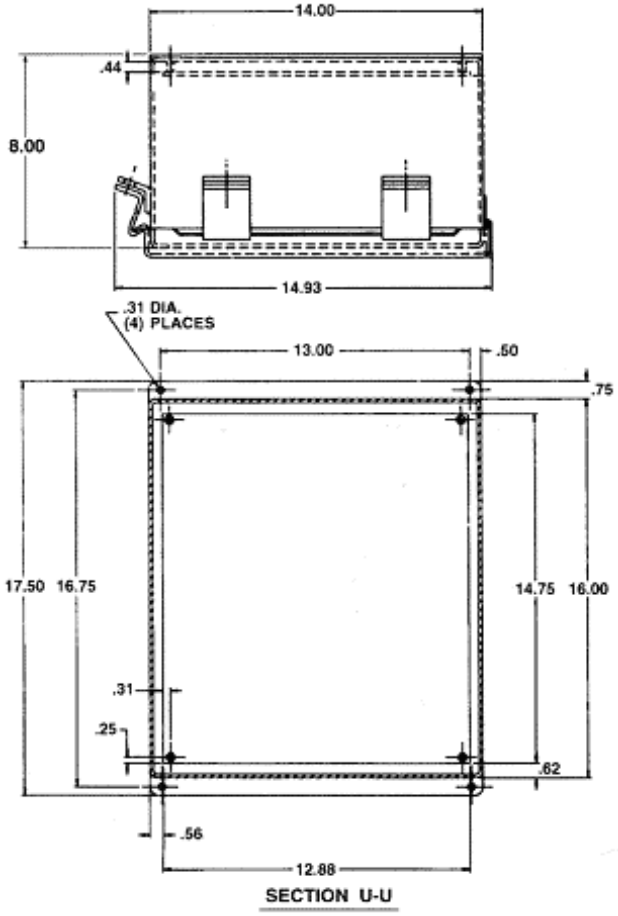
The holding voltage required to “hold in” the brake (released position) is approximately 30 volts DC.

When power to the rectifier is cut-off, the brake will de-energize quickly and the main brake spring will set the brake.

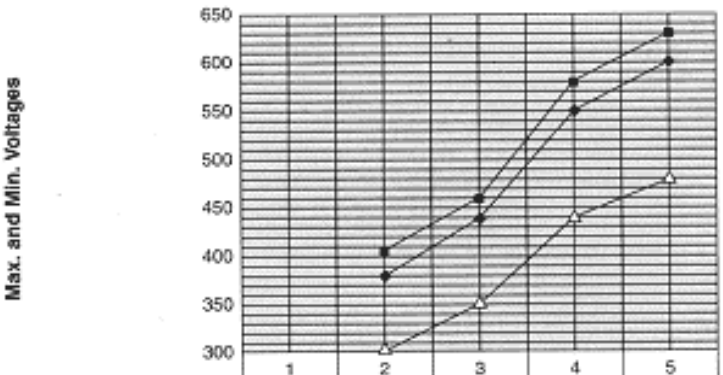
For more information on setting and holding, setting and releasing times, and general electrical information on brakes, see Shunt Brake connections or consult the factory. A wiring diagram will be furnished with each rectifier or upon request.

Two identical brake assemblies can be operated simultaneously by a single rectifier. This applies to TM43, TM63, TM83, TM1035, TM1355, TM1665 and TM1985 brake sizes.

OPTIONAL N4 RECTIFIER ENCLOSURE



Acceptable AC Voltage Ranges by Tap Voltages
All Voltage Ranges are 50/60 Hz

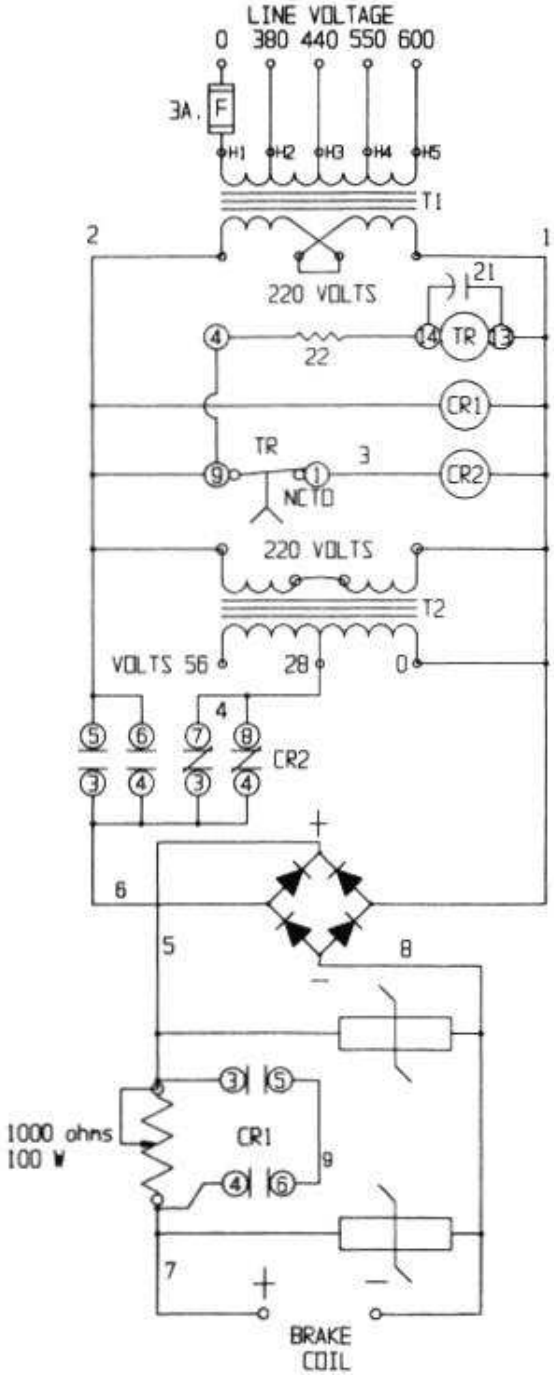


AT TAP VOLTAGE		380	440	550	600
AT MAX. VOLTAGE		403	460	580	630
AT MIN. VOLTAGE		304	352	440	480

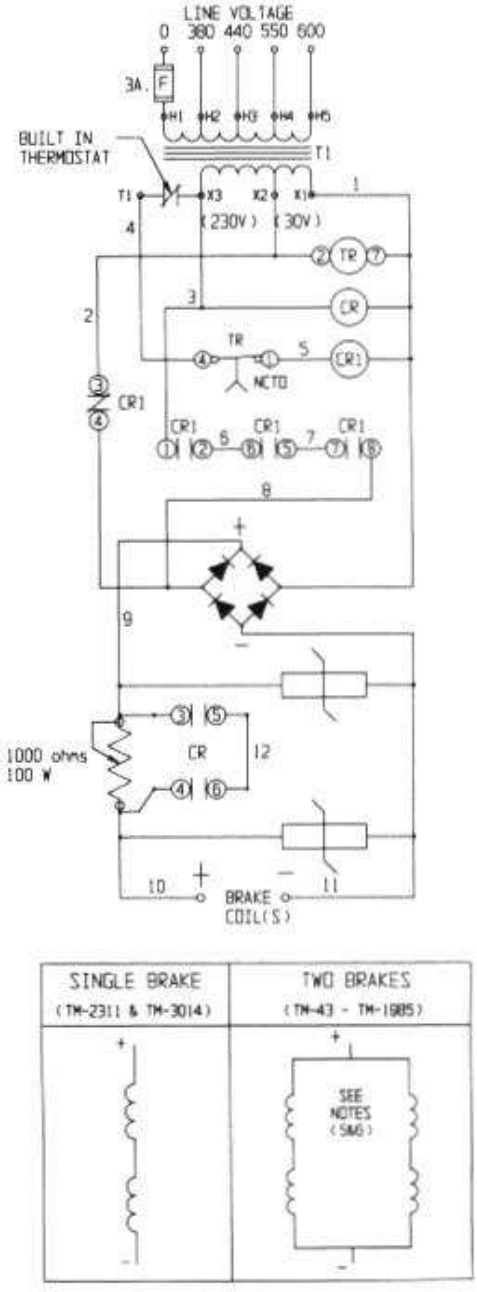
RECTIFIER OPERATION;
TM BRAKE ASSEMBLY (TYPE TMR)

WIRING DIAGRAM

Open Chassis E010327
NEMA 4 E010326
Rectifier Assembly
For TM43 ~ TM1985
(1) Brake



Open Chassis E023205
NEMA 4 E023204
Rectifier Assembly
TM2311 and TM3014
(1) Brake or TM43 ~
TM1985 (2)Brakes



SHUNT BRAKE RESISTORS/ FORCING RESISTORS

SHUNT BRAKE RESISTORS

Shunt brakes are designed for one or eight hour duty and rated at 80 volts (1 hr.) or 64 volts (8 hr.). To operate the brake, it is necessary to have a resistor in series with the brake assembly. Coil voltage and value of series resistor, based on a line voltage of 250 VDC is shown in the following table. The TM brake has two identical coils except the TM43 and TM63 which have only one coil.

STANDARD SHUNT COIL INFORMATION

Frame	Standard Shunt Coil Style No.	Cold Coil Resistance OHMS/ Coil	Coil Volts/Coil		Ohms Resistance Required in Line 1				Resistor Part Number
					Continuous		Intermittent		
			Cont	Int	OHMS	Amp	OHMS	Amp	
43 [2]	E004051	73	64	80	212	0.88	155	1.1	E004044
63 [2]	E006026	59.4	64	80	171	1.08	125	1.35	E006024
83	E008026	31.3	32	40	177	1.0	132	1.28	E008022
1035	E010049	23.8	32	40	137	1.35	101	1.68	E010044
1355	E013026	19.1	32	40	111	1.68	81	2.1	E013022
1665	E016026	8.83	32	40	51.5	3.6	37.7	4.53	E010622
1985	E019025	8.51	32	40	49.5	3.8	36.2	4.7	E016022
2311	E023026	6.12	32	40	35.6	5.2	26.1	6.54	E023022
3014	E030024	4.5	32	40	26.2	7.12	19.1	8.9	E030022

1 For 250 VDC without discharge resistor.
2 TM 43 and TM63 frames differ from larger TM brakes. Only (1) coil is used.

FORCING SCHEME

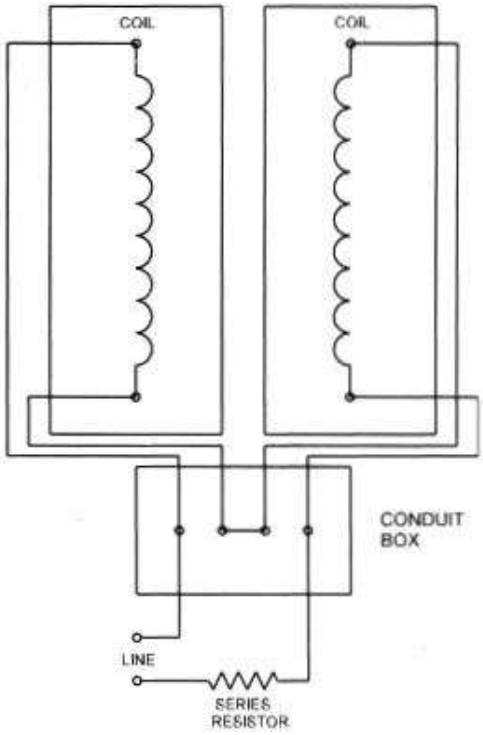
Often, it is desirable to force magnet coils with a “higher-than rated” voltage to obtain a faster response time. The following table shows typical resistors which can be used to obtain satisfactory results. The customer’s control circuit must be designed so that when first energized, the high resistance section is shorted out causing a high voltage to be impressed across the brake. After a short time delay (.8 to 1 second) a relay inserts the high resistance section reducing the holding voltage to approximately 25 to 30 volts. Forcing and hold voltages are not critical. Both release and setting times are faster with a forcing scheme when compared to a standard shunt circuit.

Holding at a low voltage also allows operation at the full brake torque (1 hr. rating) at a continuous duty cycle (8 hr. rating).

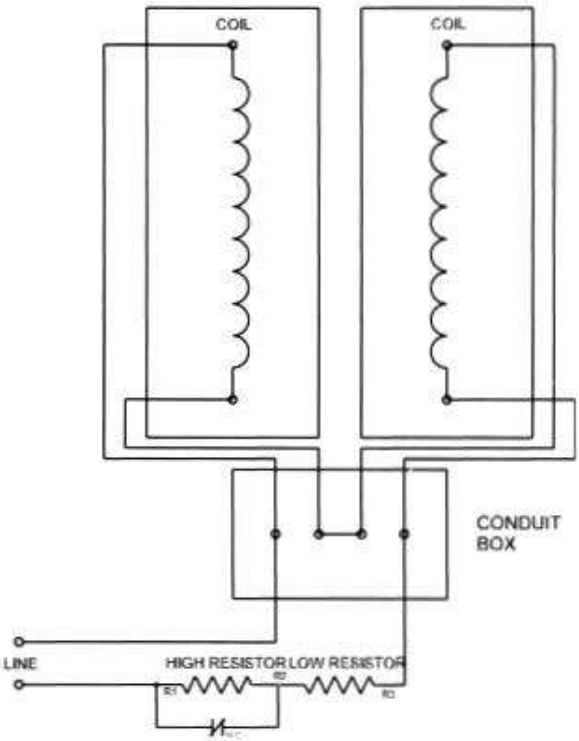
Frame	External Resistor Forced Part Number	High Resistor Ohms R1-R2	Low Resistor Ohms R2-R3	Coil Volts		Coil Amps	
				Inrush	Hold	Inrush	Hold
TM 43	E004045	720	26	185	22	2.5	.30
TM 63	E006025	585	22	182	22	3.0	.37
TM 83	E008023	625	24	182	22	2.8	.35
TM 1035	E010045	460	22	173	23	3.5	.47
TM 1355	E013023	380	13	188	23	4.7	.57
TM 1665	E016023	165	6.5	184	24	10	1.3
TM 1985	E019022	165	6.5	182	23	10	1.3
TM 2311	E023023	120	4.7	182	23	14	1.8
TM 3014	E030023	77	3.4	182	25	20	2.7

SHUNT BRAKE RESISTORS/FORCING RESISTORS

STANDARD SHUNT BRAKE

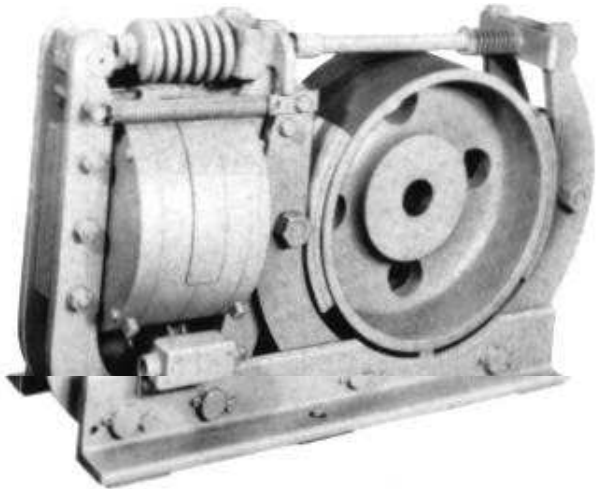


FORCING SCHEME



NOTE: Normally closed contact is to be customer supplied.

COIL DATA SHEET - TYPE TM
FRAMES 43 TO 3014



Series Coil

Frame Size	Coil Amperes		Resistance Ohms 1	Style Number 2
	One Hour	Half Hour		
83	25	36.5	0.086	E008053
	20	27.5	0.143	E008054
	15.5	21.5	0.206	E008055
	10.5	12.5	0.713	E008052
	4.1	5.5	3.13	E008056
1035	38	54	0.0494	E010109
	28.5	38.5	0.099	E010110
	20	27.5	0.209	E010111
	15	21	0.343	E010112
	10	13	0.905	E010113
1355	105	144	0.0137	E013057
	63	85	0.0358	E013058
	46	63	0.0604	E013059
	36	48	0.116	E013060
	30	40	0.1551	E013061
	25	33	0.243	E013062
	13.5	18	0.73	E013063
1665	137	180	0.0099	E016055
	105	150	0.0153	E016056
	90	125	0.021	E016054
	71	98	0.0327	E016057
	63	85	0.0415	E016058
	46	63	0.0797	E016059
1985	178	245	0.0054	E019061
	137	180	0.0117	E019062
	90	123	0.022	E019063
	63	85	0.052	E019064
2311	360	475	0.0027	E023053
	265	360	0.0049	E023054
3014	890	1175	0.0004	E030029
	488	640	0.0014	E030030

1 Average
2 Two required connected in parallel

Shunt Coils

Frame Size	Volts per Coil		Resistance Ohms 1	Style Number 2
	Continuous	Intermittent		
43	64	80	73	E004051 3
63	64	80	59.4	E006026 3
83	32	40	31	E008026
1035	32	40	24	E010049
1355	32	40	19	E013026
1665	32	40	8.8	E016026
1985	32	40	8.5	E019025
2311	32	40	6.1	E023026
3014	32	40	4.5	E030024

1 Average
2 Two required connected in series.
3 One required.

ORDERING INFORMATION:

- Give style number and name of part.
- Give the complete nameplate reading.
- State method of shipment desired.
- Send all orders or correspondence to nearest sales office of the company.
- Other coils available. Contact nearest sales office.