Reithoffer

DOUBLE DECK MIRROR MAZE SERIES

02064

MFG: OWENS CUSTOMS
NAME: MIRROR IMAGE
TYPE: ATTRACTION

SERVICE MANUAL FOR 48 FT. MIRROR MAZE

MODEL NO. 48FDDMM

BY:
OWEN TRAILERS, INC.
12911 EAST GARVEY AVENUE
BALDWIN PARK, CA 91706
818-337-3592

4.0) WARRANTY INFORMATION

WARRANTY

DATE OF DELIVERY FEB 1998 - REITHOFFER SHOWS

DATE OF MANUFACTURE FEB 1998

RIDE SERIAL NUMBER 1C9025488W1139321

MODEL NUMBER 48FDDMM

COLOR AND STYLE RED + WHITE "CRYSTAL LITS"

1. All parts manufactured by seller, except tires, hydraulics, electrical, batteries, fire and alarm system, glass and posts, etc. which come under each manufacturer's own warranty for a period of six months.

2. The purchaser will pay for any service charge for making service calls and/or transporting the equipment to the place where the warranty work is done.

3. This warranty does not cover depreciation or damage caused by normal wear, accident, improper maintenance, improper protection in storage or improper use. Normal maintenance and service replacement cost will be borne by the purchaser.

4. Seller shall not be liable for loss, damage or expenses directly or indirectly arising from improper use of the ride.

5. Under these conditions all such parts and materials will be invoiced to the customer upon shipment by us of required replacement parts. Full credit will be allowed on such parts subject to the following conditions:

   A. if they are returned to us, freights PREPAID within a period of ninety (90) days after the date of invoice

   B. after our examination of said parts they provide to out satisfaction that such defects did exist.
   This is our sole obligation under the warranty.

INTRODUCTION

To the owner

This manual is your guide to safe, productive operation. Read it carefully. It will help reduce trial and error learning and minimize downtime caused by improper maintenance.

For additional information, contact the OWEN TRAILERS CUSTOMER SERVICE DEPARTMENT.

NOTE: Because we try to improve every OWEN TRAILERS product, specifications and product design are subject to change without notice.

Intended uses

The equipment described herein is intended to be used by a commercial operator to provide a service to the buyer's customers. As a commercial operator, the buyer agrees to operate and maintain the equipment for its intended use in a professional and competent manner as per OWEN TRAILERS recommendation and instructions, ASTM standards on amusement rides and devices, applicable governmental standards, and good commercial practices using professional and competent mechanics and operators. If at any time, and for any reason, the equipment cannot be adequately and safely operated for its intended use, buyer agrees not to operate the equipment until proper repairs or corrections are made.

Ride information plaque

The ride information plaque is mounted to the main structure in the center of the ride. The plaque lists ride specifications, operating dimensions, ground loads, as well as model and serial number and date of manufacture. When ordering parts or requesting information from the OWEN TRAILERS CUSTOMER SERVICE DEPARTMENT, always specify the model and serial number of your ride.

CONTENTS

1.0) SPECIFICATIONS

48 FT. DOUBLE DECK MIRROR MAZE WITH SLIDE
MODEL NO. 48FDDMM
RIDE DURATION - 8 MINUTES
MAXIMUM PASSENGER CAPACITY - 20 ADULTS OR 30 CHILDREN W/SINGLE OPERATOR
MAXIMUM PASSENGER CAPACITY - 3,000 LBS.
MINIMUM PASSENGER HEIGHT - 36 IN. UNLESS ACCOMPANIED BY ADULT
ELECTRICAL SERVICE - 120/240 VAC / 100 AMP / 60 HZ / SINGLE PHASE

TRAILERING INFORMATION:

LENGTH - 48 FT.
WIDTH - 8.5 FT.
HEIGHT - 13.5 FT.
CURB WEIGHT - 35,000 LBS.
AXLE WEIGHTS - 20,000 LBS.
KINGPIN WEIGHT - 15,000 LBS.

ASSEMBLED DIMENSIONS AND WEIGHTS:

LENGTH - 69 FT.
WIDTH - 15.5 FT.
HEIGHT - 26 FT.
WEIGHT WITH PASSENGERS - 38,000 LBS.
LANDING GEAR LOAD DISTRIBUTION - 5,000 LBS.
WIND STABILIZER MAXIMUM LOAD - 5,000 LB.

2.0) MOTOR VEHICLE ID (DATA PLATE)

48 FT. DOUBLE DECK MIRROR MAZE SERIES WITH SLIDE
MODEL NO. - 48FDDMM
SERIAL NO. - [ ]
DATE OF MFG. - [ ]
GVWR - 38,000 LBS
GAWR (EACH) - 18,000 LBS.
WITH 215/75R-17.5H TIRES AT 110 PSI
CURB WEIGHT - 35,000 LBS.
AXLES - 20,000 LBS. KINGPIN - 15,000 LBS.

MFG. BY:

OWEN TRAILERS, INC.
12911 EAST GARVEY AVENUE
BALDWIN PARK, CA 91706
818-337-3592

THIS VEHICLE COMPLIES WITH ALL FEDERAL MOTOR VEHICLE SAFETY STANDARDS IN EFFECT ON THE DATE OF MANUFACTURE.

3.0) RIDE INFORMATION PLAQUE (DATA PLATE)

48 FT. DOUBLE DECK MIRROR MAZE SERIES WITH SLIDE
MODEL NO. - 48FDDMM
SERIAL NO. - [ ]
DATE OF MFG. - [ ]
RIDE DURATION - 8 MINUTES
MAX. PASSENGER CAPACITY - 20 ADULTS OR 30 CHILDREN
MAX. PASSENGER CAPACITY - 3,000 LBS.
MINIMUM PASSENGER HEIGHT -42 IN. UNLESS ACCOM. BY ADULT
ELECTRICAL SERVICE - 120/240 VAC / 100 AMP / 60 HZ

MFG. BY:

OWEN TRAILERS, INC.
12911 EAST GARVEY AVENUE
BALDWIN PARK, CA 91706
818-337-3592

Midway Engineering

November 27, 1996

Mr. Charles Bruckner, Director
Commonwealth of Pennsylvania
Department of Agriculture
Bureau of Ride and Measurement Standards
2301 N. Cameron St.
Harrisburg, PA 17110-9408

Dear Mr. Bruckner,
Ref: Mirror Maze by Owen Trailers, Inc.

In accordance with a request by Mr. Ross Owen of Owen Trailers, Inc., my services as a professional engineer have been retained with respect to the"Mirror Maze" Series Amusement device. This device is also made in other themes such as "Mardi Gras", etc. This certification applies to all themes of Model No. 48FDDMM.

Examination of the Amusement device, Engineering Drawings and Analysis, and Service Manual was completed on February 7, 1996. The "Mirror Maze" was examined for conformance with the following ASTM Standards and to the Amusement Ride Regulations for the Commonwealth of Pennsylvania:

ASTM F698-88	Physical Information
ASTM F747-89	Definition of Terms
ASTM F770-88	Operation Procedures
ASTM F846-92	Testing Performance
ASTM F853-91	Maintenance Procedures
ASTM F893-87	Inspection
ASTM F1159-92	Design and Manufacture
ASTM F1193-88	Quality Assurance

The results of my review indicate that the "Mirror Maze" Series Amusement device, and the manufacturer, Owen Trailers, Inc., conform to the applicable requirements of the ASTM Standards and the Amusement Ride Regulations for the Commonwealth of Pennsylvania in effect on the date of manufacture.

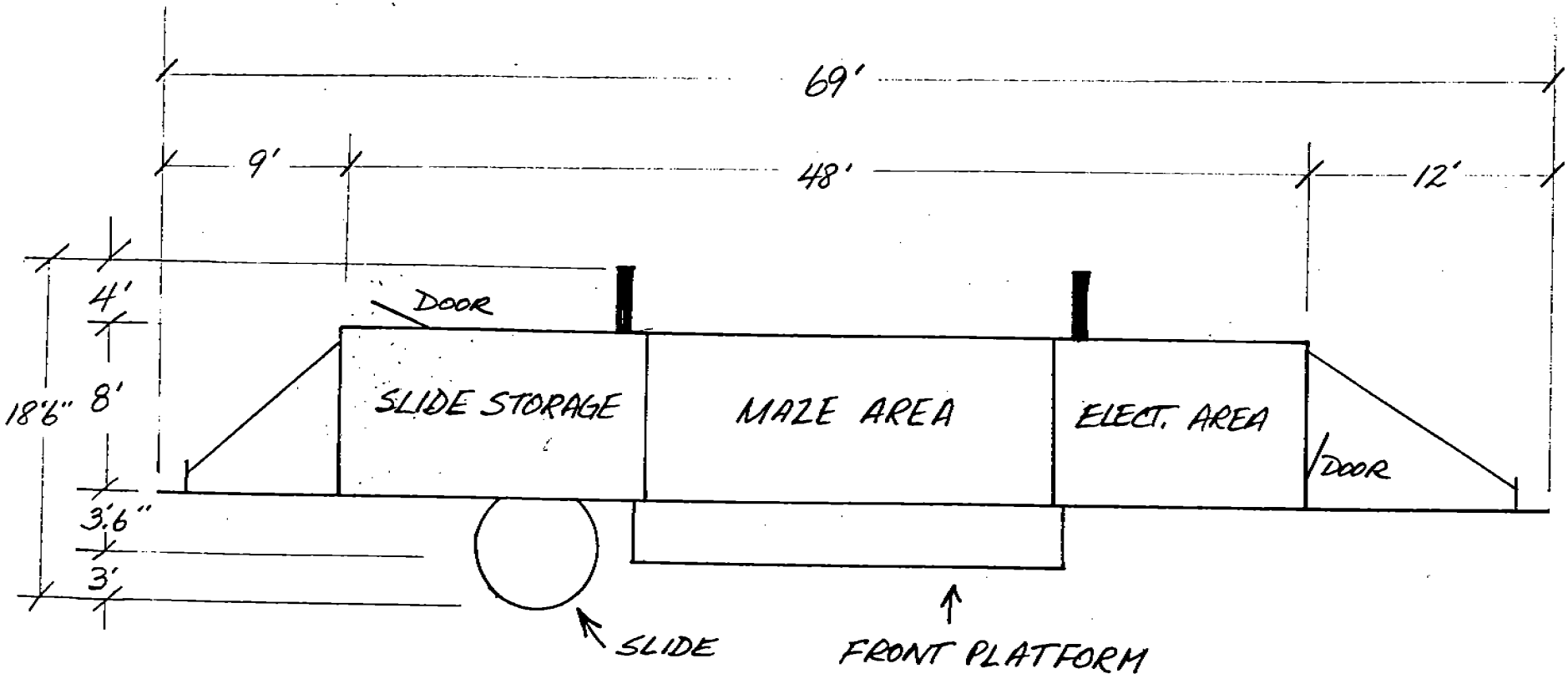
Based upon the above results, I do hereby certify conformance of the "Mirror Maze" Series Amusement device manufactured by Owen Trailers, Inc. of Baldwin Park, CA to the applicable ASTM Standards referenced above and to the Amusement Ride Regulations for the Commonwealth of Pennsylvania in effect on the date of manufacture.

Should you have any questions regarding the above, please contact me.

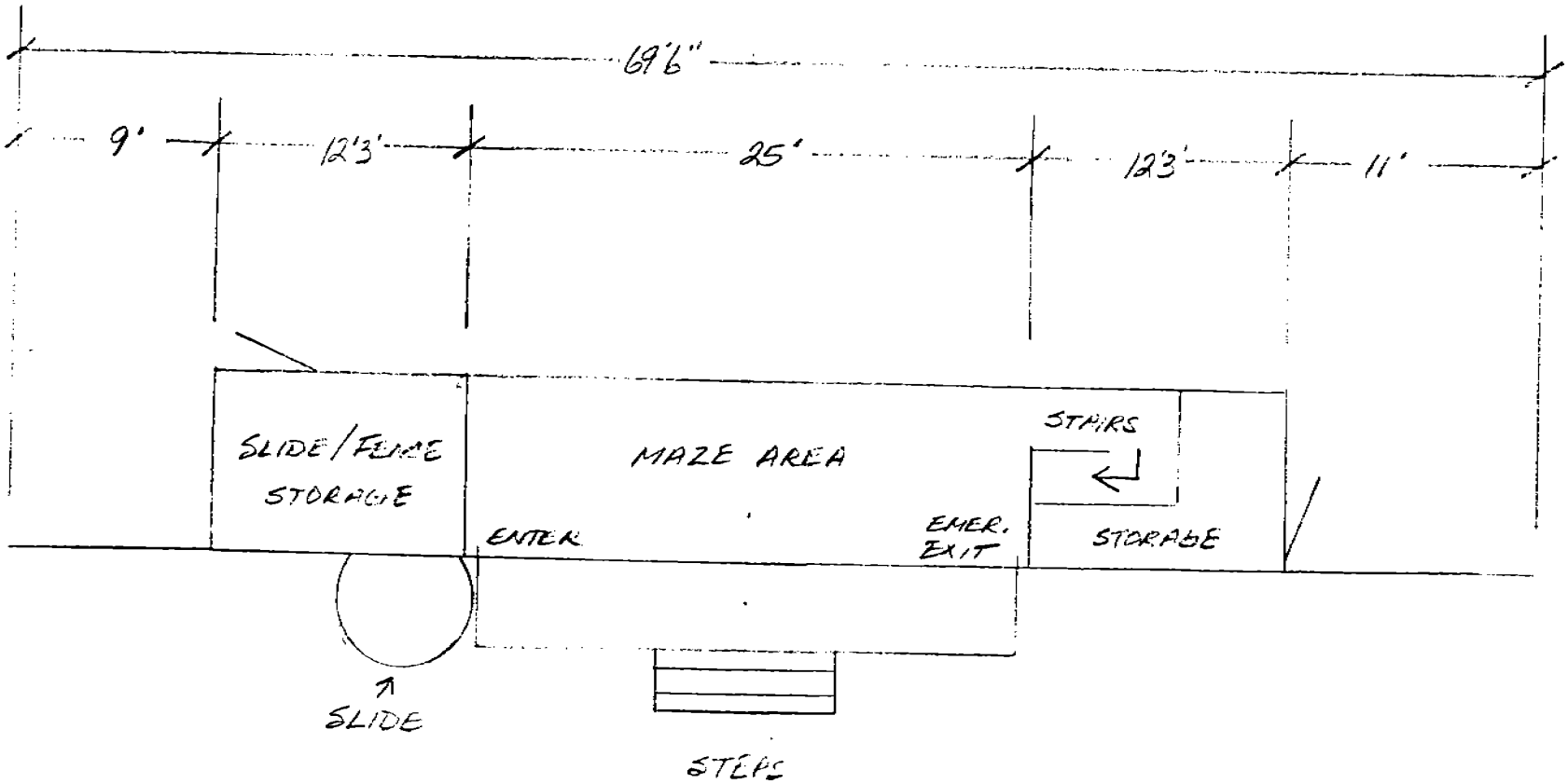
Timothy A. Horn, P. E.
Professional Engineer

2695 Springmill Rd. Mansfield, OH 44903 (419) 717-1708

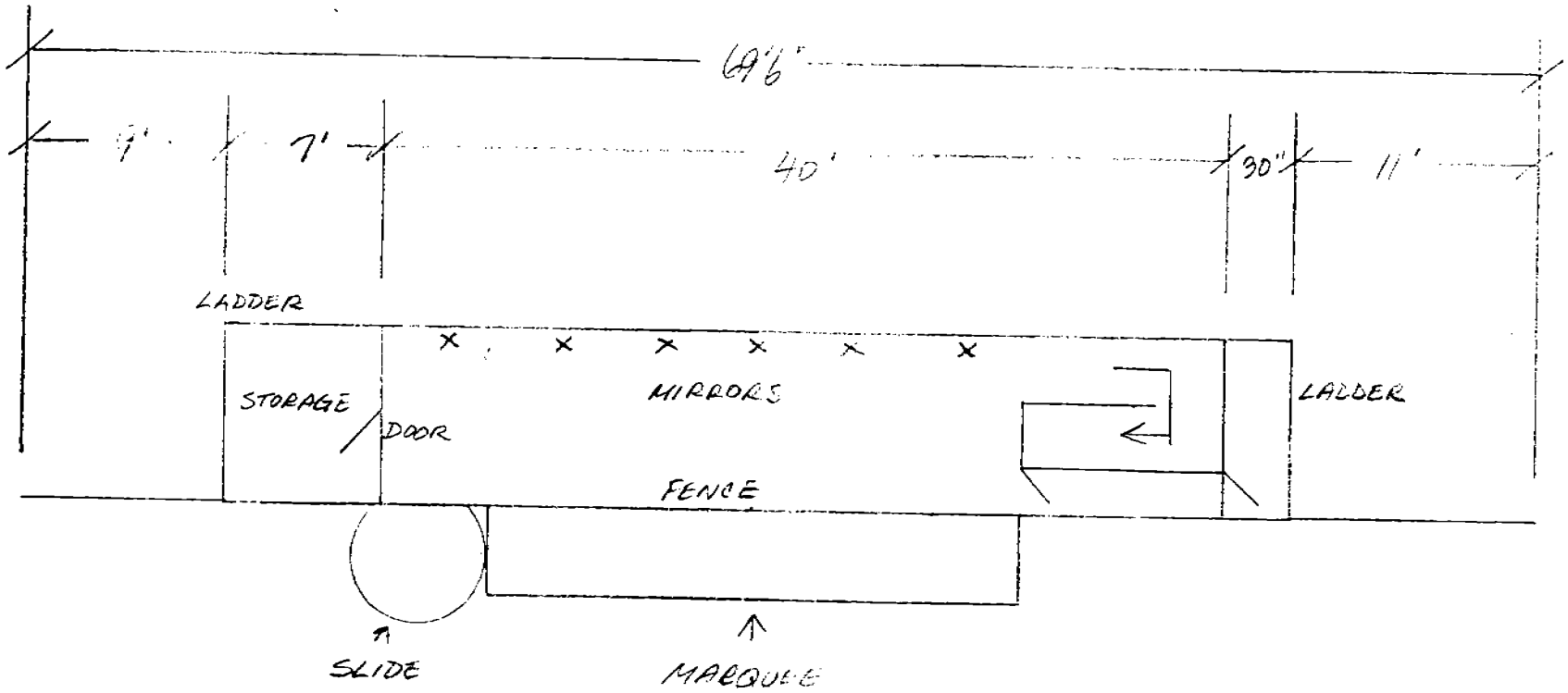
48Ft OWEN DOUBLE DECK MAZE



48' QUEEN DOUBLE DECK MAZE
FIRST FLOOR LAYOUT



48' OWEN DOUBLE DECK MAZE
SECOND FLOOR LAYOUT



SETUP AND TEARDOWN

General Information

This manual provides detailed instructions for setting up and tearing down the portable ride. The general sequence is given for carrying out each procedure, and should be followed. If the size of the set-up crew permits, some steps can be performed simultaneously. Extra caution must be used, however, to keep all workers clear of any potential hazard.

WARNING: When setting up or tearing down the ride, never allow bystanders and/or other workers in the area. Always know the whereabouts of all workers during the entire set-up or tear-down procedure.

CAUTION: Precautions for personal safety must be observed at all times when setting up or tearing down the ride. Be aware of elevated area, pinch points, suspended loads, moving equipment, etc. Keep a safe distance from these hazards to avoid serious personal injury.

CONTENTS

ELECTRICAL CONNECTION

Before starting to set up the ride, electrical power must be connected as follows:

1. Check the main circuit breaker located in the main control box. Make sure it is in the "OFF" position.

2. Ground per local code.

IMPORTANT: Make sure the small ground wire of the power cable is connected to an adequate ground per local code.

3. Connect the main electrical power supply to the ride. Check the electrical schematics for the power requirements of the ride, noting the color coding of the power cable.

   GROUND - Green wire
   NEUTRAL - White wire
   PHASE - Black, red and blue wires

4. Make sure all switches on the control console are in the "OFF" position.

1.0) LEVELING AND UN-HOOKING FROM TOW VEHICLE

A) Select a suitable location which is as level as possible. The following minimum clearances must be maintained for the Mirror Maze when fully erected:

Overall Length - 70 ft.
Front of trailer to end of wing panel - 13 ft.
Rear of trailer to end of wing panel - 9 ft.
Overall height without flags - 26 ft.
Overall height with flags - 32 ft.
Curbside of trailer to extended slide - 7 ft.
Roadside of trailer to stabilizers & open door - 3 ft. 6 in.
Roadside scenery to ground - 5 in. below trailer frame
Roadside platform scenery to ground - 6 1/2 in. below trailer frame

B) Place blocking under all (4) landing gears, front and rear. Also place blocking at the front and rear of at least one tire. Lower the front landing gears and raise the trailer to unload the tractor. Disconnect (2) air line connections and the ICC Electrical cable. Unlatch the tractor fifth wheel from the kingpin. Pull the tractor forward and away from the trailer.

C) Lower the rear landing gears and level the trailer. Level from curbside to roadside first, and then from front to back. If the curbside is high, drain the air suspension using the cable drain located at the center of the roadside tandem. This can be used to lower the entire unit using the landing gears.

D) Unwind all of the electrical lead cable from in the gooseneck service room. This unit requires 120/240 vac - single phase - 60 hertz - 100 amp service. Make the electrical connection in accordance with the instructions on page 1 of this section.

WARNING: Failure to connect the lead in cable according to the proper color code will result in damage to the electrical system and controls. Always make sure that all circuit breakers are off whenever electrical connections are made.

2.0) SETUP PROCEDURE

A) Unlatch and slide out (2) roadside stabilizers. Relatch in extended position. Remove R-clip and pin and fold down adjustable leg. Re-install pin and R-clip. Place blocking under leg, and adjust threaded pad for a tight fit.

Note: If ground clearance will not permit leg to fold down, use blocking under stabilizer arm and lower landing gears for tight fit.

B) Unlatch and fold out (3) curbside stabilizers. Remove R-clip and pin and fold down adjustable leg. Re-install pin and R-clip. Place blocking under leg, and adjust threaded pad for tight fit.

Note: If ground clearance will not permit leg to fold down, use blocking under stabilizer arm and lower landing gears for tight fit.

C) Remove rear scenery wing panel latch bar (Orange) by removing R-clip, pulling to the side and lifting up on the latch bar to remove it from upper pocket. Store latch bar under curbside of trailer. Unlatch and unfold lower scenery panel as rear scenery wing panel is folded towards the rear. Remove rear scenery wing panel brace (Orange) from curbside storage brackets and insert S-hook end into scenery wing panel. Place other end in the bracket on the trailer rear and R-clip. Use caution and additional help in windy conditions.

D) Remove front scenery wing panel latch bar (Yellow) by removing R-clip, pulling to the side and lifting up on the latch bar to remove it from the upper pocket. Store latch bar under curbside of trailer. Unlatch and unfold lower scenery panel as front scenery wing panel is folded towards the front. Remove front scenery wing panel brace (Yellow) from curbside storage brackets and insert S-hook end into scenery wing panel. Place other end in bracket on the trailer front and R-clip. Use caution and additional help in windy conditions.

E) Unlatch and unfold under gooseneck scenery and latch in place.

F) Open access door on curbside front over gooseneck and turn on main circuit breaker and slide room sub-panel breaker. Enter slide room through roadside rear door and turn on hydraulic pump circuit breaker in sub-panel.

2.0) SETUP PROCEDURE (CONT.)

G) **Climb the front or rear ladders to the roof level.**

> **WARNING: Individuals who are uncomfortable at heights or unsure or feel unsafe should not be permitted on the roof level. Exercise caution on the roof and step only on catwalks and structural members to prevent damage.**

H) **At the front of the trailer, unlatch and foldup, the catwalk, support braces, and support arm frame. Latch in place and install all R-clips. See Figure H at right.**

FIGURE H

I) **At the rear of the trailer, unlatch and foldup, the catwalk, and support braces. Latch in place and install all R-clips. See Figure I at right.**

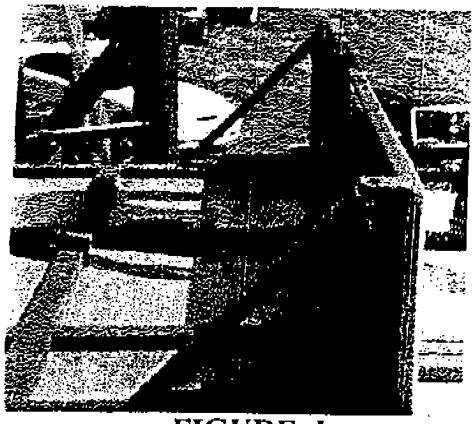


FIGURE I

J) **Remove R-clips and unlatch (6) locks holding main front wall on roadside of roof. See Figure J at right. Make sure the locks are open before using hydraulics.**

> **WARNING: Failure to unlatch roof will cause severe damage if hydraulic system is operated.**

FIGURE J

2.0) SETUP PROCEDURE (CONT.)

K) All personnel should now exit the roof.

L) Open hydraulic control access door to the left of the rear ladder and turn the pump switch on. If the pump does not start, refer to Para. F and check circuit breakers. Refer to Figure L at right. Use caution while using the controls from on the ladder.

FIGURE L

M) Pull out valve handle #1 marked "MAIN WALL" to begin raising wall. Use caution as the wall will begin to move more quickly as it reaches the top. Ease off the valve to slow the wall as it reaches the top. Failure to slow the wall may cause damage.

N) When the wall has reached the vertical position, the braces on the front and rear of the trailer must be locked in place. You can use the hydraulic rams to adjust for a good fit. Install R-clips in the pins. Refer to Figure N at right.

FIGURE N

O) Remove R-clips and unlatch (6) RED latches which hold the top sign in place. There is one at each end and four along the bottom. See Figure O at right. Make sure all locks are open before using hydraulics.

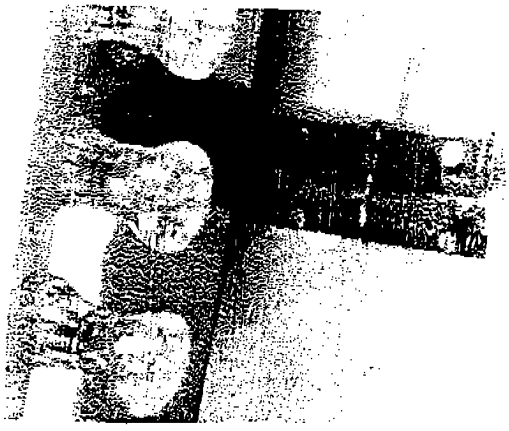


FIGURE O

WARNING: Failure to unlatch the top sign will cause severe damage if the hydraulic system is operated. Please double check all latches.

2.0) SETUP PROCEDURE (CONT.)

P) Four people should space themselves evenly along the bottom of the main sign. All together they must pull out the bottom of the sign about 3 ft. from the wall and hold it there so the lift cylinders are all over center. Refer to Figure P at right.

FIGURE P

Q) Refer to Para. L and pull the valve handle #2 marked "TOP SIGN" to begin raising the sign. If the sign pulls in instead of pushing out, the sign has not be pulled out far enough in Para. P above. Repeat until the sign pushes out and begins to raise. Stop the sign when the bottom is approximately 6 ft. above the roof.

R) Remove Light #1 from its storage in the gooseneck hand it up to the roof, and install at the front of the roof sign. Pin in place and plug-in cord. Remove Light #A from its storage in the rear slide room , hand it up to the roof, and install at the rear of the roof sign. Pin in place and plug-in cord. Install flags in these two lamps.

S) Refer to Para. Q and continue to raise the roof sign to its midway up position. This will be at about 15 deg. beyond horizontal. Remove (7) support braces from their storage at the rear of the roof. Install S-hook end in the rear of the sign and the other end into the brackets on the folding roof. Raise or lower the top sign to make these fit. Install R-clips in the pins. Refer to Figure S at right.

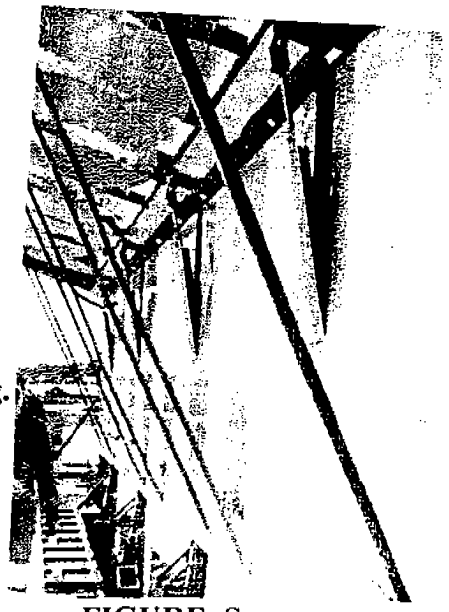


FIGURE S

T) Unlatch (6) sliding YELLOW locks on folding roof. One at each end and four along the bottom. Be sure to hold and re-latch the center section of fence. Make sure the sliding locks are R-clipped in the open position. Refer to Figure T at right.

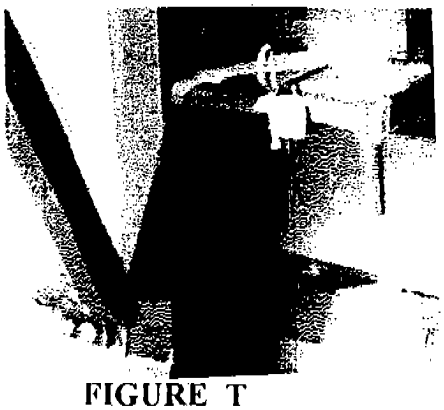


FIGURE T

WARNING: Failure to unlatch the roof will cause severe damage if the hydraulic system is operated. Please double check all latches and make sure they are R-clipped open.

2.0) SETUP PROCEDURE (CONT.)

U) **Refer to Para. L and pull the valve handle #2 marked "TOP SIGN" to complete raising the sign/folding roof assembly to the full open position. This will occur when the folding roof is at about 15 deg. below horizontal. Refer to Figure V below.**

V) **Refer to Para. L and pullout the far valve handle #3 marked "BACK WALL" to raise the back wall. Stop the wall at about half way or 45 deg. from the down position. Fold the (3) upper sections over onto their supports. Refer to Figure V below .**

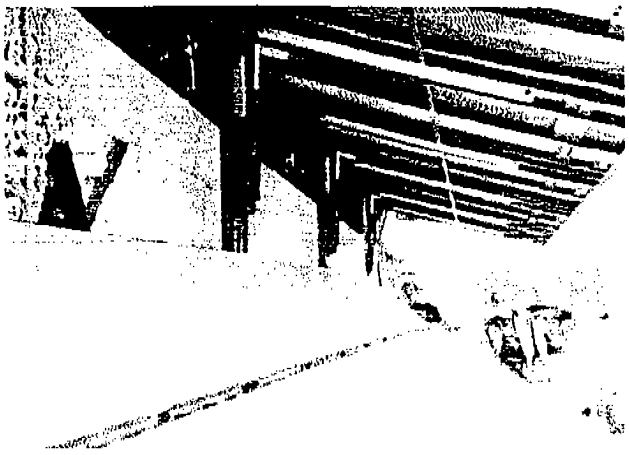


FIGURE V

W) **Continue to raise the back wall to the full up position. Push up on the folding roof, if required, to raise the back wall into position. Refer to Figure W below.**

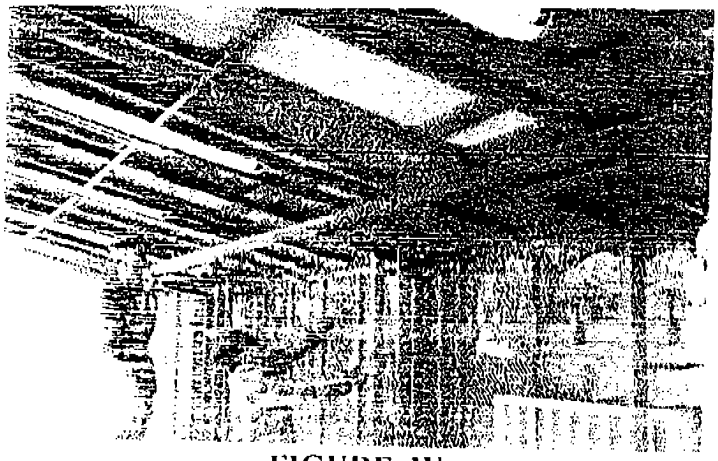


FIGURE W

2.0) SETUP PROCEDURE (CONT.)

X) **Unlatch, fold up into place, and relatch braces on either side of the lift cylinders on the curbside and roadside walls. Use the rams if necessary and adjust the walls for a good fit. Refer to Figures X1 and X2 below. Lower both walls so that they lock in place.**

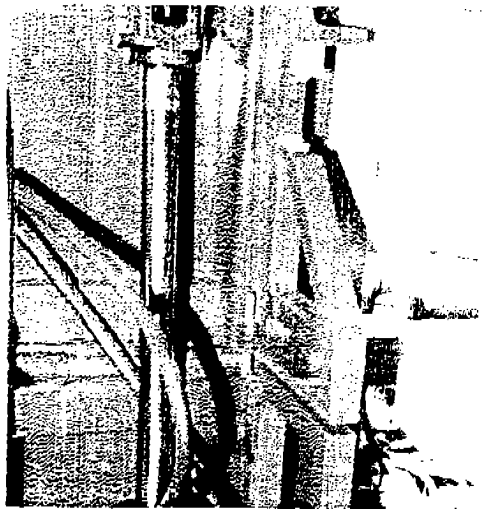


FIGURE X1

FIGURE X2

Y) **Unlatch, fold around into place, and re-latch front and rear end walls. Fold up pie shaped upper panels as end walls are folded around. Fold up and latch upper closure panels to complete. Refer to Figure Y below.**

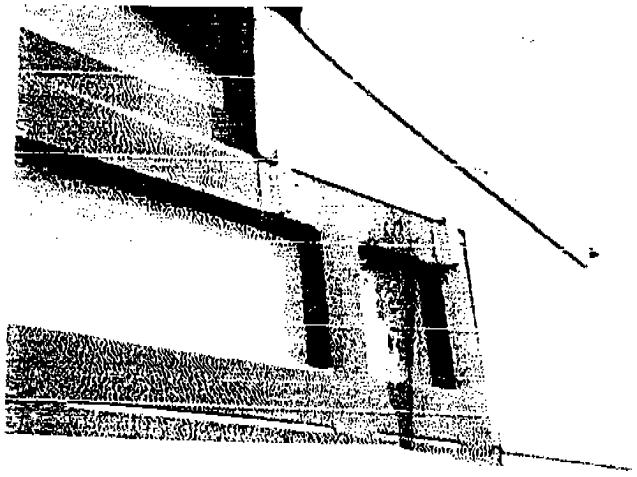


FIGURE Y

2.0) SETUP PROCEDURE (CONT.)

Z) **Fold up and latch all scenery and wall panels around the stairway. Install all R-clips. Unlatch, fold down, and re-latch curbside white fence sections. Refer to Figure Z at right.**

FIGURE Z

AA) **At ground level, remove all remaining scenery wind braces from the storage brackets on the curbside of the trailer. YELLOW parts go to front scenery, and ORANGE parts go to the rear scenery. On the front of the trailer, using the longest YELLOW wind brace, insert the S-hook end into the tab hole on the bottom corner of the upper front scenery wing panel. A person on the roof, can then unlatch the upper wing panel bottom latch, then the top latch. The ground level person then swings the upper panel into position using the wind brace. A second ground level person can install the ladder style brace by dropping the top pin into the V-slot, swinging the brace to the side, and inserting the tabs into the slots. Latch in place and R-clip. Remove long wind brace and install with other braces to color coded brackets. All S-hooks attach to scenery. Refer to Figure AA at right for completed bracing.**

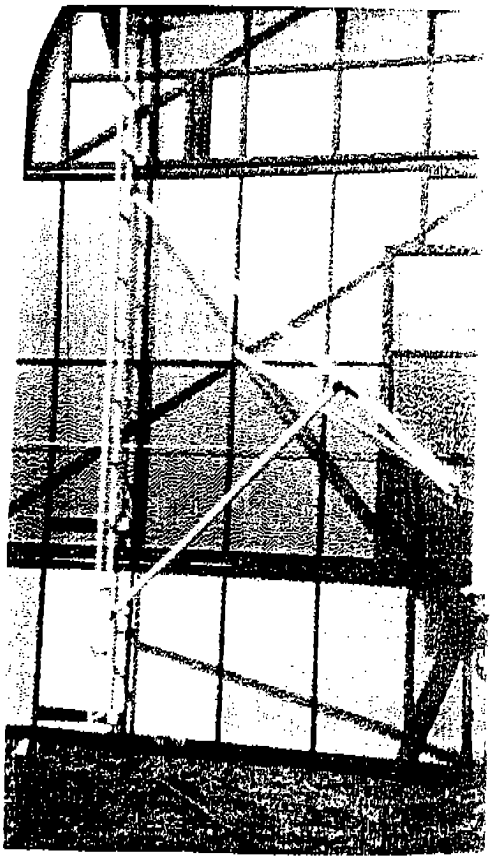


FIGURE AA

2.0) SETUP PROCEDURE (CONT.)

AB) **Repeat Procedure AA for the ORANGE colored braces and the the upper rear scenery panel on the rear of the trailer. Make sure latches are locked and R-clips are installed. Install all wind braces to the color coded brackets. All S-hooks attach to the scenery.Refer to Figure AB at right for completed bracing.**

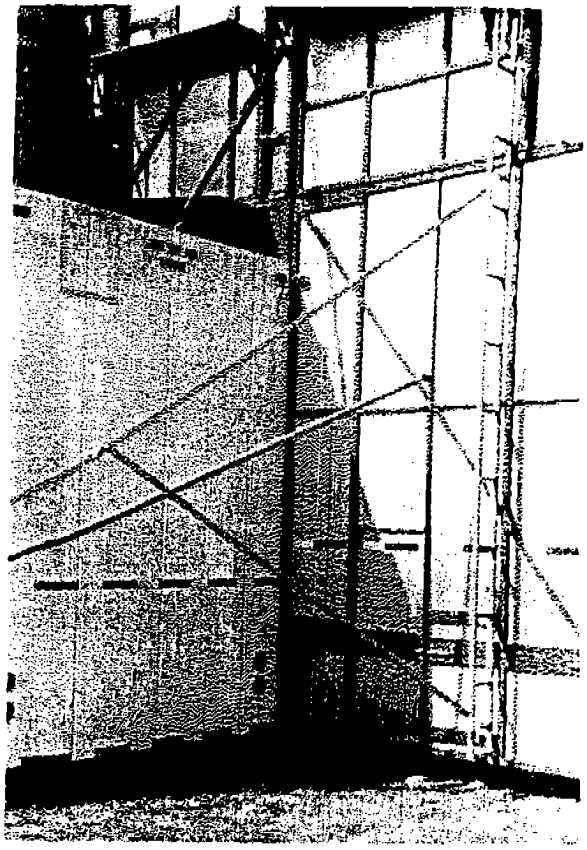


FIGURE AB

AC) **Unpin, pullout and re-pin platform support tubes on curbside under platform. Make sure R-clips are installed in the pins.**

AD) **Using (4) people, unlatch and lower platform down onto support tubes.**

AE) **Using the same (4) people, step up on platform, unlatch (4) latches holding curbside roof and marquee, and fold up marquee panel using two support rods to hold in place. Make sure R-clips are installed in support rods. Refer to Figure AE at right.**

FIGURE AE

2.0) SETUP PROCEDURE (CONT.)

AF) Open small access door to the rear of the marquee, and turn hydraulic pump on. Push in on control valve to raise the awning-marquee assembly about 8" away from the trailer. Refer to Figure AF at right.

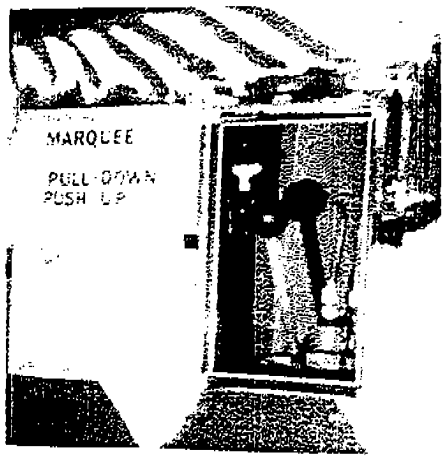


FIGURE AF

AG) Open large slide-room access door on curbside by entering slide room through small access door on roadside at rear. Pull the blue cable on the inside of the large access door to release the latches.

AH) Unlatch slide assembly and swingout through door opening for access to parts stowed in this room.

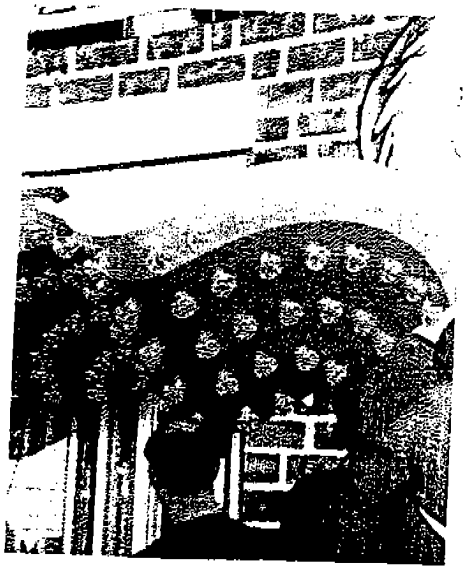


FIGURE AI

AI) Remove (2) marquee end return panels and carry to front platform. Install on the ends of the marquee, leaving them open against their stops. Plug in the power cord for the lights. Refer to Figure AI at right.

AJ) Refer to Para. AF and raise the awning-marquee assembly to the full up position. Use caution and make sure the end return panels do not swing in against the trailer.

AK) Remove awning support posts, fences, scenery panels, steps, and handrails from their storage positions in the slide room.

2.0) SETUP PROCEDURE (CONT.)

AJ) Install support posts between platform and awning. Posts are numbered and must be installed correctly for fences and handrails to fit. Install be inserting single pin on top end into the hole in the awning and pushing up. Then lower the two bottom pins into the holes in the platform. Refer to Figure AJ at right. Refer to Para. AF and lower the awning onto the posts.

FIGURE AJ

AK) Latch (2) marquee end return panels in place. Install front steps and make sure they are properly adjusted for height and locked in place. Install fences between posts and handrails on steps.

AL) Install long scenery on platform. The ends with the tab with a hole go to the ends of the platform. Fold the slide back into the slide room, and install the wheel well scenery. Fold the slide back out into position.

AM) Install the end pieces of scenery on the platform. Install with pin through hole tab on the long scenery. Unfold the short end so that it goes under the frame. Latch in place with the prop latch.

AN) Return to the roof and the front end, and fold up the remaining catwalk and braces and latch in place. Remove the remaining lights from their storage areas and hand them up to the persons on the catwalks. Also hand up the remaining flags. Remember to plug in the lights.

AO) Unfold the short platform to the slide and latch in place. Remove the slide post and fences from their storage and install at the slide.

AP) Raise and latch mirror assemblies in place.

AQ) Latch access doors on the front and rear upstairs ends from the outside and climb down outside ladders.

2.0) SETUP PROCEDURE (CONT.)

AR) Remove lower slide pole support leg from its storage, and install on the bottom of the slide pole. Insert blocking under the pad, and adjust for tight fit.

AS) Remove lower slide section from its storage, and bolt to bottom of folding slide assembly.

AT) Fold the short end section of the large slide room access door to the inside and swing the door assembly closed. Make sure the door is properly latched. The blue cable on the inside of the door may be used to make sure latches are closed. This completes the setup of the Mirror Maze.

3.0) TEARDOWN PROCEDURE, HOOKUP, AND TRAVEL

A) The teardown or disassembly procedure for the Mirror Maze is generally the reverse order of the setup procedure. Follow the setup procedure in reverse to disassemble the Mirror Maze.

WARNING: Failure to properly latch and unlatch the hydraulically operated components and assemblies will result in severe damage to this unit. Only persons experienced in their operation should be permitted to use this equipment.

WARNING: Individuals who are uncomfortable at heights or unsure or feel unsafe should not be permitted on the roof level. Exercise caution on the roof and step only on catwalks and structural members to prevent damage.

3.0) TEARDOWN PROCEDURE, HOOKUP, AND TRAVEL (CONT.)

B) **Once the Mirror Maze has been completely disassembled and closed for the travel position, the tractor should be backed into position at the front of the unit. Raise the rear landing gears to the travel position. Raise or lower the front landing gears to the proper height for the tractor fifth wheel height.**

C) **Make sure that at least one tire has been blocked both front and rear to prevent the unit for rolling. Back the tractor carefully under the kingpin until the fifth wheel latch engages. Ease the tractor forward to make sure the kingpin is locked in the fifth wheel.**

D) **Attach (2) air line glad hands and the ICC electrical connector. Check to see that all trailer lighting is working. Crank up the front landing gears to the travel position and double check that everything is stowed, latched, and locked properly in the travel position. Remove all blocking and stow in the storage areas. The Mirror Maze is now ready for travel.**

OPERATION

General Information

Safe operation is a combined responsibility and effort of the ride manufacturer and the owner/operator. This manual provides detailed information on the operation of the ride and provides the operator with important safety information.

All operators must be thoroughly familiar with the contents of this section before attempting to operate the ride. This information must be immediately available to all operators of the ride.

CONTENTS

1.0) OPERATOR SELECTION AND INSTRUCTION

1. Select competent, mature operators, capable of understanding the function, use and control of amusement rides.

2. Instruct each operator fully in the proper use and function of the ride he/she is to supervise, including:
   a. Controls and procedures for normal and emergency operation.
   b. Manufacturer's recommended maximum speed and load.
   c. Manufacturer's recommended length of ride time and frequency of repeat rides.
   d. Any foreseeable misuse of the ride as determined by the manufacturer or owner, or by special conditions such as weather, location or crowds.
   e. Each operator must have immediate availability of the manufacturer's operation manual for the ride he supervises.

3. Require the operator to inspect the ride he supervises before each day of operation.
   a. Determine that no portion of the ride is damaged, missing or worn in such a manner that it is unsafe, or that can develop into an unsafe condition.
   b. Report any irregularities to superintendent or owner.
   c. If any irregularities are found, do not operate the ride until such condition is corrected.

4. Instruct operators to allow no passenger to ride who is visibly ill, or under the influence of drugs or alcohol.

5. Instruct operators and attendants on the proper methods of securing passengers in the ride. Do not allow a passenger in the ride that cannot be properly secured due to passenger size or malfunction of the securing device. Stop the ride immediately if any passenger is observed tampering with any restraining device or behaving dangerously, such as changing positions or walking around the ride.

1.0) OPERATOR SELECTION AND INSTRUCTION (CONT.)

6. Advise the operator against starting the ride while any person (passenger, spectator or employee) is in a dangerous or unsafe position on the ride, or within the ride area.

7. Insist that each operator remain in full control of the operating controls during operation of the ride. The operator's full attention must be given to the ride and its passengers.

8. Instruct the operator to allow no other person, except for another trained operator, to operate the controls of the ride (excepting portions of the ride that are designed to be controlled by the passenger).

9. Instruct the operator and attendants fully as to the proper method of assembly and disassembly of portable rides. Always supply adequate personnel and equipment to do it safely.

10. Instruct the operator to inspect and correct damaged, lost or worn parts that are unsafe or that can develop into unsafe parts, during assembly or disassembly.

11. Advise the operator that factory-installed safety devices must not be tampered with or removed.

12. Instruct operator of owner's or supervisor's procedure for assisting ill or injured passengers.

13. Instruct operators and attendants that patrons are required to secure all articles, such as keys, change, eye glasses, etc., which may become loose while riding.

2.0) OPERATOR'S CONTROLS

A) MAIN CIRCUIT BREAKER PANEL

The main circuit breaker panel is located behind the access door on the curbside front over the gooseneck. Only the operator should be permitted to access this panel during operation.

B) SUB-FEED CIRCUIT BREAKER PANEL

The sub-feed circuit breaker panel is located on the curbside wall in the rear slide storage room toward the hitch end. Enter the slide room through the roadside rear door. Only the ride operator should be permitted to access this panel during operation.

C) EMERGENCY LIGHTING

The emergency lighting charging circuit is controlled by a branch circuit breaker in the main panel. This circuit breaker should always be in the "ON" position during operation. The emergency lights activate automatically when power is lost.

D) MAIN LIGHTING

Branch circuit breakers for all lighting systems are located in both the main and sub-feed breaker panels.

E) FIRE PROTECTION SYSTEM

Circuit breakers for the smoke alarm and sprinkler system compressor are located in the main breaker panel. These circuit breakers should always be in the "ON" position during operation.

F) SPRINKLER SYSTEM

The water control valves for filling and draining the sprinkler system are located in the front storage room over the gooseneck. A vent valve is located on the upstairs roadside wall adjacent to the sprinkler head.

3.0) PASSENGER LOADING

CAUTION: Do not operate the ride unless all parts of the vehicles are in good condition, including the passenger restraints. All safety signs and placards must be legible.

Any broken or missing parts must be repaired or replaced immediately.

CAUTION: Do not allow any passenger on the ride who cannot be properly secured because of passenger size or condition.

Never allow a passenger who is visibly ill or under the influence of drugs or alcohol on the ride.

Persons who have physical impairments must be advised of potential risks before riding.

CAUTION: Never allow the ride to become overloaded. Maximum capacity of the ride is (20) adults or (30) children or a maximum of (3000) lbs. with a single operator. Additional capacity is permitted if additional operators are added according to this manual.

The minimum passenger height is (42) inches, unless accompanied by an adult.

3.0) PASSENGER LOADING (CONT.)

A) LIGHT CAPACITY OPERATION (UP TO 150/HR)

One employee can operate the ride under these conditions.

1. **The operator should position himself at the top of the front entrance steps. He should take tickets from patrons entering on the rear of the stairway and direct them to the rear and the entrance to the maze.**

2. **The operator should also direct patrons from the bottom of the stairway from the upstairs to the forward end of the entrance steps, if the patrons do not exit the upstairs by the spiral slide but instead come down the stairs.**

B) NORMAL CAPACITY OPERATION (150/HR TO 450/HR)

Two employees are required to operate at normal capacity. The #1 employee will perform the duties in light operation above.

1. **The #2 employee should be positioned upstairs at the spiral slide entrance. This employee will keep patrons moving uniformly through the upstairs and assist patrons entering the spiral slide.**

4.0) OPERATOR'S POSITION

The operator is responsible for the safety of the passengers as they enter, and exit the ride. He must know and understand all operation and emergency procedures for this ride, and must be in the operators position at all times while the ride is in operation. The ride must have the operators complete attention at all times.

WARNING: Before starting the ride, make sure there is no one around the ride structure, close to any exposed electrical components, or any other areas where there is a possibility of personal injury.

CAUTION: The operator must remain in full control of the operating controls at all times during the operation of the ride. The ride and its passengers must be given the full attention of the operator at all times.

Never leave the operating controls while the ride is in operation.

5.0) OPERATION AT INCREASED CAPACITY

A). HIGH CAPACITY OPERATION (OVER 450/HR)

Three employees are required to operate at high capacity. Employees #1 and #2 should be positioned in accordance with Para. 3.0a normal capacity operation.

1. **The #3 employee should be positioned at the bottom of the stairway to the upstairs. This employee should help to maintain orderly uniform flow of patrons up the stairway. He must question each patron about going upstairs and exiting via the spiral slide. Any patron not willing or able to exit by the spiral slide should be directed to exit down the platform to the exit stairs.**

6.0) EMERGENCY PROCEDURES

A) **In the event of loss of electrical power, the emergency lighting system will automatically operate. If electrical power is not restored, direct passengers to carefully exit via the spiral slide or stairway from upstairs or the front platform and steps from downstairs.**

B) **If there is smoke inside or under the ride, evacuate the ride immediately and shut down the electrical system. The operator should assure that all passengers have exited the ride, and then notify the proper authorities.**

NOTE: **THE STORAGE OF ANY COMBUSTIBLE OR FLAMMABLE MATERIAL IN, OR UNDER THIS RIDE IS STRICTLY PROHIBITED AND INCLUDES PAPER, WOOD, PLASTICS, FUEL, OILS, AND ANY OTHER COMBUSTIBLE OR FLAMMABLE MATERIAL. THE OPERATOR MUST INSPECT DAILY TO ASSURE THAT NO SUCH STORAGE EXISTS DURING OPERATION.**

MAINTENANCE

General Information
Proper maintenance of the ride is vital to safe operation, reduced operating costs and longer equipment life.

This manual provides detailed information on scheduled maintenance and lubrication of the ride. It also includes troubleshooting information.

CONTENTS

1.0) PREVENTATIVE MAINTENANCE

Preventive maintenance is the easiest and most economical means of assuring many satisfactory, productive hours of operation. Properly scheduled maintenance is the key to lower operating costs and longer service life.

Hourly intervals have been established for servicing the ride. Intervals are based on the number of hours the ride has run.

The items listed in this section are separated into maximum hourly intervals. These intervals are based on "average" operating conditions. Actual conditions under which your ride is operated are the determining factors when setting up a maintenance schedule. When operating under "severe" conditions, such as excessive heat, cold, dust, mud or water, more frequent servicing is necessary.

First week of operation

The ride has been completely serviced and tested before leaving the factory. However, during the first week of operation and after each set-up, the ride operator must be especially observant and watch for loose parts, leaks, etc.

In addition to scheduled maintenance, check the following:

1. Check the torque of all functional load-carrying capscrews after the first week of operation and after each set-up. This allows for initial seating of components. Check the torque at monthly intervals thereafter.

2. Check for leaks in the hydraulic system and air system, if equipped. During transport, vibrations can cause leaks at hoses and fittings.

3. Check for lubricant leaks from gearboxes and chain drive enclosures.

2.0) FLUIDS AND LUBRICANTS

TIMELY LUBRICATION AND THE USE OF HIGH QUALITY LUBRICANTS IS NECESSARY TO OBTAIN THE MAXIMUM LIFE OF THE RIDE AND ITS COMPONENTS. USE ONLY THE FLUIDS AND LUBRICANTS SPECIFIED IN THE FOLLOWING CHART.

FLUIDS AND LUBRICANTS CHART

COMPONENT	CAPACITY	SPECIFICATION
TRAILER AXLES HUBS	2.0 PINTS	SAE 90 EP MULTI-PURPOSE GEAR LUBE MEETING A.P.I. SPECIFICATION GL-5.
SLACK ADJUSTER ZERKS (4 PLACES)	AS REQUIRED	NLGI NO. 2 LITHIUM BASE GUN GREASE
LANDING GEAR ZERKS	AS REQUIRED	NLGI NO. 2 LITHIUM BASE GUN GREASE
HINGE PINS	AS REQUIRED	GRAPHITE BASE SPRAY LUBE
AIR COMPRESSOR	AS REQUIRED	SAE 30W OIL
HYDRAULIC RESERVOIR	20.0 GAL	D.T.E.-24 MOBIL 10-10W UNIVERSAL HYDRAULIC FLUID

3.0) MAINTENANCE SCHEDULE

WEEKLY

REF. NO.	SERVICE POINT	SERVICE REQUIRED
1	HYDRAULIC RESERVOIR	CHECK OIL LEVEL
2	TRAILER AXLE HUBS	CHECK OIL LEVEL
3	EMER. LIGHT BATTERIES	CHECK CHARGE CONDITION

MONTHLY

REF. NO.	SERVICE POINT	SERVICE REQUIRED
4	AIR COMPRESSOR	CHECK OIL LEVEL
5	* WHEEL NUTS	CHECK TIGHTNESS
6	BRAKE SHOES	CHECK CONDITION
7	BRAKE OPERATION	CHECK ADJUSTMENT
8	SLACK ADJUSTER ZERKS	GREASE (4 PLACES)
9	LANDING GEAR ZERKS	GREASE (8 PLACES)
10	HINGES	SPRAY (AS REQUIRED)

* INITIALLY CHECK WHEEL NUT TIGHTNESS AFTER THE FIRST 50 MILES OF OPERATION AND MONTHLY THEREAFTER.

ANNUALLY

REF. NO.	SERVICE POINT	SERVICE REQUIRED
11	HYDRAULIC RESERVOIR	DRAIN AND REFILL
12	HYDRAULIC FILTER	REPLACE

RESERVED

4.0) SAFETY

The following is a list of general rules which should be observed by everyone.

Remember that the key to safe and successful operation is to have well trained and well supervised employees.

General safety guidelines

1. All work must be performed by competent, qualified mechanics, capable of understanding the function of the parts and their proper installation.

2. Inspect the ride before each day of operation to determine that no portion of the ride is damaged, missing, or worn in such a manner that unsafe conditions can develop.

3. Perform the manufacturer's recommended maintenance procedures at the intervals specified and in the manner described in this manual.

4. Study each job carefully to determine all hazards so that necessary safeguards can be taken.

5. Examine safety devices (tools, ladders, etc.) before they are used to make sure they are in good condition. Use only OSHA approved safety items. Ladders must be clean and unpainted.

6. Use the proper tool or equipment for each job. Ground all hand electric power tools before use.

7. Wear close-fitting, comfortable clothing when working on or close to moving parts or live electrical circuits. Avoid finger rings, jewelry or other articles which can be caught in moving parts or come in contact with electrical circuits.

4.0) SAFETY (CONT.)

8. Protect your eyes by wearing approved safety glasses or goggles.

9. Wear a hard hat at all times. When working in elevated areas, use a safety belt.

10. Where work to be performed is hazardous, at least two persons shall work together.

11. If guards must be removed from equipment, make sure they are replaced before leaving the job. Check that all safety decals, signs and placards are properly installed and legible.

12. Clean up after each job, and properly dispose of surplus materials.

13. Keep a record of parts replaced and the date of replacement. Inform the manufacturer of any replacement requirements that are frequent or cause unsafe conditions.

14. Make modifications and additions as outlined in manufacturer's service and safety bulletins.

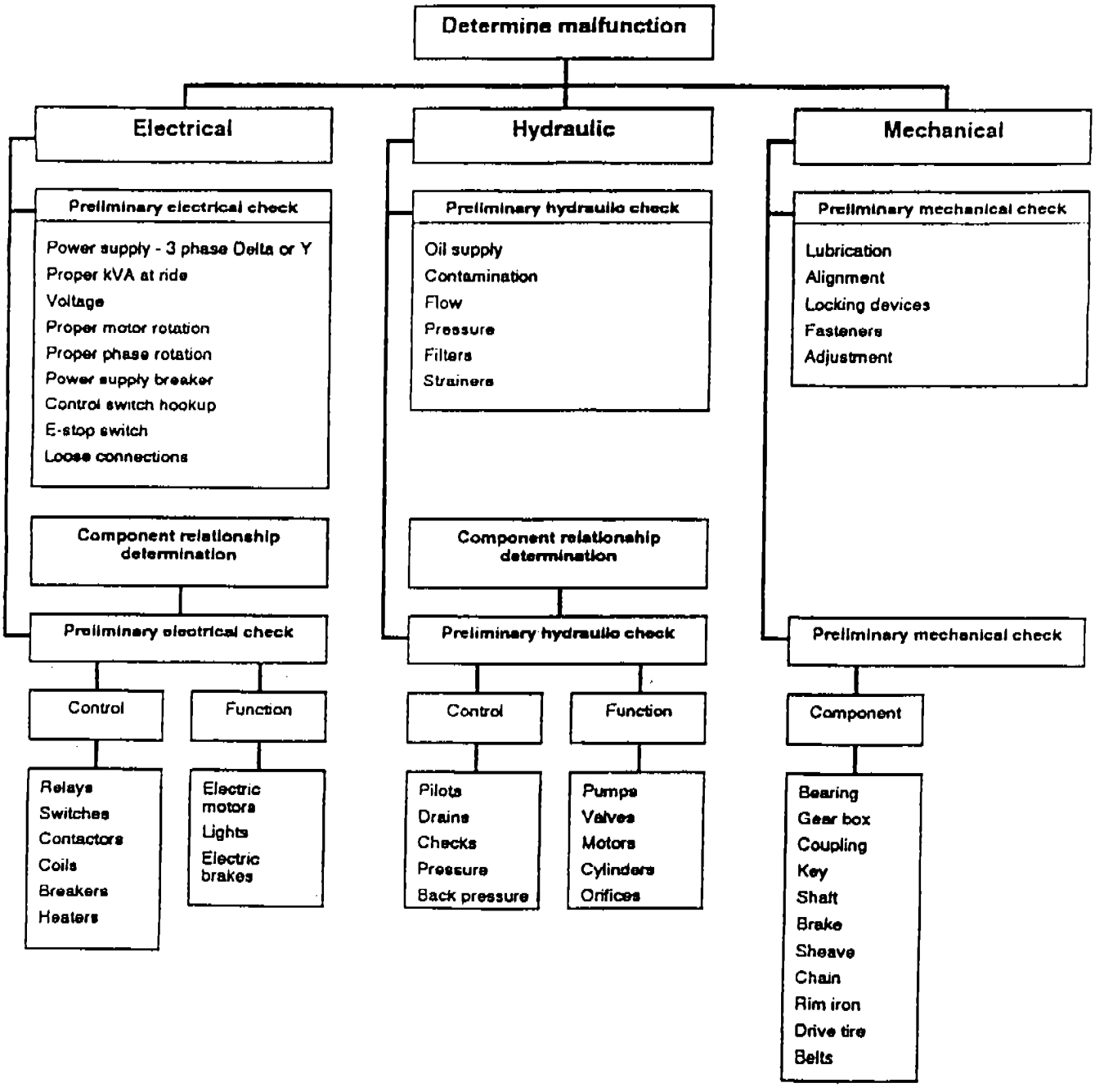
5.0) TROUBLESHOOTING PROCEDURES

Before calling the OWEN TRAILERS CUSTOMER SERVICE DEPARTMENT for help, be prepared with the following information:

1. Have the ride serial number and name available.
2. Have the service manual ready to use as a reference.
3. If ride was previously owned, by whom? (OWEN TRAILERS often show changes made to a ride by its previous owner).
4. Have the same person make all calls. Be sure to get the name of the person to whom he is speaking at the factory. All calls should then be made to that person.
5. Have a phone number ready at which you can be reached.
6. Have shipping instructions ready (how, when, and where to ship parts).
7. Have a list of any alterations, modifications or kits that have been added to the ride.
8. The person calling the factory must be familiar with the problem and be able to describe symptoms of the ride problem (such as: was the problem gradual, did it suddenly quit; are any sounds occurring that are not normal; does the problem occur continuously or is it intermittent; does the ride run in one direction only; does the ride run but have no braking, etc.).
9. Many times the problem that completely stops a ride from working is one of many simple things that are forgotten or overlooked. Listed on the following chart are many of the items that can cause this, as well as all items that must be checked before any calls are made to the factory. Use this chart to try to determine the cause. It can save several expensive phone calls or a more expensive visit by a factory representative, as well a valuable time.

5.0) TROUBLESHOOTING PROCEDURES (CONT.)

Troubleshooting chart



6.0) FASTENERS

Capscrews

Capscrews used by OWEN TRAILERS . are classified as functional load-carrying capscrews if:

- They are used as tension members in the erection or operation of the ride

and/or

- They are required to resist shear through friction-type connections in the erection or operation of a ride.

Capscrews are selected with consideration to grade, size and quantity, using joint capacities based on tightness torques of 60% rated yield and group joint efficiencies of 62.5%

Torque requirements

Capscrews must be tightened to the torque values listed in the torque chart, unless otherwise specified. These values were selected to produce a tightening torque range of 60% to 70% of proof load. when tightened with a hardened washer under the nut or capscrew head (whichever is accessible for tightening). When the capscrew is tightened from the head end, apply anti-seize lubricant to the shank end of the capscrew. When the threads are lubricated, use 10% less torque to tighten the capscrew.

DO NOT TIGHTEN CAPSCREWS OVER THE RECOMMENDED TORQUE. This can damage the capscrew, due to variances in coefficients of friction and torque wrench accuracy. Always use a torque wrench. It is impossible to accurately measure the tightness of a capscrew by other methods. Torque wrenches must be checked for accuracy twice each operating season.

Capscrew grades

OWEN TRAILERS uses only grade 5 or better capscrews

6.0) FASTENERS (CONT.)

Size Diameter - Threads/inch	Foot pound torque range (see notes 1 and 2) with locknut and hardened washer	
	SAE J429 Grade 5 ASTM A325	SAE J429 Grade 8 ASTM A490
1/4 - 20	5-6	7-8
1/4 - 28	6-7	8-10
5/16 - 18	11-13	15-18
5/16 - 24	12-15	17-21
3/8 - 16	19-24	27-33
3/8 - 24	22-27	31-38
7/16 - 14	30-35	45-55
7/16 - 20	35-40	50-60
1/2 - 13	50-60	65-80
1/2 - 20	55-65	75-90
5/8 - 11	95-115	130-160
5/8 - 18	105-130	150-180
3/4 - 10	165-200	235-285
3/4 - 16	185-225	260-320
7/8 - 9	270-325	380-460
7/8 - 14	295-360	415-505
1 - 8	400-490	565-690
1 - 12	440-535	620-755
1 1/8 - 7	495-600	800-975
1 1/8 - 12	555-675	900-1095
1 1/4 - 7	700-850	1135-1380
1 1/4 - 12	775-940	1255-1525
1 1/2 - 6	1215-1480	1975-2395
1 1/2 - 12	1370-1660	2220-2700

and grade 8 locknuts, with A325 hardened washers for functional loads. The *Grade markings chart* shows the capscrew markings to be found on OWEN TRAILERS. The manufacturer's identification symbols must be present on all functional load carrying capscrews.

OWEN TRAILERS requires the use of cold-formed hex head capscrews with rolled threads. Hex bolts and hot formed hex head capscrews are not recommended because they may

Torque chart

Torques for functional load carrying cold finished hex head capscrews with dry rolled threads, used with locknuts (see note 3), and tightened with an ASTM A325 hardened washer under the capscrew head or locknut (whichever is accessible for tightening).

This torque range will develop 60% to 70% of proof load.

*Refer to **Replacement of capscrews and locknuts** for conditions requiring replacement*

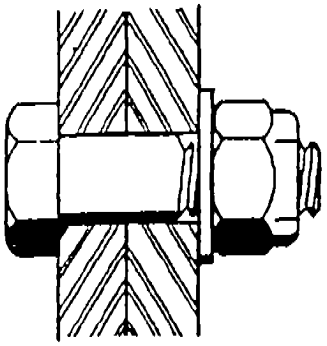
NOTES

1. Use anti-seize lubricant on capscrew shank when tightened from head end.
2. Use 10% less torque when anti-seize or other lubricant is used on threads.
3. Use same torque range for holes tapped in steel.

6.0) FASTENERS (CONT.)

ASTM A325

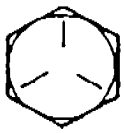
ASTM A490



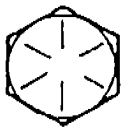
Capscrew comparison

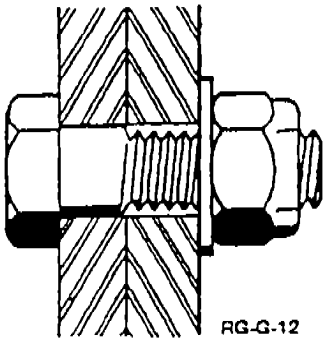
ASTM A325 or ASTM A490 Capscrew - Longer shank shorter threads

Grade 5



Grade 8





Grade 5 or Grade 8 capscrew - Shorter shank longer threads

Replacement of capscrews and locknuts

When permanently installed capscrews and locknuts are disassembled for repair or adjustment, they must be replaced if they have been in service over five (5) years, or corrosion, or other damage requires over-torquing for removal. If a torque wrench is not used to measure excessive removal torques, the capscrews and locknuts must be replaced.

Capscrews and locknuts which are frequently disassembled for portability must be replaced each operating season. If the capscrews and locknuts become damaged, corroded or require excessive torque for removal, they must be replaced. If a torque wrench is not used to measure excessive removal torques, the capscrews and locknuts must be replaced.

6.0) FASTENERS (CONT.)

have machined threads and can have die seams along the shank.

NEVER REPLACE CAPSCREWS OR NUTS WITH PARTS OF A LESSER GRADE, OR DIFFERENT LENGTHS THAN THOSE SHOWN IN THE OWEN TRAILER CATALOG.

Grade markings for functional load carrying capscrews
Manufacturer's identification symbols must be present on all capscrews

Correct markings	Examples of unacceptable markings
SAE J429 Grade 5 Medium carbon 81,000 yield	**Grade 5.1** Low carbon **Grade 5.2** Low carbon martensitic
ASTM A325 Type 1 Medium carbon Longer shank and shorter thread length than Grade 5 81,000 yield **ASTM A325 Type 3** Corrosion resisting Longer shank and shorter thread length than Grade 5 81,00 yield	A325 **ASTM A325 Type 2** Low carbon martensitic
SAE J429 Grade 8 Medium carbon 130,00 yield	8.8 **ISO R898** Class 8.8 Medium carbon 92,000 yield 8.8
ASTM A490 Alloy steel Longer shank and shorter thread length than Grade 8 130,00 yield	A490 10.9 **ISO R898** Class 10.9 Alloy steel 130,000 yield 10.9

RG-G-11

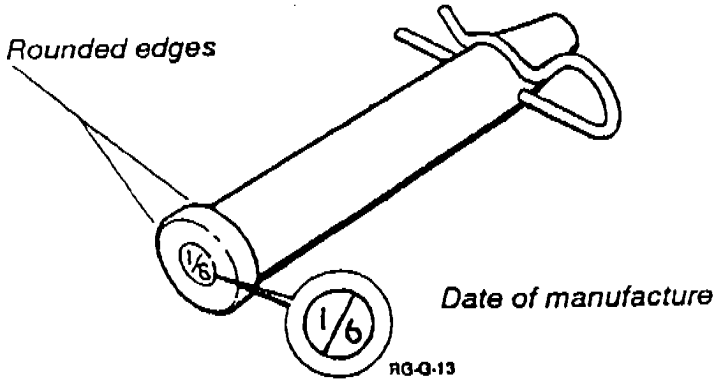
6.0) FASTENERS (CONT.)

Pins

Tapered pins used on amusement rides are subject to deterioration due to improper use and wear. OWEN TRAILERS Inc. specifies certain pins for certain applications on amusement rides. These pins have been developed over a period of years, taking into account size, design, material and hardness characteristics.

Use only the pins specified by OWEN TRAILERS . These pins are identified as shown in the following illustration. Always use the correct hairpin.

Pin identification



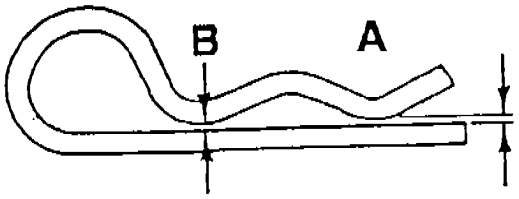
Use care when installing and removing tapered pins. Since these pins are hardened (as are hammers and punches) care must be taken to strike the pin straight on. Striking a pin at an angle can cause the pin to chip, resulting in personal injury. For this reason APPROVED SAFETY GLASSES OR GOGGLES MUST BE WORN AT ALL TIMES when tapered pins are being installed or removed. If a tapered pin is chipped, bent, or "mushroomed" on either end, discard it and replace it with a new pin.

Pin keepers

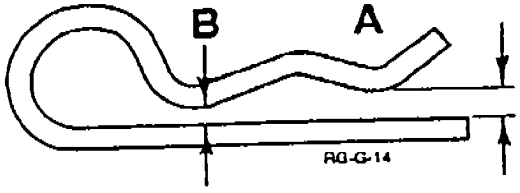
All keepers (R-keys, hair pins, lynch pins, etc.) must be inspected for wear. If a keeper is bent out of shape or "sprung", it must be replaced.

Hairpins are expendable parts. After repeated use, they become worn and "sprung" as shown.

6.0) FASTENERS (CONT.)



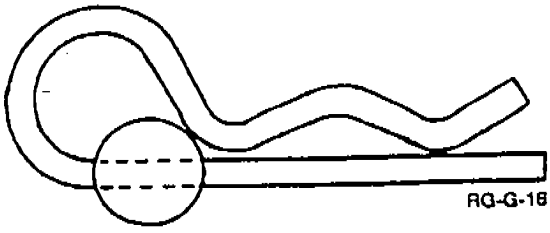
Acceptable hair pins
Dimension "A" equals dimension "B" in a relaxed position



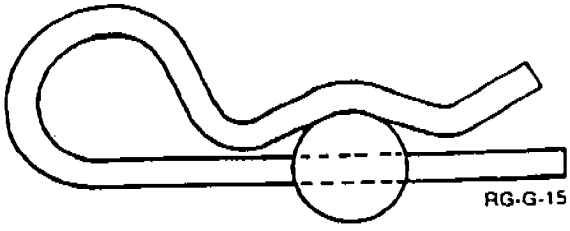
Unacceptable hair pins
Dimension "A" is greater than dimension "B" in a relaxed position

NEVER ATTEMPT TO BEND A HAIR PIN BACK INTO SHAPE. REPLACE IT WITH A NEW PART.

The correct installation of a hairpin is shown. Incorrectly installed hairpins are more likely to fail, and will distort after only a few uses.



Incorrect



Correct

OWEN TRAILERS recognizes and recommends the safety procedures specified in *ASTM Standards F770 Operation Procedures for Amusement Rides and Devices and F853 Maintenance Procedures for Amusement Rides and Devices.*

7.0) FIRE PROTECTION SYSTEM

THE MIRROR MAZE HAS BEEN EQUIPPED WITH AN APPROVED FIRE SUPPRESSION SPRINKLER SYSTEM. IT IS THE OPERATORS DUTY TO MAINTAIN THE SYSTEM IN PROPER WORKING ORDER.

TO LOAD WATER INTO THE SYSTEM:

A) CLOSE THE VALVE IN THE AIRLINE BETWEEN THE COMPRESSOR TANK AND WATER TANKS.
B) OPEN THE AIR-OUT VALVES ON TANKS 1 AND 2.
C) OPEN THE AIR VENT VALVE NEXT TO THE SPRINKLER HEAD IN THE UPSTAIRS.
D) CONNECT A WATER HOSE TO THE FILL FITTING AND OPEN THE VALVE.
E) CLOSE AIR VENT VALVE UPSTAIRS WHEN WATER IS PRESENT.
F) TURN FILL VALVE OFF WHEN WATER REACHES CORRECT LEVEL IN BOTH TANKS.
G) CLOSE AIR-OUT VALVES ON TANKS 1 AND 2.
H) DISCONNECT WATER HOSE FROM FILL CONNECTOR.
I) OPEN AIRLINE VALVE TO TANKS TO PRESSURIZE THE SYSTEM.

THE FIRE SPRINKLER SYSTEM WORKS ON AIR PRESSURE OVER WATER AND PROVIDES A PORTABLE SYSTEM WHICH IS READY FOR ACTIVATION AT ANY TIME. THIS STAND ALONE SYSTEM REQUIRES NO ADDITIONAL EXTERNAL CONNECTIONS. COMPRESSED AIR IS SUPPLIED BY AN ON-BOARD, REMOTE MOUNTED AIR COMPRESSOR. THE COMPRESSED AIR WHICH IS SUPPLIED TO THE PRESSURE TANK IS PRESET AND CANNOT ESCAPE DUE TO A CHECK VALVE. THIS KEEPS THE SYSTEM IN A CONSTANT "READY" STATE.

IN TEMPERATURES BELOW 32 DEGREES FAHRENHEIT (0 DEGREES CELSIUS), THE SYTEM MUST BE DRAINED OF WATER AND A 75% EDIBLE (U.S.P.) GLYCOL - 25% WATER MIXTURE MUST BE INSTALLED IN THE LINES TO PREVENT FREEZING DAMAGE.

1-8-91

AXLE WORK ORDER FERROUS HUBS

CUSTOMER Owens Trailer DATE 5-8-90

AXLE ASSEMBLY NO. D250K 715 GHI Axle complete

INVOICE NO. P.O. NO. Ross

TOTAL COST	EACH COST	QTY.	
		1	AXLE D250K Axle 71.5" Track For Air Ride
			[redacted]
			[redacted]
		1	WEBB #10519R CLM 10 STUD - 8¾" Bolt circle
		1	WEBB #10519LCLM ~~10~~ STUD - 8¾" Bolt circle
			[redacted]
			[redacted]
		2	INNER BEARING CONE HM 218248
		2	OUTER BEARING CONE HM 212049
		2	SPRING BRAKE 165295 anchorlok
			[redacted]
		10	INNER CAP NUT RH, 10708
		10	INNER CAP NUT LH, 10709
		10	OUTER CAP NUT RH, 37891
		10	OUTER CAP NUT LH, 37892
			[redacted]
			[redacted]
		2	OIL SEAL 370025A National Oil Seal
		2	HUB CAP 343-4009 W/GASKET, CAP SCREW & L.W.
		1	80/90 GEAR OIL, PINTS
		2	SLACK ADJUSTER AS1001 Gunite Auto Slack
		2	AS3000 Gunite clevis kit

NEWAY ANCHORLOK INTERNATIONAL

Parts List Number 11190078 **Revision Letter** B
Model or Part Name ARU-93-6-SPEC.
Refer to Drawings 10000382 10000155

SPECIFICATIONS

pring Centers
Beam Centers
Axle Size 5" ROUND

By TVR Date 12-28-95
Eng JD Date

REVISIONS

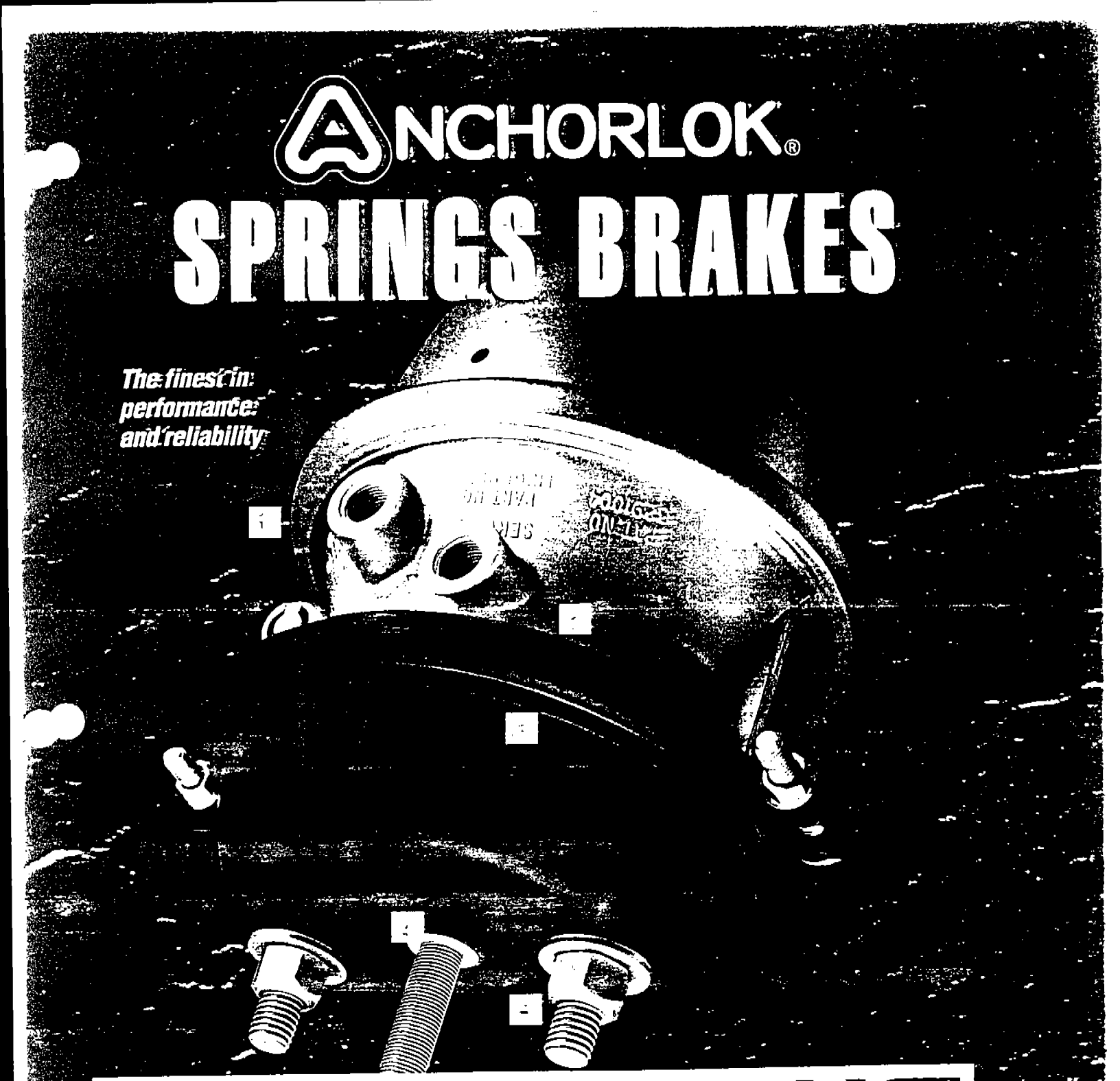
Ltr	Date	PCN	By	Description of Change
	26OCT95	3945	SH	CREATED
A	17NOV95	3836K	JD	ADD 94100648 (QTY 1) FORM 864
B	28DEC95	3836J	TVR	ADDED 94100590

Item	Part Number	Unit	Kit	Description / Part Name
1	90520153	1		BRACKET FRAME ADJUSTABLE
	90520154	1		BRACKET ASSEMBLY FIXED
2	90025157	2		GUSSET
3	90036177	8	4	WASHER FLAT 1.141
4	90516600	1		BEAM EQUALIZING ASSEMBLY LH
	90516601	1		BEAM EQUALIZING ASSEMBLY RH
5	90001200	2		ADAPTER AXLE
8	90557113	2		SPRING AIR
9	90018543	2		BRACKET SHOCK
10	90033785	2		PLATE AIR SPRING MOUNTING
11	90044089	2		SHOCK
12	93201051	4		BOLT HEX 1.125-7 x 8.5
13	93201055		2	BOLT HEX 1.12-7 X 9.25
14	90025288	2		PLATE WRAPPER
15	90008147		2	ALIGNMENT BLOCK
16	93002993		2	BOLT HEX .5-13 X 5 GR 8
17	93400149		2	NUT HEX .75-16
18	93600077		4	WASHER LOCK .75
19	93400136		2	NUT HEX .5-13
20	93600072		4	WASHER LOCK .5
21	93003597		4	BOLT HEX .75-10 X 3.5
26	93400492		2	NUT LOCK .75-10
32	93400367		2	NUT SQUARE .75-10
34	93400506	4	2	NUT LOCK 1.12-7
	94100684	1		LITERATURE SPECIFICATION NS-65-78
	94100687	1		LITERATURE SPECIFICATION NS-65-84
	94100648	1		LITERATURE FORM 864
	94100590	1		LITERATURE LABEL

ANCHORLOK®

SPRINGS BRAKES

The finest in performance and reliability



Integral Rolled Seal prevents inadvertent disassembly of emergency brake.

Safety Hooks on chamber are standard with clamp style spring brakes.

Double "O" Ring Seal extends service life by doubly protecting against air leakage between chambers.

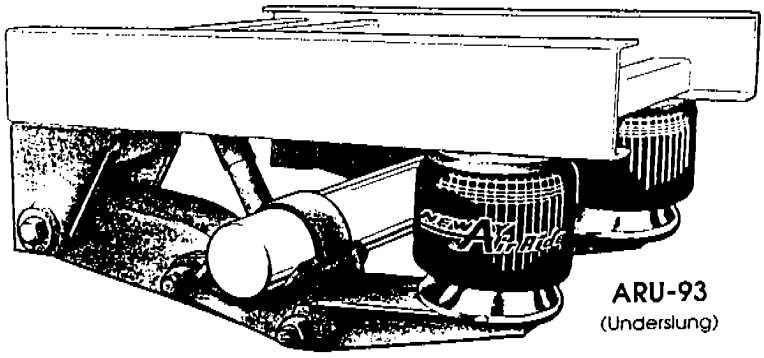
Orange Alert Stroke Indicator lets you see if the brake needs attention. Meets Oct-94 FMVSS-121 requirements.

Dust Shield smoothly guides push rod – parts work properly and brakes wear more evenly. Also reduces contaminants.

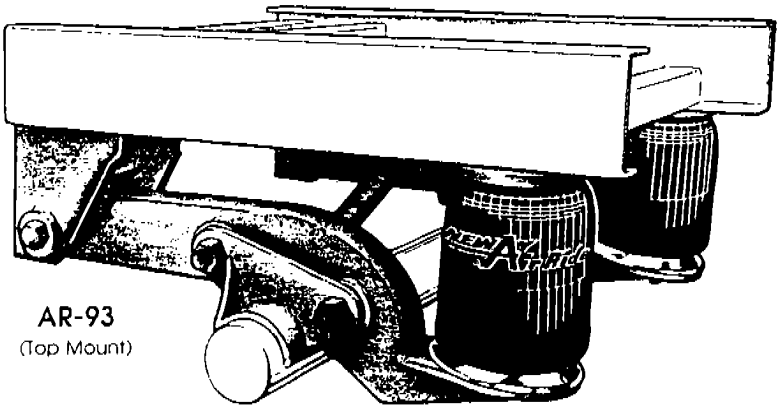
Ribbed Service Housing strengthens the service housing and prevents distortion that is often caused by severe road vibrations.

AR-90, 92 AND 93
ARU-92 AND 93

THE MOST SPECIFIED AIR SUSPENSION DESIGN IN THE TRAILER INDUSTRY



ARU-93
(Underslung)



AR-93
(Top Mount)

- **Improves Tracking, Reducers Tire Wear.** *Neway's unique 3-bushing design provides a high fore and aft spring rate- approximately twice the rate of our nearest competitor's single bushing design. This results in improved tracking and more permanent axle alignment. So you get increased tire life.*

- **Better Handling and Reduced Maintenance Costs.** *Neway's rigid trailing arm has a much longer life expectancy than leaf springs. We accurately pre-torque the axle connection's grade 8 bolts ensuring years of maintenance-free*

- **Four times Longer Bushing Life.** *Neway's bushings last four times longer than conventional rubber bushings, thanks to improved rubber compounds, hardened wear washers and receptacles. The new design dramatically reduces relative part motion and subsequent loading on the bushings during heavy turning maneuvers.*

- **Unsurpassed Shock Absorber Life.** *Neway's urethane shock bushings live four times longer than rubber bushings. And Neway has the best sealed shocks in the industry.*

- **Reduced Axle Stress.** *Patented axle adapter design, combined with its rubber bushed connections, provides controlled compliance during axle torque, reducing axle stress levels resulting in longer axle life - and a roll rate superior to typical mechanical leaf spring suspensions.*

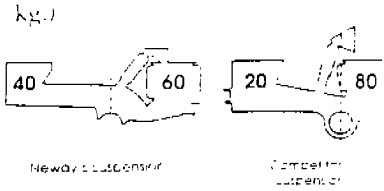
- **Long Life, Low Maintenance Pistons** - *are made of high impact, corrosion resistant composite material. The hytrel air spring bumper and improved rubber flex member add up to years of no maintenance air spring life.*

- **Complete Service Support and Fast Parts Availability** - *We support you with more than comprehensive technical literature. Our experienced service technicians are on standby to answer any technical question, or provide field service. And NAI supports you with the best parts availability in the suspension business from over 300 authorized distributors in North America, who are served by 3 strategically located warehouses, and an "in by 2 p.m. out by 5 p.m." emergency parts fulfillment system.*

The Right Suspensions for Most On-Highway Applications.

Neway suspension systems combine field proven durability and reliable performance with your choice of weights for every conceivable trailer application.

Your choices start with our famous AR-90, the most popular air suspension in the industry, with nearly 130,000 units built and road-proven since 1984. If you'd like the same design and lighter weight, choose from the AR and ARU 92 or 93 series with models available in either a top mount or underslung configuration. In all we offer 29 wide spread and close spaced models that span applications from low profile autohaulers to high center of gravity tankers with ride heights ranging form 6 to 19 inches, axle capacities to 22,500 lbs. (10,206 kg.)



Neway Suspension

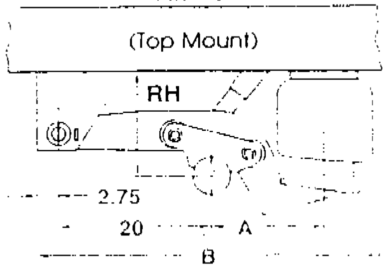
Competitor Suspension

Neway Suspensions Protect Vehicles with Better Load Distribution. Suspensions input shock and vibration into a trailer at two points: through the air springs and frame brackets. This load distribution should be nearly even, or there is a greater risk the vehicle structure will fatigue prematurely. Our load distribution is 60/40. Our nearest competitor's is a very uneven 80/20.

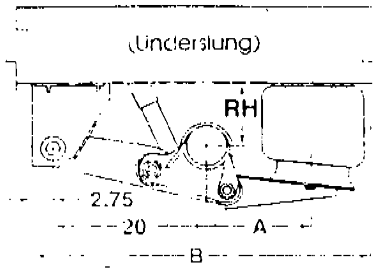
For complete application and specification information, see reverse side.

NEWAY ANCHORLOK

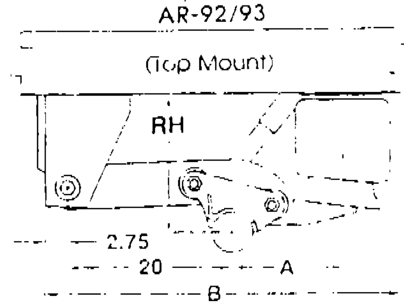
AR-90



ARU-92/93



AR-92/93



APPLICATIONS

MODEL	AUTO TRANSPORTERS	VANS DROP FRAME	VANS CLOSE SPACED	VANS WIDE SPREAD	PLATFORMS CLOSE SPACED	PLATFORMS WIDE SPREAD	LOW BEDS	BOTTOM DUMPS	TANKERS CLOSE SPACED	TANKERS WIDE SPREAD
AR-90-14*				•	•	•		•	•	•
AR-90-15*				•	•	•		•	•	•
AR-90-16*				•	•	•		•	•	•
AR-90-17*				•	•	•		•	•	•
AR-90-1-12*			•		•			•	•	
AR-90-1-14*			•		•			•	•	
AR-90-1-15*			•		•			•	•	
AR-90-1-16*			•		•			•	•	
AR-90-1-17*			•		•			•	•	
ARU-92-8	•	•	•	•	•	•	•	•	Up to 38.000 lbs. Tandem Only	
ARU-92-9	•	•	•	•	•	•	•	•		
ARU-92-10	•	•	•	•	•	•	•	•		
ARU-92-12	•	•	•	•	•	•	•	•		
ARU-93-6	•	•	•	•	•	•	•	•		
ARU-93-7	•	•	•	•	•	•	•	•		
ARU-93-8	•	•	•	•	•	•	•	•		
ARU-93-9	•	•	•	•	•	•	•	•		
ARU-93-10	•	•	•	•	•	•	•	•		
AR-92-12			•	•	•	•		•	Up to 38.000 lbs. Tandem Only	
AR-92-14			•	•	•	•		•		
AR-92-15			•	•	•	•		•		
AR-92-16			•	•	•	•		•		
AR-92-17			•	•	•	•		•		
AR-92-18			•	•	•	•		•		
AR-93-14			•	•	•	•		•		
AR-93-15			•	•	•	•		•		
AR-93-16			•	•	•	•		•		
AR-93-17			•	•	•	•		•		
AR-93-19			•	•	•	•		•		

SPECIFICATIONS

MODEL	CAPACITY	(A)	(B)	RIDE HEIGHT	AXLE TRAVEL		SUSP. WEIGHT (COMPLETE)	TANDEM AXLE SPACING MIN./MAX.	LIFT AXLE	ON/OFF HIGHWAY
					TOTAL	UP				
AR-90-14*	22,500 lbs	15	45.5	14.0	9.3	4.3	352	45.5/122	yes	on only
AR-90-15*	22,500 lbs	15	45.5	15.0	5.3	9.3	358	45.5/122	yes	on only
AR-90-16*	22,500 lbs	17	45.5	16.0	9.3	5.3	370	45.5/122	yes	on only
AR-90-17*	22,500 lbs	[illegible]	45.5	[illegible]	9.5	[illegible]	[illegible]	45.5/122	yes	on only
AR-90-1-12*	22,500 lbs	14.25	44.75	12.0	6.0	3.0	[illegible]	45.5/52	no	on only
AR-90-1-14*	22,500 lbs	14.25	44.75	14.0	6.5	3.0	[illegible]	45.5/52	no	on only
AR-90-1-15*	22,500 lbs	14.25	44.75	15.0	7.0	3.0	363	45.5/52	no	on only
AR-90-1-16*	22,500 lbs.	14.25	44.75	16.0	6.6	3.0	395	45.5/52	no	on only
AR-90-1-17*	22,500 lbs	14.25	44.75	17.0	6.5	3.0	418	45.5/52	no	on only
ARU-92-8	20,000 lbs	13.35	43.8	8.0	8.0	4.0	352	45.5/122	yes	on only
ARU-92-9	20,000 lbs	13.35	43.8	9.0	9.12	4.1	360	45.5/122	yes	on only
ARU-92-10	20,000 lbs.	13.35	43.8	10.0	9.0	4.25	372	45.5/122	yes	on only
ARU-92-12	20,000 lbs	13.35	43.8	12.0	9.0	4.75	377	45.5/122	yes	on only
ARU-93-6	20,000 lbs	13.34	43.8	6.0	5.75	2.5	346	45.5/60	no	on only
ARU-93-7	20,000 lbs	13.34	43.8	7.0	8.0	3.0	352	45.5/122	no	on only
ARU-93-8	20,000 lbs.	13.34	43.8	8.0	8.0	3.0	357	45.5/122	no	on only
ARU-93-9	20,000 lbs	13.34	43.8	9.0	8.0	3.0	360	45.5/122	no	on only
ARU-93-10	20,000 lbs.	13.34	43.8	10.0	8.0	3.0	372	45.5/122	no	on only
AR-92-12	22,500 lbs	13.8	44	12	8.0	3.0	332	45.5/122	no	on only
AR-92-14	22,500 lbs	13.8	44	14	8.0	4.0	341	45.5/122	yes	on only
AR-92-15	22,500 lbs	[illegible]	44	[illegible]	8.0	4.0	346	45.5/122	yes	on only
AR-92-16	22,500 lbs	[illegible]	44	[illegible]	8.0	4.0	[illegible]	45.5/122	yes	on only
AR-92-17	22,500 lbs	13.8	44	[illegible]	[illegible]	4.0	363	45.5/122	yes	on only
AR-92-18	22,500 lbs	13.8	44	18	8.4	4.4	377	45.5/122	yes	on only
AR-93-14	22,500 lbs	13.8	44	14	8.0	3.0	[illegible]	45.5/122	no	on only
AR-93-15	22,500 lbs	13.8	44	15	8.0	3.0	347	45.5/122	no	on only
AR-93-16	22,500 lbs	13.8	44	16	8.0	3.0	357	45.5/122	no	on only
AR-93-17	22,500 lbs	13.8	44	17	8.0	3.0	362	45.5/122	no	on only
AR-93-19	22,500 lbs	13.8	44	19	8.0	3.0	383	45.5/122	no	on only

* Standard air control kit has single valve; for offset loads use AC-60-17

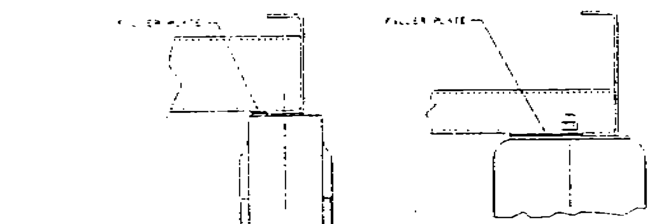
■ Refer to Form No. 665A for detailed information on all models

Note: AR and ARU-93 models are not approved for three or more axles. AR and ARU-92 models are approved for three axles and will permit 110" spread at 18,000 lbs. (8,156 kg.) per axle capacity. If four or more axles are used, contact Neway for application approval. AR-90 models are spreadable to a maximum of 10'-2". For Canadian tri-axle applications, contact Neway Anchorlok International.

NEWAY ANCHORLOK
INTERNATIONAL

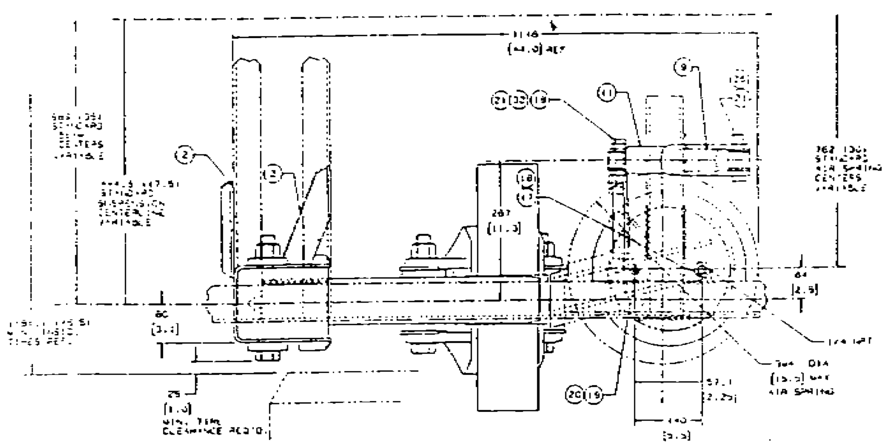
PO BOX 425, MUSKEGON, MICHIGAN 49443-0425
PHONE 616-773-3271 • FAX 616-[illegible]

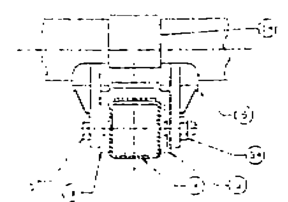
[illegible] PRIMAR, MISSISSAUGA, ONTARIO, CANADA [illegible]
PHONE [illegible] • FAX [illegible]

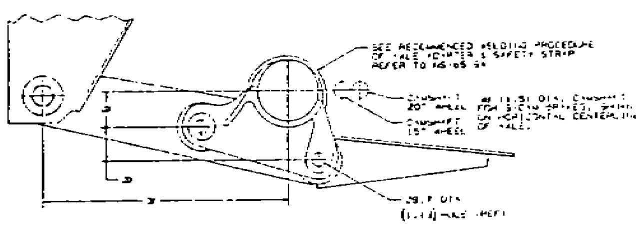


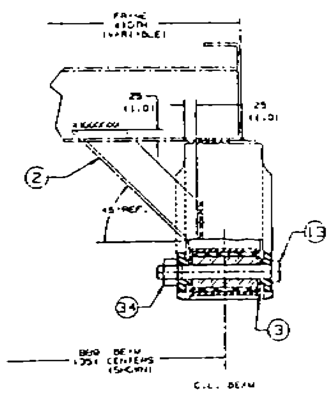
NOTE: CROSSMEMBERS
1.) ALTERNATIVE TO SPRING CROSSMEMBER CAN BE ACHIEVED BY INSTALLING A FILLER PLATE BETWEEN THE CROSSMEMBER & SUSPENSION COMPONENTS AT INBOARD EDGE OF FRAME.
2.) ALL CROSSMEMBERS TO BE DETERMINED & SUPPLIED BY CUSTOMER.

OPTIONAL FLUSH MOUNTED CROSSMEMBERS

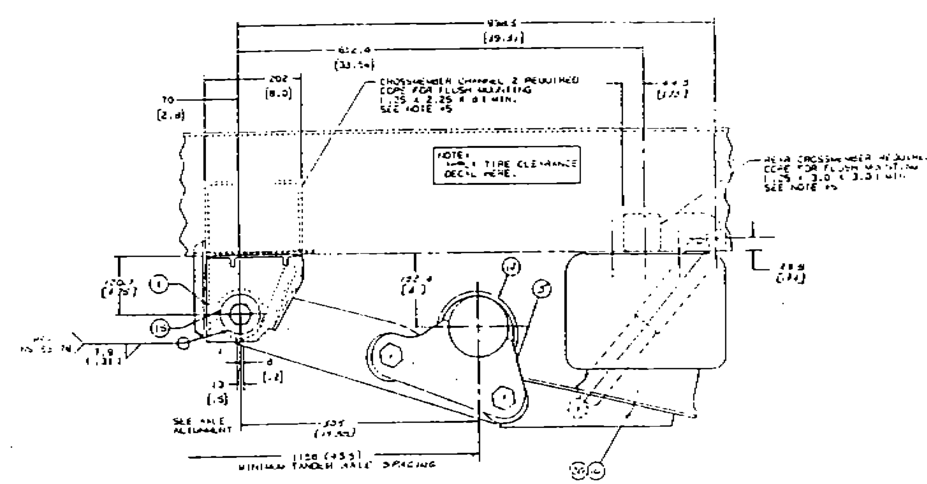








OPTIONAL ITEM 2 ANGLE BRACE LOCATION



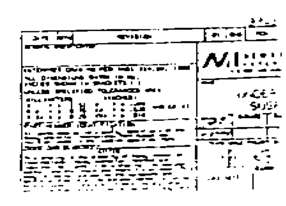
MODEL [illegible] L-SPECIAL
AXLE TRAVEL [illegible]
CAPACITY - 20,000 LB

NOTE: MISC.
1.) WELD WHERE INDICATED THUS [illegible] (.25 MIN. WELD SIZE)
2.) FOR S-CAM BRAKE INSTALLATION SEE DRAWING 10000153
DO NOT WELD WITHIN 1.5 FROM 4X4 EDGE OF FRAME
FOR DISC BRAKE INSTALLATION SEE DRAWING 10000213
3.) FOR AUTOMATIC AIR CONTROL KIT INSTALLATION REFER TO THE FOLLOWING DRAWINGS:
42010235 (FOR SINGLE HEIGHT CONTROL VALVE) AC-8100
4.) ALL DIMENSIONS TO BE ± 1.5(.06) UNLESS OTHERWISE SPECIFIED
5.) ALL CROSSMEMBERS SUPPLIED BY CUSTOMER MUST PROVIDE BACKUP TO SUSPENSION COMPONENTS AS WELL AS SUPPORT TO FRAME. SIZES SHOWN ARE MINIMUM RECOMMENDED SIZES FOR SUSPENSION COMPONENTS.

NOTE: AXLE ALIGNMENT
1.) ALIGN AXLE AT [illegible] FRAME BRACKET BY MOVING OUTER ALIGNMENT BUSHING (ITEM [illegible]) FORWARD AND BACKWARD AS REQUIRED. TO WELD ALIGNMENT BUSHING [illegible] BETWEEN ALIGNMENT BUSHING AND SIDE OF FRAME BRACKET (ITEM 1). TO WELD ALIGNMENT BUSHING [illegible] FRAME BRACKET [illegible]
2.) WELD [illegible] FRAME BRACKET [illegible]

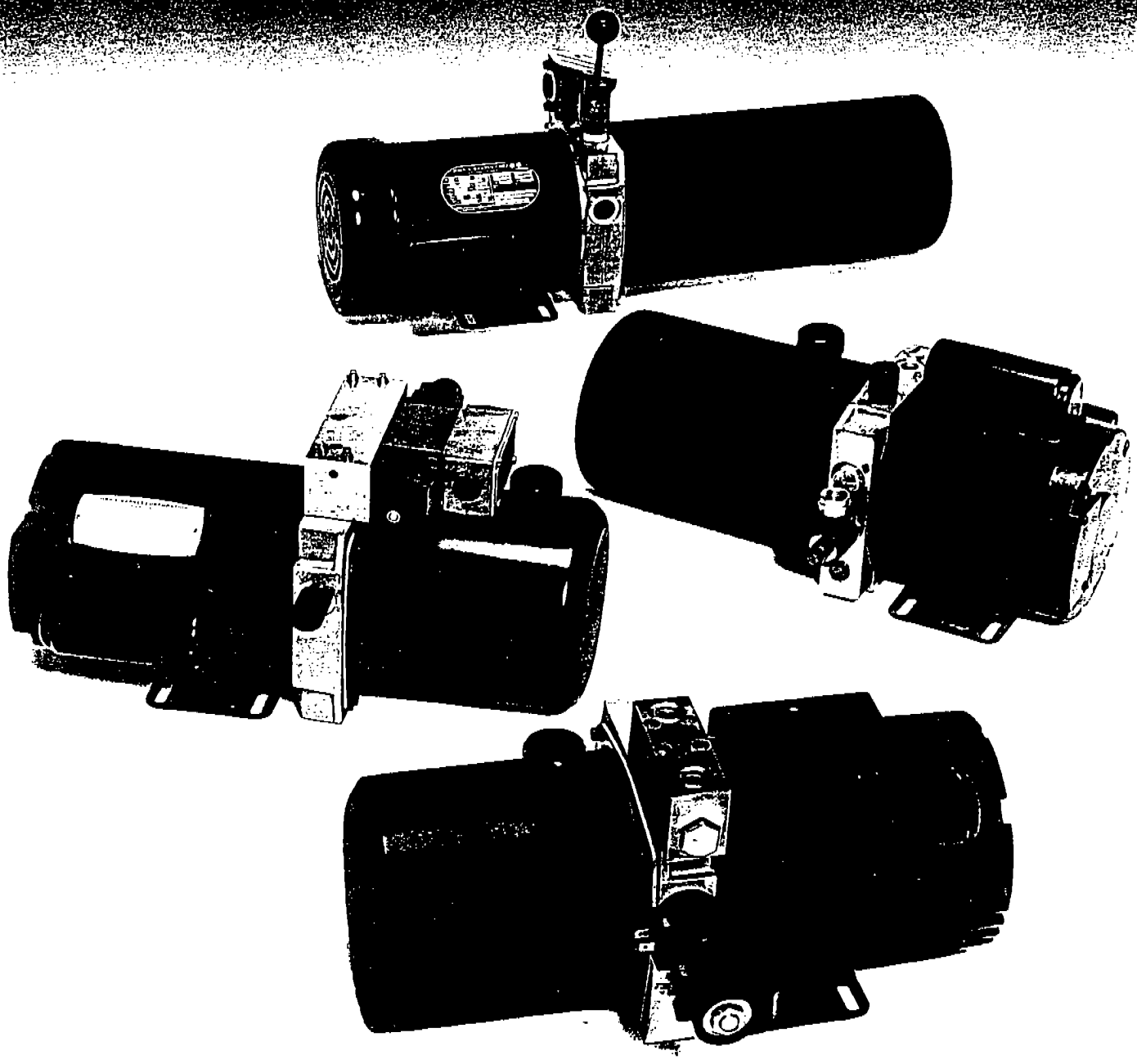
REF. PARTS LIST [illegible]

NOTE:
ALL WELDING PER [illegible] ENGINEERING STANDARD [illegible] UNLESS OTHERWISE SPECIFIED.
ALL [illegible] TO BE [illegible] UNLESS OTHERWISE SPECIFIED



G.C. 9000 SERIES
AC HYDRAULIC POWER UNITS

Modular units designed to meet your requirements.



JSB

John S. Barnes Corporation

G.C. 9000 AC POWER UNITS

THE GC-9000 SYSTEM LETS YOU SPECIFY THE HYDRAULIC POWER UNIT

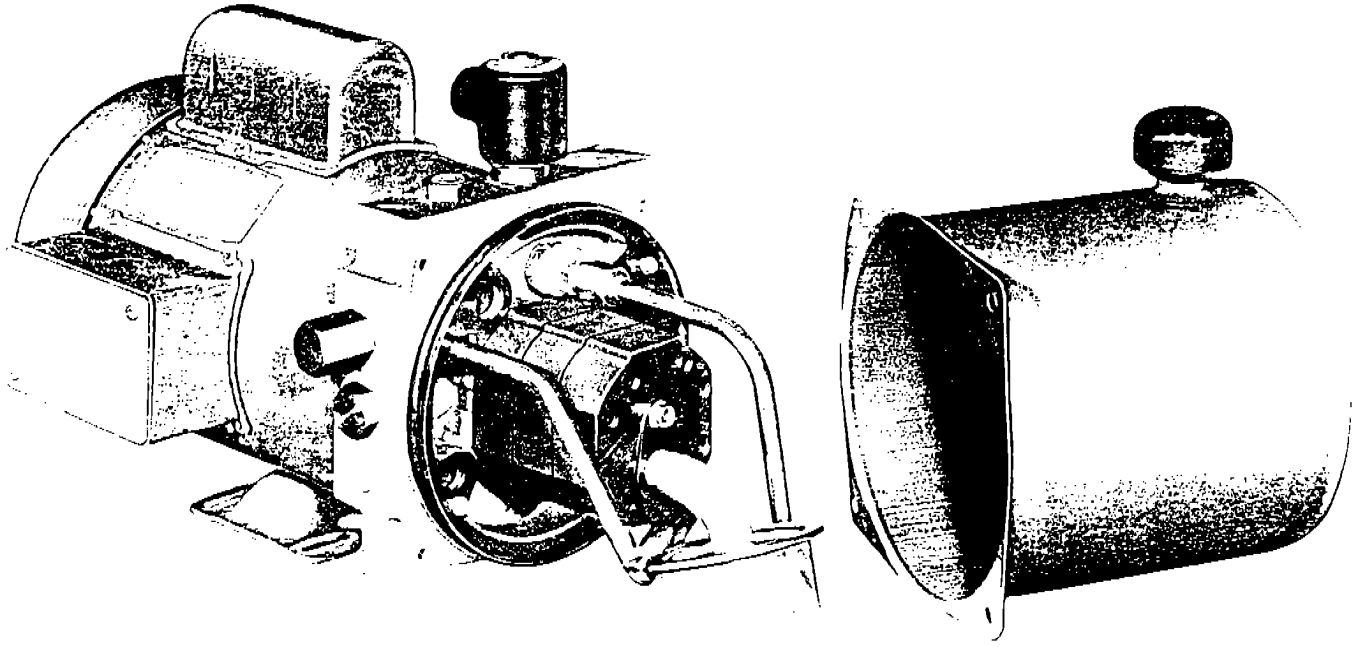
The GC-9000 System has been designed to provide a practical, economical solution to your individual AC power requirements. We manufacture GC-9000 power units by incorporating interchangeable components in permanent-mold aluminum adapters. This unique manufacturing and assembly process allows us to produce larger quantities at reduced cost.

Here's how this innovative system works: You specify the required motor/adapter, pump, controls, valves and reservoir for your requirements by choosing the appropriate part from each of the component sections of this catalog.

Should your requirements change, the GC-9000 system can be modified for new specifications. Motor, pump, reservoir and controls can be replaced as needed.

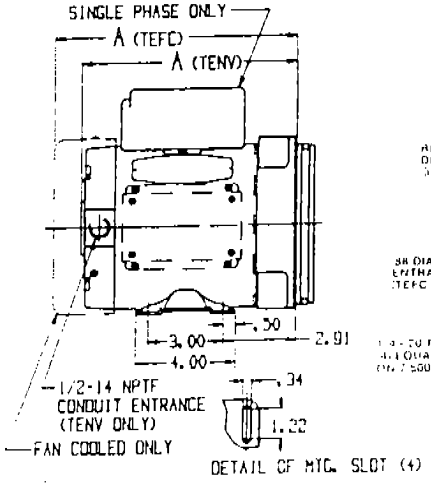
Here are just a few of the GC-9000's many applications:

Conveyors
Lift Tables
Hose Crimpers
Dock Levelers
Packaging Machines
Machine Tools
Trash Compactors
Car Hoists
Presses
Robots

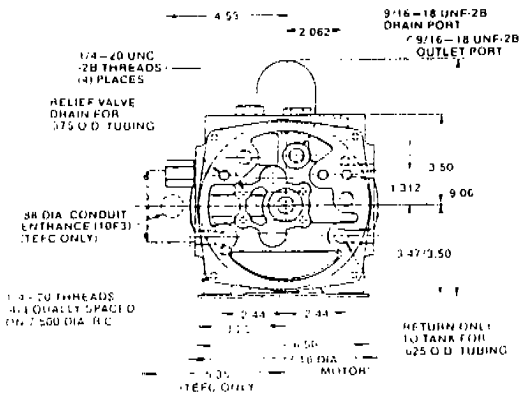


MOTOR/ADAPTER ASSEMBLIES

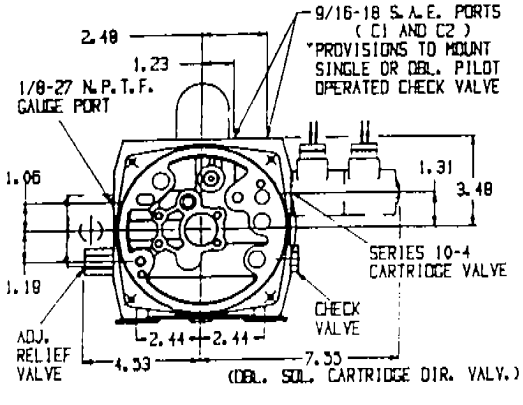
Single and three-phase motors are available in 1/3, 1/2, 1 and 2 HP sizes. All motors are totally enclosed. Each motor comes complete with an adapter that contains an adjustable relief valve and check valve, and incorporates SAE "O" ring outlet and return ports.



SIDE VIEW



FRONT VIEW
GC-9000 TYPE



FRONT VIEW
GC-9001 TYPE

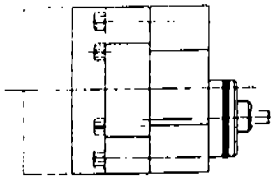
MOTOR/ADAPTER ASSEMBLIES (cont'd.)

GC-9000 MOTOR/ADAPTER KITS

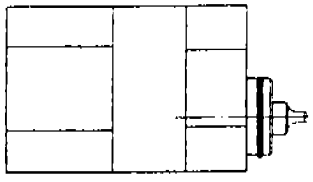
Order Code	Kit No.	HP	Ph	Hz	Voltage	Enclosure	RPM	A in.	A'in.	Amm	A'mm
0	1300213	1/3	1	60	115/208/230	TENV	1725		9.153		232.48
1	1300221	1/2	3	50/60	208/230/460	TENV	1725		9.593		243.66
2	1300217	1/2	1	60	115/208/230	TEFC	1725	8.653		219.78	
3	1300237	1	3	60	208/230/460	TEFC	3450	9.093		230.96	
4	1300229	1	1	60	115/208/230	TEFC	3450	10.593		269.06	
5	1300233	1	3	50/60	208/230/460	TEFC	1725	11.093		281.76	
6	1300225	1	1	50/60	115/208/230	TEFC	1725	11.593		294.46	
7	1300249	2	3	60	230/460	TEFC	3450	10.593		230.96	
8	1300245	2	1	60	115/230	TEFC	3450	12.093		307.16	
9	1300241	2	3	60	230/460	TEFC	1725	11.593		294.46	

GC-9001 MOTOR/ADAPTER KITS

Order Code	Kit No.	HP	Ph	Hz	Voltage	Enclosure	RPM	A in.	A'in.	Amm	A'mm
10	1300772	1/3	1	60	115/208/230	TENV	1725		9.153		232.48
11	1300773	1/2	3	50/60	208/230/460	TENV	1725		9.593		243.66
12	1300774	1/2	1	60	115/208/230	TEFC	1725	8.653		243.66	
13	1300775	1	3	60	208/230/460	TEFC	3450	9.093		230.96	
14	1300776	1	1	60	115/208/230	TEFC	3450	10.593		269.06	
15	1300777	1	3	50/60	208/230/460	TEFC	1725	11.093		281.76	
16	1300778	1	1	50/60	115/208/230	TEFC	1725	11.593		294.46	
17	1300779	2	3	60	230/460	TEFC	3450	10.593		230.96	
18	1300780	2	1	60	115/230	TEFC	3450	12.093		307.16	
19	1300781	2	3	60	230/460	TEFC	1725	11.593		294.46	



SINGLE STAGE



TWO-STAGE HI-LOW

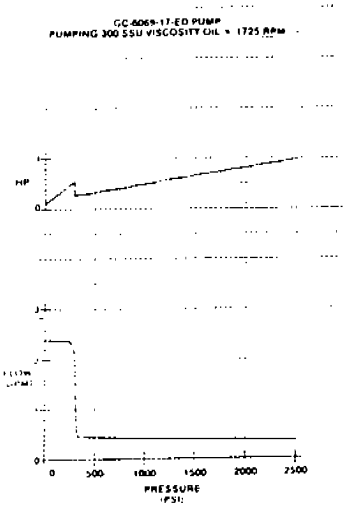
PUMPS

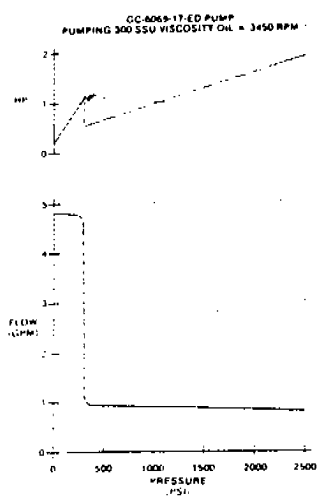
Pumps are available in both single-stage and dual-volume hi-low designs...10 models in all. Capacities range from 1/2 GPM to 8 GPM at pressures up to 3000 PSI. Each pump is packaged with the proper "O" rings, mounting gasket, screws and coupling. All pumps are clockwise rotation.

PUMPS

Order Code	Kit No.	Gear Size (In.)	Cu. In. Rev.	Flow 1800	Flow 3600	Max. Cont. Press
A	1300177	0.125	.064	0.50	1.00	3000
B	1300178	0.1875	.094	0.75	1.50	3000
C	1300179	0.250	.129	1.00	2.00	3000
D	1300180	0.375	.194	1.50	3.00	3000
E	1300181	0.500	.258	2.00	4.00	2300
F	1300182	0.625	.323	2.50	5.00	1900
G	1300183	0.750	.388	3.00	6.00	1600
H	1300184	0.875	.452	3.50	7.00	1300
J	1300185	1.000	.517	4.00	8.00	1200
Two-Stage Pump						
K	1300688	0.125 & 0.500	See Curves			

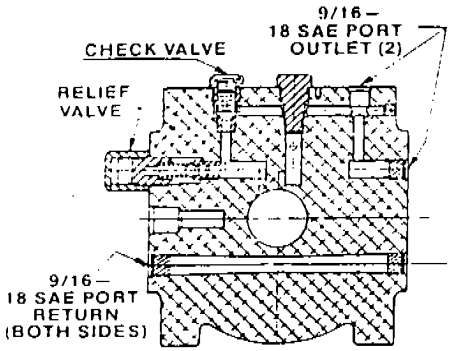
TWO STAGE PUMP FLOW CURVES



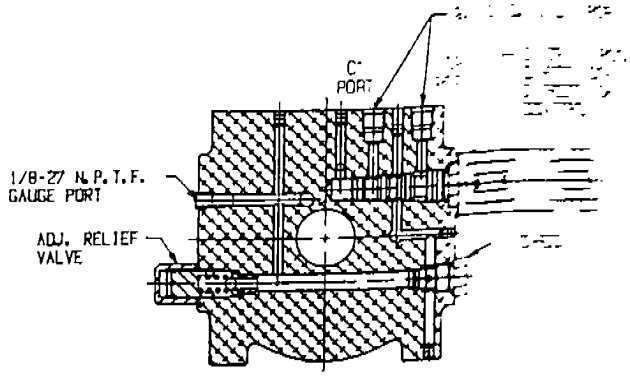


RELEASE & DIRECTIONAL CONTROL OPTIONS

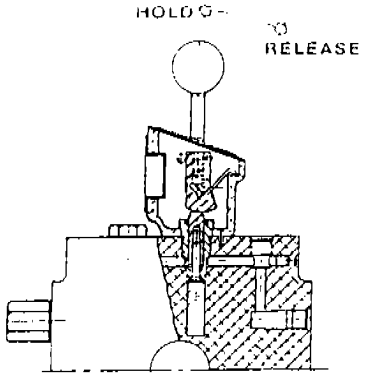
Two permanent-mold adapters serve as control bases to accomplish the lift-hold-lower function and directional control functions. The GC-9000 adapter accommodates electric or manual release valves, while the GC-9001 adapter accommodates 2-position and 3-position, 4-[illegible] directional control valves, as well as pilot-op[illegible]. The diagrams below illustrate the control op[illegible] each adapter.



GC-9000 ADAPTER

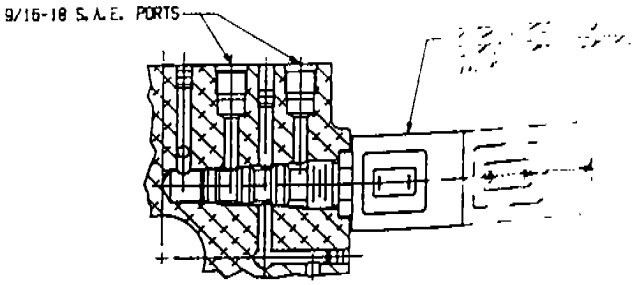


GC-9001 ADAPTER



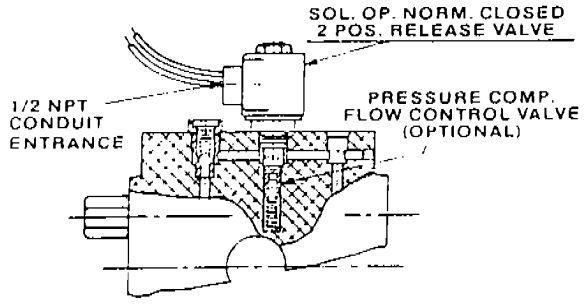
MANUAL LEVER RELEASE VALVE

The optional cam release valve is recommended for applications where lift, hold and lower circuits require a manual control.



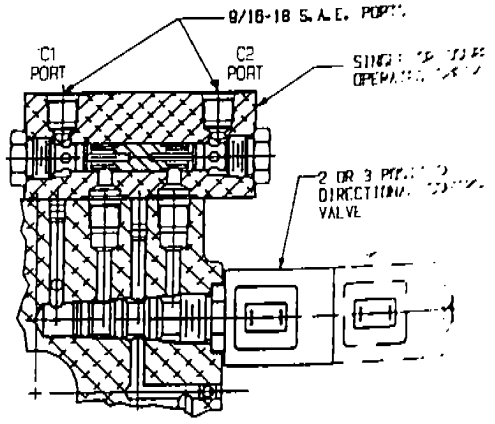
CARTRIDGE SOLENOID DIRECTIO[illegible]

Direct-acting, spool-type, solenoid operated cart[illegible] into the GC-9001 adapter. Available with 2 positi[illegible] 4-way spools.



ELECTRIC SOLENOID RELEASE VALVE

The electric solenoid release valve provides remote control of lift, hold and lower operations. (Valve with manual override available.) [illegible]5 VAC, 50/60 Hz standard. Other voltages available.



PILOT OPERATED CHECK VALVE

Single and double pilot operated check valve[illegible] the GC-9001 adapter for use in blocking or load[illegible]

Control Valves & Manifold Kits

GC-9000
RELEASE VALVE OPTIONS

RELEASE VALVES

Order Code	Kit No.	Description
A	—	GC-9000 Adapter Only—No Release
C	1300193	Manual Lever Release
D	1300025	Electric Solenoid Release, Normally Closed, 115 VAC
E	1300374	Electric Solenoid Release, Manual Override, 115 VAC
F	1300296	Electric Solenoid Release, Normally Open, 115 VAC

Pressure compensated return flow controls can be used with any of the above release valves. Flow controls are non-adjustable.

FLOW CONTROLS

Order Code	Kit No.	Description
0	—	None
1	1300036	1 GPM
2	1300022	2 GPM
3	1300035	3 GPM
4	1300034	4 GPM

GC-9001
CARTRIDGE DIRECTIONAL VALVE OPTIONS

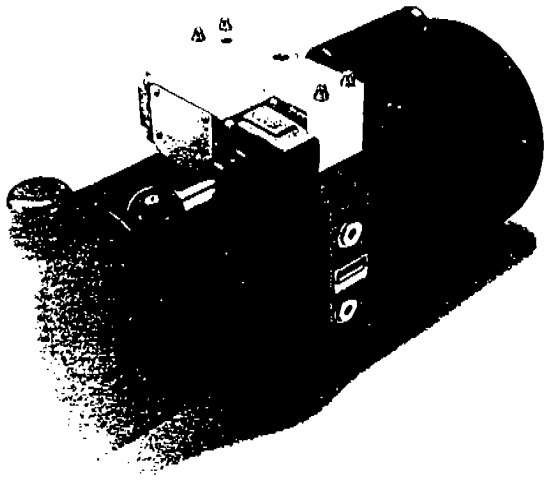
CARTRIDGE DIRECTIONAL VALVES

Order Code	Kit No.	Description
A	1300729	2-position, 4-way, 6 GPM, cartridge valve
B	1300785	3-position, 4-way, 3 GPM, cartridge valve, tandem center
C	1300786	3-position, 4-way, 3 GPM, cartridge valve, open center
F	1300727	Pilot-operated check valve, C1
G	1300728	Pilot-operated check valve, C2
H	1300763	Double pilot-operated check valve

DC & AC COILS

Order Code	Kit No.	Description
1*	1300740	12 VDC
2*	1300741	24 VDC
4*	1300732	115 VAC
5*	1300733	230 VAC

*Two coils are required for a 3-position, 4-way cartridge valve.



GC-9000
RELIEF VALVE SETTINGS

Standard relief valve setting range is 1000 PSI to 2250 PSI full bypass. Relief valve is not factory preset.

For relief valve settings from 400 PSI to 950 PSI full bypass, remove the small booster spring from the relief valve arrangement.

Contact factory for relief valve settings above 2300 PSI full bypass.

GC-9000 D03
MANIFOLDS AND MOUNTING KITS

Manifolds for GC-9000 AC Power Units provide for single and multiple directional valve combinations. All multiple valve combinations are for parallel connections only.

A base (primary) manifold mounts directly to the adapter. This manifold kit includes all hardware including check valve transfer bushing and return transfer bushing. If two or three valves are needed, secondary or stacked manifolds are added to the base manifold. In this case the proper mounting screw kit must be used.

Three valves are the maximum number that can be used with cylindrical reservoirs.

All of the manifolds are made from machined aluminum blocks. The cylinder ports are on the opposite side of the valve mounting surface. Manifold ports are 9/16-18 SAE.

MANIFOLDS

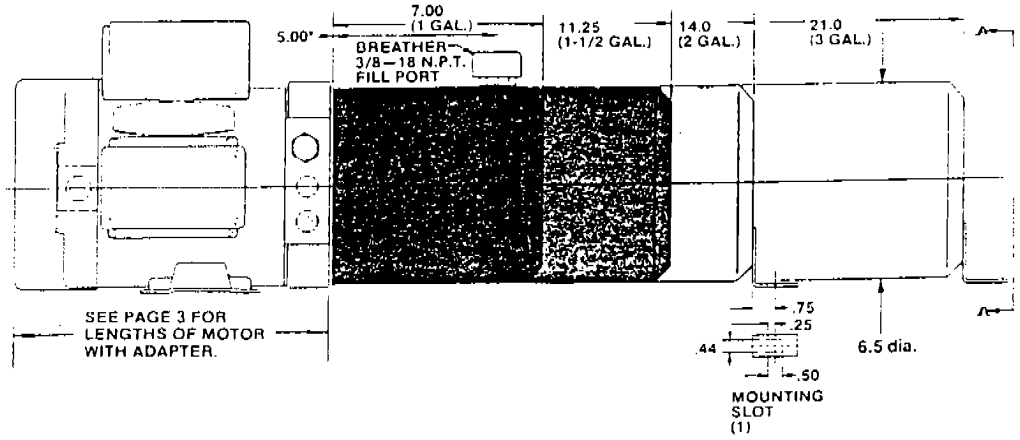
Order Code	Kit No.	Description
A	—	No manifold
B	1300329	D0-1 base manifold for cylindrical reservoir
C	1300329 1300330	One base manifold and one secondary manifold, for cylindrical reservoirs
D	1300329 & (2) 1300330	One base manifold and two secondary manifolds, for cylindrical reservoirs

MANIFOLD MOUNTING KITS

Order Code	Kit No.	Description
0	—	None
1	1300331	Two stack bolt kit (required with manifold option C)
2	1300332	Three stack bolt kit (required with manifold option D)

Reservoirs & Tube Kits

There are eight cylindrical reservoirs available in 1, 1½, 2 and 3 gallon capacities. These reservoirs are designed for both horizontal and vertical mounting. Reservoir tube kits contain all necessary screws, piping, etc.



HORIZONTAL RESERVOIR KITS

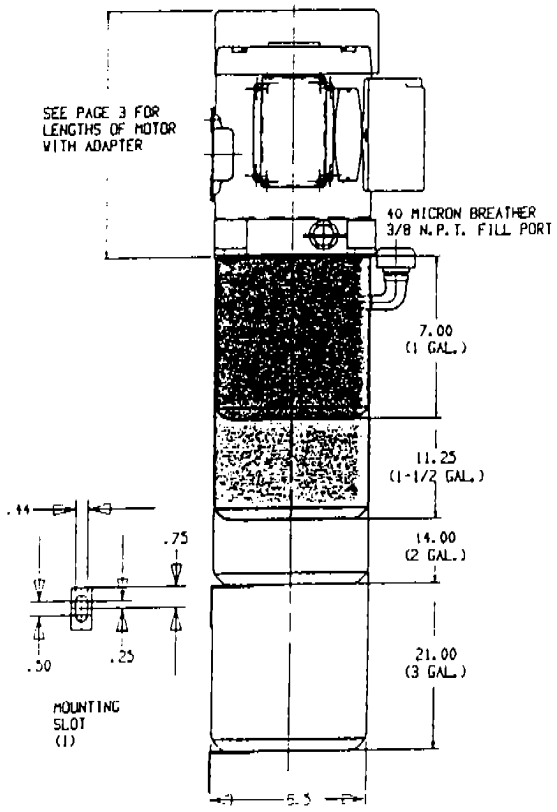
Order Code	Kit No.	Type	Capacity
Q	1300127	Cylindrical	1 gallon
*R	1300129	Cylindrical	1.5 gallon
S	1300131	Cylindrical	2 gallon
T	1300133	Cylindrical	3 gallon

*Breather port centerline dimension is 6.50" for option "R" only.

HORIZONTAL RESERVOIR TUBE KITS

Order Code	Kit No.	Description
0	—	None
1	1300187	Kit for cylindrical reservoirs (required for pump options E-J)
3	1300186	Kit for cylindrical reservoirs (required for pump option K)

JSB now stocks four (4) cylindrical reservoirs in 1, 1½, 2, and 3 gallon capacities which are designed for vertical mounting. Reservoir and tube kits contain all required hardware for applying a GC-9000 unit in a vertical orientation.



VERTICAL MOUNT RESERVOIRS

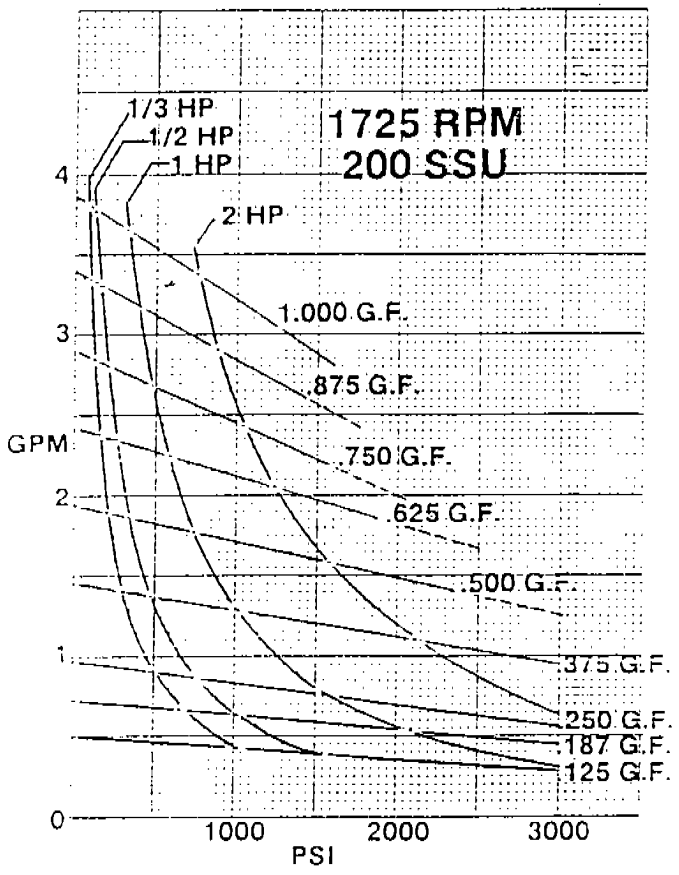
Order Code	Kit No.	Type	Capacity
U	1300793	Cylindrical	1 gallon
V	1300794	Cylindrical	1.5 gallon
W	1300795	Cylindrical	2 gallon
X	1300796	Cylindrical	3 gallon

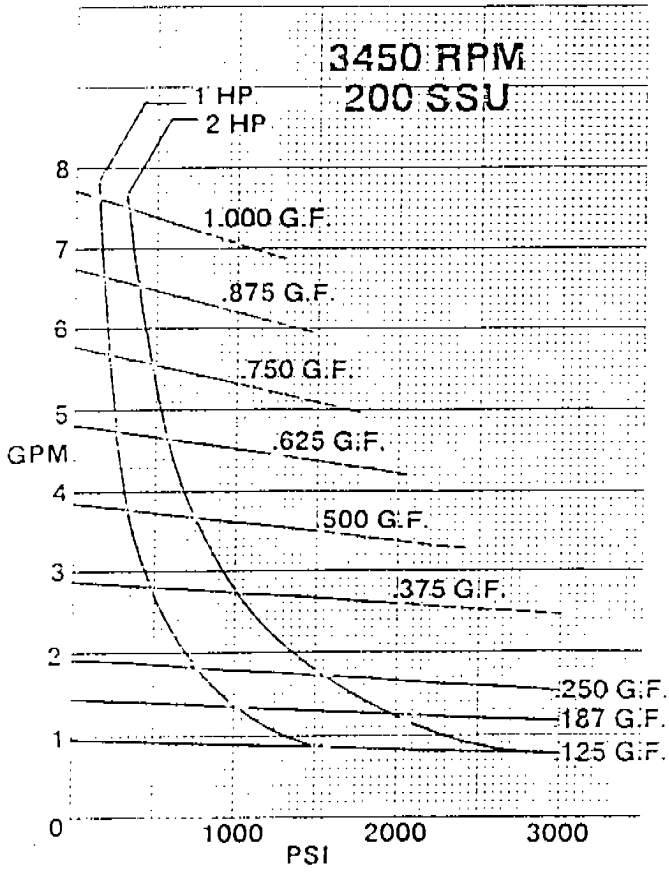
RESERVOIR TUBE KITS FOR VERTICAL MOUNT

Order Code	Kit No.	Description
4	1300801	Kit Used w/Order Code U (1300793) Reservoir
5	1300802	Kit Used w/Order Code V (1300794) Reservoir
6	1300803	Kit Used w/Order Code W (1300795) Reservoir
7	1300804	Kit Used w/Order Code X (1300796) Reservoir

*The above tube kits are only required for vertical mount units and only for pump options E-J (.258 in.^{3}-.517 in.^{3} displacement).

Performance Curves





The following curves show both the GPM and the maximum allowable continuous pressure (PSI) for each pump and motor combination. Performance based on motor nameplate voltage. For performance ratings in excess of continuous duty cycle, use intermittent duty ratings for motors.

Intermittent Duty Ratings for Motors

1300213	GC8100CBOB-90	1/3 HP	1 Phase	1725 RPM
	30 min.	15 min.		5 min
60 HZ	.66 HP	66 HP		.66 HP
*50 HZ	.60 HP	.60 HP		.60 HP
1300221	GC8124GLOB-90	1/2 HP	3 Phase	1725 RPM
	30 min.	15 min.		.5 min
60 HZ	.75 HP	.92 HP		1.0 HP
50 HZ	.55 HP	.75 HP		1.0 HP
1300217	GC8120CDOG-90	1/2 HP	1 Phase	1725 RPM
	30 min	15 min		5 min
60 HZ	.80 HP	1.0 HP		1.2 HP
*50 HZ	.75 HP	85 HP		1.0 HP
1300237	GC8145GNOG-90	1 HP	3 Phase	3450 RPM
	30 min.	15 min.		5 min.
60 HZ	1.25 HP	1 5 HP		2.0 HP
**				
1300229	GC8141CDOG-90	1 HP	1 Phase	3450 RPM
	30 min.	15 min		5 min
60 HZ	1.1 HP	1 2 HP		2.0 HP
*50 HZ	1.0 HZ	**		**
1300233	GC8144GNOG-90	1 HP	3 Phase	1725 RPM
	30 min.	15 min.		5 min.
60 HZ	1.5 HP	1 75 HP		2.0 HP
50 HZ	1.1 HP	1.25 HP		1.5 HP
1300225	GC8140CDOG-90	1 HP	1 Phase	1725 RPM
	30 min.	15 min.		5 min.
60 HZ	1.3 HP	1 7 HP		2.0 HP
50 HZ	9 HP	1 0 HP		1.2 HP
1300249	GC8181ENOG-90	2 HP	3 Phase	3450 RPM
	30 min.	15 min		5 min
60 HZ	3.0 HP	3 4 HP		4.0 HP
50 HZ	**	**		**
1300245	GC8181BDOG-90	2 HP	1 Phase	3450 RPM
	30 min.	15 min		5 min
60 HZ	2.2 HP	2 4 HP		3.0 HP
50 HZ	**	**		**
1300241	GC8180EPOG-90	2 HP	3 Phase	1725 RPM
	30 min	15 min.		5 min
60 HZ	2.5 HP	3.0 HP		4.0 HP

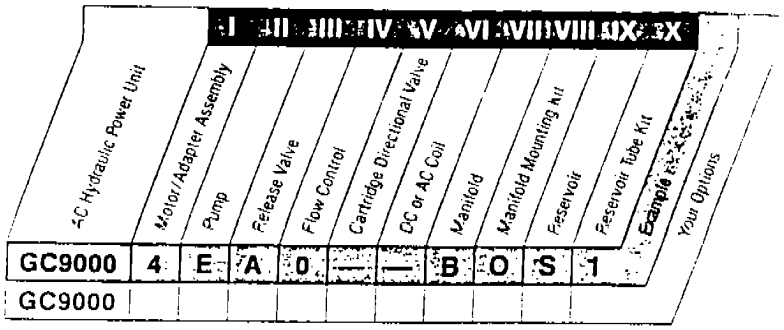
Intermittent duty is defined as operation at one of the above limits continuously for the full time period, followed by one (1) hour off

*All single phase motors must be modified for 50 HZ operation by changing the start switch

**No 50 HZ operation allowed.

How to Order G. C.-9000 Power Units

Each option has been assigned an order code. To order the unit you need, simply indicate series number GC-9000, then select the option you need from each section and put the corresponding letter or number in the ordering blanks. Order either a release valve and flow control or a cartridge directional valve and coil(s).



I Motor/Adapter Assemblies

Order Code	Description hp	phase	rpm	Kit No.
GC-9000 Type				
0	1/3	1	1725	1300213
1	1/2	3	1725	1300221
2	1/2	1	1725	1300217
3	1	3	3450	1300237
4	1	1	3450	1300229
5	1	3	1725	1300233
6	1	1	1725	1300225
7	2	3	3450	1300249
8	2	1	3450	1300245
9	2	3	1725	1300241
GC-9001 Type				
10	1/3	1	1725	1300772
11	1/2	3	1725	1300773
12	1/2	1	1725	1300774
13	1	3	3450	1300775
14	1	1	3450	1300776
15	1	3	1725	1300777
16	1	1	1725	1300778
17	2	3	3450	1300779
18	2	1	3450	1300780
19	2	3	1725	1300781

III Pumps

Order Code	Description GPM at 1800 RPM	cu. in. displacement	Kit No.
A	.5	.064	1300177
B	.75	.094	1300178
C	1.0	.129	1300179
D	1.5	.194	1300180
E	2.0	.256	1300181
F	2.5	.323	1300182
G	3.0	.388	1300183
H	3.5	.452	1300184
J	4.0	.517	1300185
K	0.125/0.500*	.064/.258*	1300688

*Two-stage pump
Note: All pumps are clockwise rotation.

III Release Valves

Order Code	(9000 ONLY) Description	Kit No.
A	Adapter only (no release)	—
C	Manual lever release	1300193
D	Electric release, normally closed, 115 VAC, 50/60 Hz.	1300025
E	Electric release, manual override, 115 VAC, 50/60 Hz.	1300374
F	Electric release, normally open, 115 VAC, 50/60 Hz.	1300296

IV Flow Controls

Order Code	(9000 ONLY) Capacity	Kit No.
0	None	—
1	1 GPM	1300036
2	2 GPM	1300022
3	3 GPM	1300035
4	4 GPM	1300034

V Cartridge Directional Control Valves

Order Code	(9001 ONLY) Description	Kit No.
A	2-position, 4-way cartridge valve	1300729
B	3-position, 4-way, cartridge valve, tandem center	1300785
C	3-position, 4-way, cartridge valve, open center	1300786
F	Pilot-operated check valve, C1	1300727
G	Pilot-operated check valve, C2	1300728
H	Double pilot-operated check valve	1300763

Note: To order a unit with both cartridge and pilot-operated check valves, put both order codes in field no. V.

VI DC or AC Coils

Order Code	(9001 ONLY) Description	Kit No.
1*	12 VDC	1300740
2*	24 VDC	1300741
4*	115 VAC	1300732
5*	230 VAC	1300733

*Two coils are required for a 3-position, 4-way cartridge valve

VII Manifolds

Order Code	(9000 ONLY) Description	Kit No.
A	No manifold	—
B	D0-1 base manifold for cylindrical reservoir	1300329
C	One base manifold and one secondary manifold, for cylindrical reservoirs	1300329 1300330
D	One base manifold and two secondary manifolds, for cylindrical reservoirs	1300329 & (2) 1300330

VIII Manifold Mounting Kits

Order Code	(9000 ONLY) Description	Kit No.
0	None	—
1	Two stack bolt kit (required with manifold option C)	1300331
2	Three stack bolt kit (required with manifold option D)	1300332

IX Reservoirs

Order Code	Description Type	Gallon Capacity	Kit No.
Q	Cylindrical	1	1300127
R	Cylindrical	1.5	1300129
S	Cylindrical	2	1300131
T	Cylindrical	3	1300133
U	Vertical Mount	1	1300793
V	Vertical Mount	1.5	1300794
W	Vertical Mount	2	1300795
X	Vertical Mount	3	1300796

X Reservoir Tube Kits

Order Code	Description	Kit No.
0	None	—
1	Kit for cylindrical reservoirs (required for pump options E-J)	1300187
3	Kit for cylindrical reservoirs (required for pump option K)	1300186
4*	Req'd. for Reservoir U (1300793)	1300801
5*	Req'd. for Reservoir V (1300794)	1300802
6*	Req'd. for Reservoir W (1300795)	1300803
7*	Req'd. for Reservoir X (1300796)	1300804

*The tube kits 4-7 are only required for vertical mount units and only for pump options E-J (.258 in.³-.517 in.³ displacement)

XI Optional GC-9000 Kits

Description	Kit No.
GC-9000 adaptor only (no motor) kit	1300268
GC-9001 adaptor only (no motor) kit	1300805
NEMA C motor (56 frame) adaptor & coupling kit	1300643
Extended shaft adaptor kit	1300654
5 gallon rectangular reservoir kit	1300117
10 gallon rectangular reservoir kit	1300108
5 & 10 gallon rectangular reservoir tube kit	1300188
5 & 10 gallon rectangular reservoir tube kit (pump option "K" only)	1300189

John S. Ba
a Garphyttan company

Headquarters
2222 15th St

Statesville Division
James Farm Road
P.O. Box 36

Berendsen Fluid Power

9999 East Rose Hills Road

ED BY:

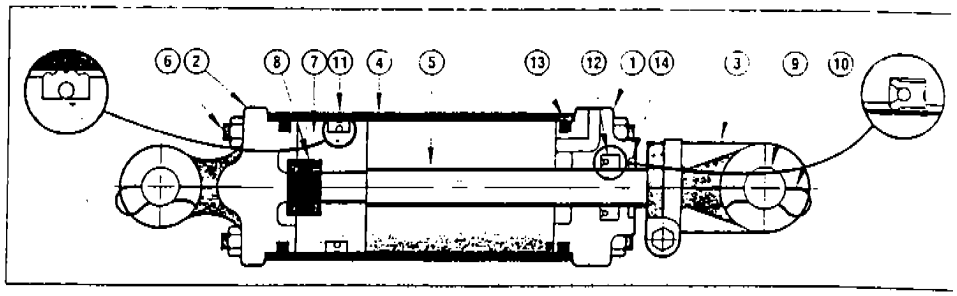
The Rockford Cylinder®

Specifications:

Bore sizes: 2" – 5"

Pressure Ratings:

3,000 PSI maximum operating pressure
4,800 PSI maximum shock and surge pressure
Porting: O-ring SAE ports standard (NPTF ports optional)



Ductile iron head casting
Ductile iron cap clevis casting
Removable ductile iron clevis with set-screw locking device
Precision skived steel tubing
Induction hardened and hard chrome plated rod
Heavy-duty high tensile strength tie rods with rolled threads
One-piece gray iron piston
High-strength self-locking piston nut
Hardened and plated pins are standard

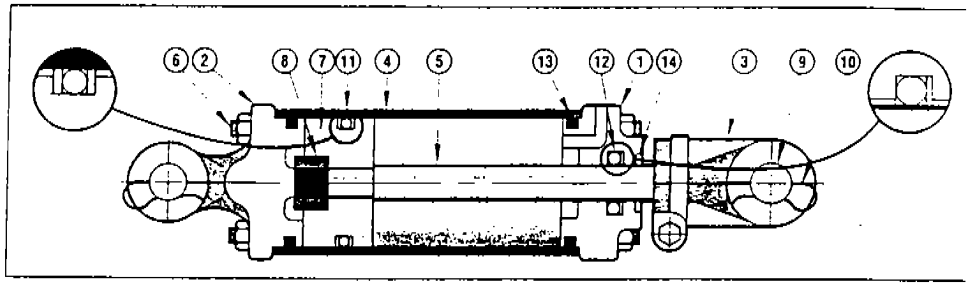
Heavy gauge plated spring clips are standard
Heavy-duty Urethane piston seal with elastomeric expander for long life
Heavy-duty Urethane rod seal with o-ring expander for long life
O-ring tube seals with back-up rings
Canned Urethane wiper
Cylinders stamped with part number and date of manufacture for permanent identification
Standard cylinder color is black

Specifications:

Bore sizes: 2" – 5"

Pressure Ratings:

2,500 PSI maximum operating pressure
4,000 PSI maximum shock and surge pressure
Porting: NPTF ports standard (O-ring SAE ports optional)



Gray iron head casting
Ductile iron cap clevis casting
Removable ductile iron clevis with set-screw locking device
Precision skived steel tubing
Hard chrome plated rod
High tensile strength tie rods with rolled threads
One-piece gray iron piston
Self-locking piston nut
Plated pins are standard (hardened steel on 3-1/2" bore and up)

Heavy gauge plated spring clips are standard
O-ring piston seal with back-up rings
O-ring rod seal with back-up ring
O-ring tube seals
Canned Urethane wiper
Cylinders stamped with part number and date of manufacture for permanent identification
Standard cylinder color is black

Model Number Explanation

EXAMPLE: Rockford 3000 Series
2" Bore X 6" Stroke
Non-ASAE

The model code designates standard rod and port sizes and standard side port position #2 (in line with the pins). Options are available for both the Rockford 3000 and the Rockford 2500 Series cylinders if ordered in quantity. Prices quoted on request.

20 06 AR H

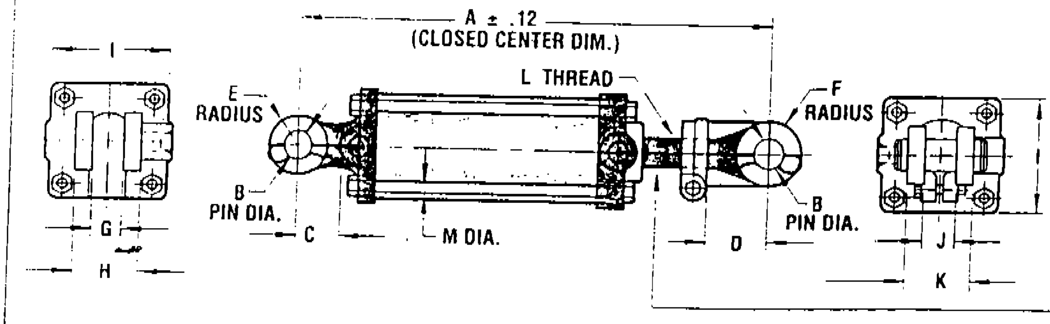
20 = Bore (inches) X ten
06 = Stroke (inches)
= Non-ASAE standard
or
ASAE = ASAE standard
H = Rockford 3000 Series
(Add no suffix for Rockford 2500 Series)

- Oversize rods (specified on pages 4 and 5)
- Top porting (perpendicular with pins)
- SAE ports (Rockford 2500)
- NPTF ports (Rockford 3000)
- Mechanical depth stop (ASAE cylinders only)
- Non-standard paint colors
- Rephasing
- Special seals
- Special retracted lengths
- Hardened clevis pins (Rockford 2500)
- Clevis bushings
- Induction hardened rod (Rockford 3000)
- Non-standard pin diameters

Rockford 2500 Cylinders

ASAE Standard Cylinder Dimensions

All 8" stroke, 2" – 5" bore cylinders and all 16" stroke, 3" – 5" bore cylinders conform to ASAE standards as shown in the chart below.



*Mechanical Depth Stop Option

Model No.	Rod Size
C-291	1 1/16"
C-292	1 1/4"

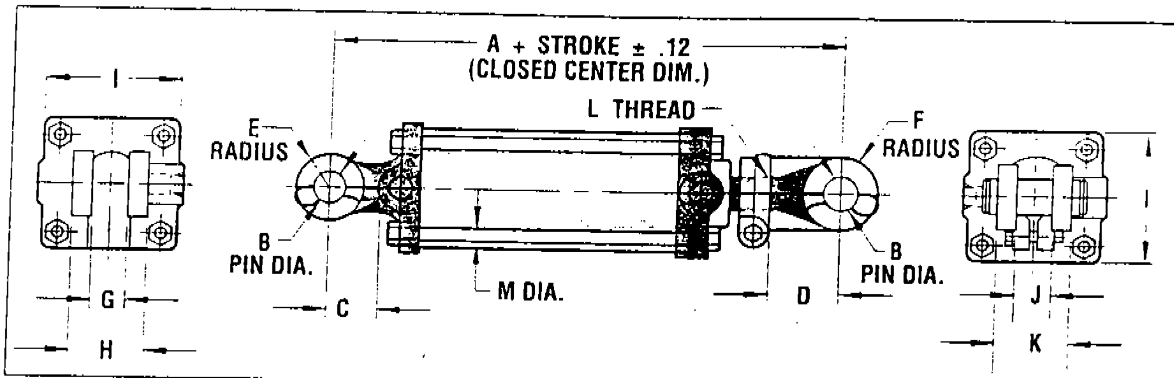
All 8" stroke, 2" through 4" bore, cylinders are designed with the rod threaded to accommodate an optional depth stop collar.

Model No.	Bore Dia.	Stroke	Port Size & Type	Rod Dia.	A	B	C	D	E	F	G	H	I	J	K	L	M	WEIGHT (LBS.)
*2008ASAE	2	8	3/8" NPTF	1 1/16	20 1/4	1	1 5/8	2 1/8	7/8	1	1 1/8	2 1/2	2 7/8	1 1/8	2 5/8	1 1/16-12	3/8	19
*2508ASAE	2 1/2	8	3/8" NPTF	1 1/16	20 1/4	1	1 5/8	2 1/8	1	1	1 1/8	2 5/8	3 1/4	1 1/8	2 5/8	1 1/16-12	[illegible]	21
*3008ASAE	3	8	1/2" NPTF	1 1/4	20 1/4	1	1 5/8	2 1/8	1	1	1 1/8	2 5/8	3 3/4	1 1/8	2 5/8	1 1/4-12	1/2	27
*3508ASAE	3 1/2	8	1/2" NPTF	1 1/4	20 1/4	1	1 3/4	2 1/8	1	1	1 1/4	2 3/4	4 1/4	1 1/8	2 5/8	1 1/4-12	7/16	34
*4008ASAE	4	8	1/2" NPTF	1 1/4	20 1/4	1	2	2 1/8	1 1/8	1	1 1/4	2 7/8	5	1 1/8	2 5/8	1 1/4-12	5/8	42
5008ASAE	5	8	1/2" NPTF	1 1/2	20 1/4	**1	2 5/16	2 1/8	1 1/2	1 1/4	1 3/8	3 1/2	6	1 1/4	2 3/4	1 1/2-12	3/4	66
3016ASAE	3	16	1/2" NPTF	1 1/4	31 1/2	1 1/4	1 5/8	2 1/8	1	1	1 1/8	2 5/8	3 3/4	1 1/8	2 5/8	1 1/4-12	1/2	38
3516ASAE	3 1/2	16	1/2" NPTF	1 1/2	31 1/2	1 1/4	1 5/8	2 1/8	1	1 1/4	1 1/4	2 3/4	4 1/4	1 1/4	2 3/4	1 1/4-12	7/16	54
4016ASAE	4	16	1/2" NPTF	2	31 1/2	1 1/4	2	2 1/8	1 1/8	1 1/4	1 1/4	2 7/8	5	1 1/4	2 3/4	1 1/4-12	5/8	69
5016ASAE	5	16	1/2" NPTF	2	31 1/2	1 1/4	2 5/16	2 1/8	1 1/2	1 1/4	1 3/8	3 1/2	6	1 1/4	2 3/4	1 1/2-12	3/4	92

*Mechanical depth stop option is available for these sizes.

**1500 PSI maximum operating pressure

AR Series Cylinder Dimensions



Bore Dia.	A	B	C	D	E	F	G	H	I	J	K	L	M
2	10 1/4	1 1/64	1 5/8	2 1/8	7/8	1	1 1/8	2 1/2	2 7/8	1 1/8	2 5/8	1 1/16-12	3/8
2 1/2	10 1/4	1 1/64	1 5/8	2 1/8	1	1	1 1/8	2 5/8	3 1/4	1 1/8	2 5/8	1 1/16-12	[illegible]
3	10 1/4	1 1/64	1 5/8	2 1/8	1	1	1 1/8	2 5/8	3 3/4	1 1/8	2 5/8	1 1/4-12	1/2
3 1/2	10 1/4	1 1/64	1 5/8	2 1/8	1	1 1/4	1 1/4	2 3/4	4 1/4	1 1/4	2 3/4	1 1/4-12	7/16
4	10 5/8	1 1/64	2	2 1/8	1 1/8	1 1/4	1 1/4	2 7/8	5	1 1/4	2 3/4	1 1/4-12	5/8
5	12 1/4	1 17/64	2 5/16	2 1/8	1 1/2	1 1/4	1 3/8	3 1/2	6	1 1/4	2 3/4	1 1/2-12	3/4

All dimensions are nominal and are for standard configurations.

Cylinder Port Options and Rod Requirements by Stroke

Bore Dia.	Size & Type Ports		Standard Rods		Optional Rods	
	Standard	Optional	Dia.	Max. Stroke*	Dia.	Max. Stroke*
2	3/8 NPTF	9/16-18 SAE	1 1/16	24"	1 1/8	29"
2 1/2	3/8 NPTF	9/16-18 SAE	1 1/16	16"	1 1/4	24"
3	1/2 NPTF	3/4-16 SAE	1 1/4	22"	1 1/2	30"
3 1/2	1/2 NPTF	3/4-16 SAE	1 1/4	18"	1 1/2	24"
4	1/2 NPTF	3/4-16 SAE	1 1/4	12"	1 1/2 2	20" 46"
5	1/2 NPTF	[illegible]-16 SAE	2	36"	1 1/2	9"

[illegible]

HYDRO-LINE Actuation Products

N5 Series Cylinders
- NFPA interchangeable
- **N5** – 3000 PSI nominal hydraulic
- – to 250 PSI very heavy-duty ...matic
- **LAN5** – to 250 PSI very heavy-duty pneumatic – permanently lubricated
- All steel construction

R5 Series Cylinders
- NFPA interchangeable
- **R5** – to 250 PSI pneumatic
- **LR5** – to 250 PSI pneumatic permanently lubricated
- **HR5** – to 1500 PSI nominal hydraulic
- All steel construction

A5 Series Cylinders
- NFPA interchangeable
- **A5** – to 250 PSI pneumatic
- **LA5** – to 250 PSI pneumatic – permanently lubricated
- **HA5** – to 400 PSI hydraulic
- Steel end caps with aluminum tube and piston

Q5 Series Cylinders
- NFPA interchangeable
- **Q5** – to 250 PSI pneumatic permanently lubricated
- **HQ5** – to 400 PSI hydraulic
- All aluminum construction

HM Series Cylinders
- Conform to international metric specifications ISO 6020/2 and DIN 24 554
- 25mm to 200mm bore sizes
- 210 BAR nominal hydraulic
- All steel construction

Rockford Series Cylinders
- ASAE interchangeable agricultural cylinders
- **Rockford 2500** – 2500 PSI hydraulic
- **Rockford 3000** – 3000 PSI hydraulic

Custom Cylinders
Custom cylinders to meet special requirements
- Bores to 30"
- Strokes to 300"
- Pressures to 10,000 PSI or higher

Systems Cylinders
Hydraulic or pneumatic cylinders which incorporate cylinder position sensing and feedback throughout the stroke. Available in N5, R5, A5, Q5, HM or special cylinders.

Series 20/30 Boosters
- Standard series to 5000 PSI and custom designs to 20,000 PSI output

T Series Air/Oil Tanks
- All steel construction

QT Series Air/Oil Tanks
- Aluminum end caps and translucent tubing

Warranty

Rockford Cylinders® are warranted for a period of twelve (12) months from date of shipment from our plant to be free from defects in material and workmanship under correct use, normal operating conditions and proper application.

Our obligation under this warranty shall be limited to the repair or exchange, at our option, F.O.B. our factory, of any Rockford Cylinders product or part which proves to be thus defective. We reserve the right to either inspect the product at the buyer's location or require it to be returned to the factory for inspection. Replacement articles or parts hereof repaired under this warranty shall be warranted under the terms of this warranty for the remainder of the term of the original warranty or for a period of six (6) months (after such repair or replacement), whichever is longer. Upon expiration of the warranty period, all of Rockford Cylinders' obligation hereunder shall terminate.

The above warranty does not extend to goods damaged, or subjected to accident, abuse, or misuse after shipment from our factory, nor to goods altered or repaired by anyone other than authorized Rockford Cylinders representatives.

Hydro-Line shall not be liable for loss of time, manufacturing costs, labor, material, loss of profits, consequential damages, direct or indirect, because of defective products, whether due to rights arising under the contract of sale or independently thereof, and whether or not such claim is based on contract, tort, or warranty. Hydro-Line reserves the right to make design changes at anytime without obligation to modify articles previously shipped from Hydro-Line.

Written permission for any warranty claim return must be first obtained from authorized Rockford Cylinders personnel. All returns must be accompanied with a complete written explanation of claimed defects and the circumstances of operational failure.

An affirmation of fact or promise made on behalf of Hydro-Line shall not be deemed to create an express warranty that the goods shall conform to the affirmation or promise; any description of the goods is for the sole purpose of identifying them and shall not be deemed to create an express warranty that the goods shall conform to such description; any sample or model is for illustrative purposes only and shall not be deemed to create an express warranty that the goods shall conform to the sample or model; and no affirmation or promise, or description, or sample or model, shall be deemed part of the basis of the bargain. Buyer is solely responsible for determining suitability for use.

This warranty is expressly in lieu of other warranties expressed or implied including the warranties of merchantability and fitness for use of all other obligations or liabilities on our part. The warranty states our entire and exclusive liability and buyer's exclusive remedy for any claim of damages in connection with the sale or furnishing of Rockford Cylinders' products or parts, their design, suitability for use, installations or operation, or for any claimed defects therein.

The above industrial products are available through authorized Hydro-Line distributors. Contact Hydro-Line for the distributor location in your area.

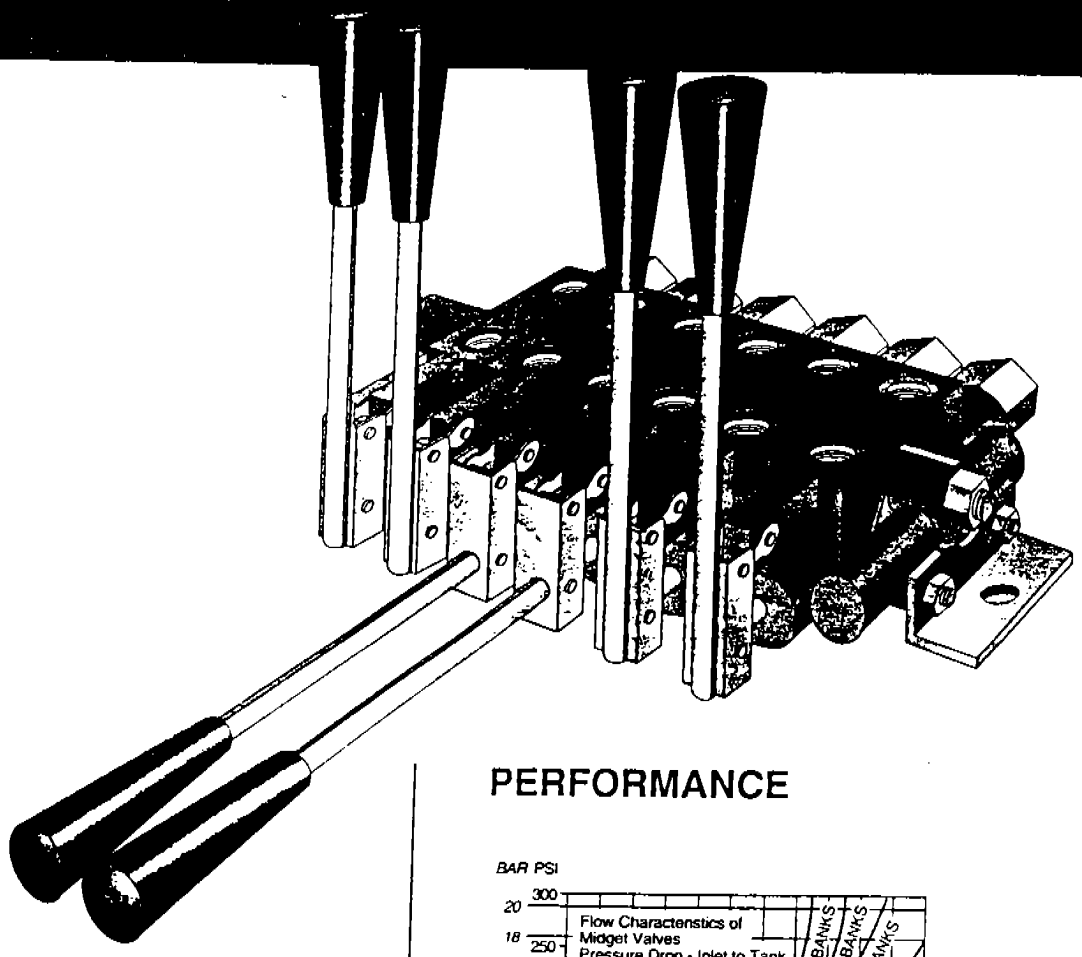
Berendsen Fluid Power

9999 East Rose Hills Road
Whittier, California 90601
(310) 692-6912
Telefax: (310) 692-2647

HYDRO-LINE, INC.

Delivering Engineered Solutions in Actuation Worldwide

Fluid Power Systems



MV3 SERIES
Midget Valves

FPS Midget Valves provide multiple-function directional control in series, parallel and series-parallel circuits. Proven for more than 30 years in thousands of mobile and industrial hydraulic systems, FPS Midget Valves are modular in design and can be assembled in a wide variety of circuit configurations.

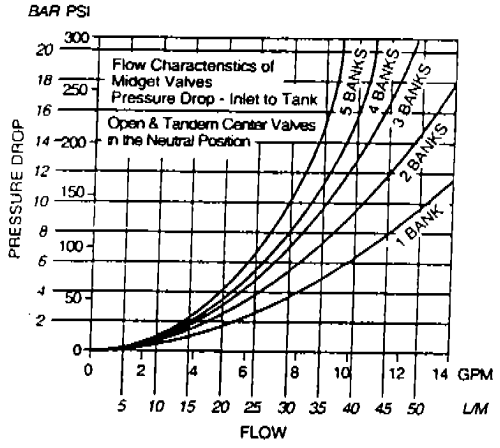
FEATURES

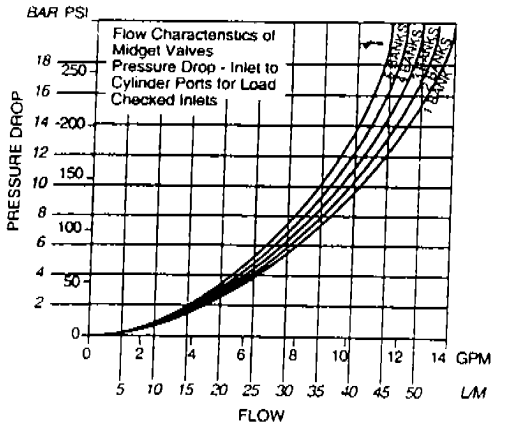
- Superior versatility.
- Both open and closed center configurations.
- Excellent metering characteristics.
- Inlet load drop checks.
- Optional high flow inlets (low △ P).
- Fourth position float.
- Combinable with FPS Mini-Pak solenoid operated directional control valves.
- Power Beyond feature.

SPECIFICATIONS

Operating Pressure: 3,000 psi *(207 BAR)* max.
Power Beyond Pressure Capability: 3,000 psi *(207 BAR)*
Operating Fluid: Standard petroleum-based.
Leakage C-T at 3,000 psi *(207 BAR)*: 5.4 in³/min *(88.5 cc/min)* at 100°F *(38°C)*, 150 SSU *(32 cSt)*.
Handle Pull Force at 3,000 psi *(207 BAR)*: 15 lbs. *(66.6 N)* maximum, spring centered or detent.
Filtration Requirement: Recommend 25 micron (nominal).

PERFORMANCE





Note: SAE 10 oil at 100°F *(38°C)*, Viscosity 150 SSU *(32 cS*

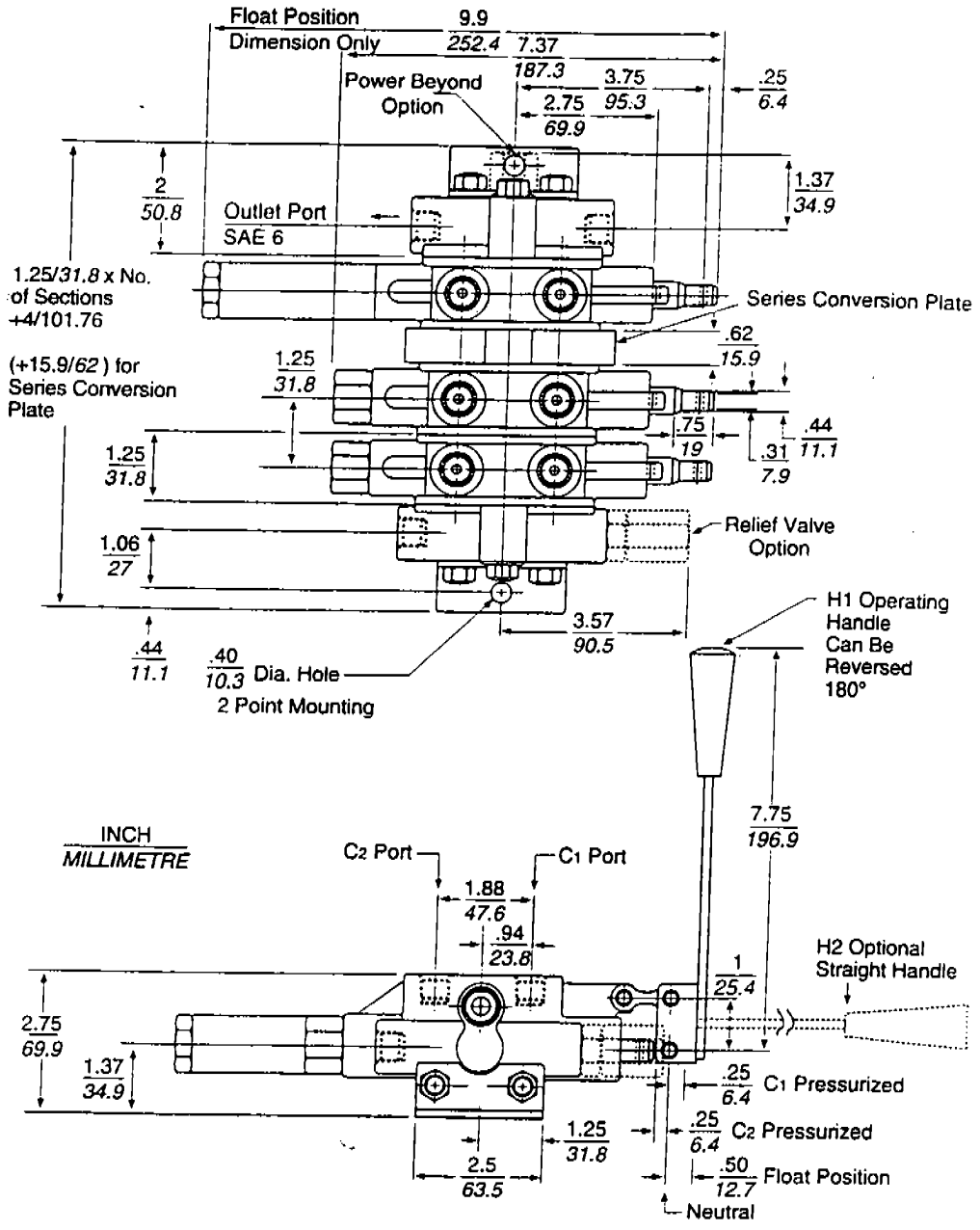
MATERIALS

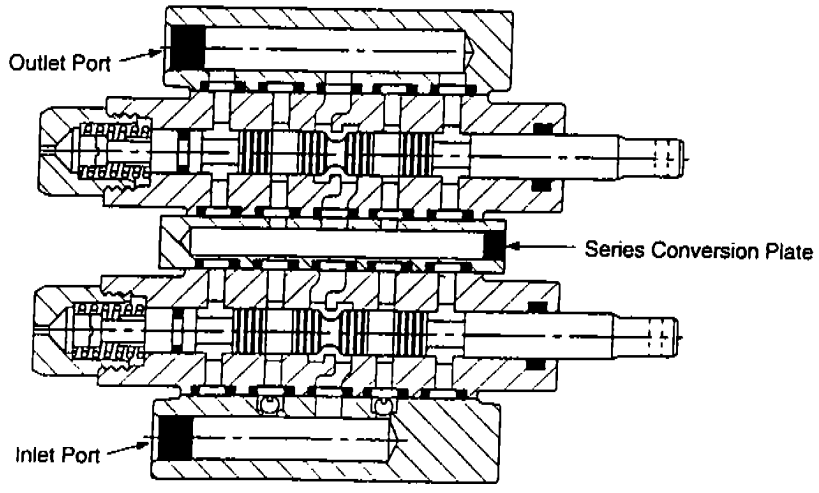
Construction: Chrome-plated, hardened precision spool, high-strength alloy cast iron body, standard Buna "N" seals.

Porting: SAE-6 (9/16" x 18 thread)

Stacking Limitation: Recommended to 6 stacks maximum. Additional sections on special factory-approved applications.

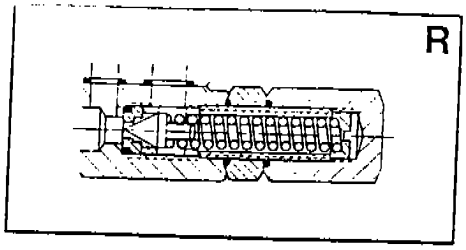
Shipping Weight Per Section: 6 lbs. *(2.7 kg)* approx.





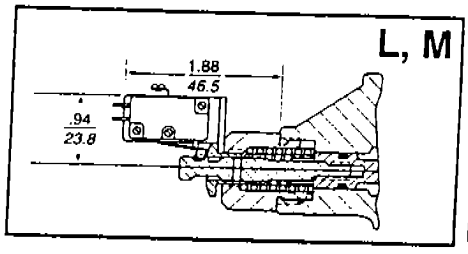
OPTIONS

- Spring-centered or detented spools in any combination.
- Integral, adjustable inlet relief valve.
- Priority inlet with direct-acting relief valve; available in 50 - 3,000 psi *(3.5 - 207 BAR)*.
- Power beyond outlet sections.
- Electric limit switches for DC power unit switching with 1/4" *(6.35 mm)* spade connectors.
- Open center series conversion.
- Closed center parallel circuit stack conversion.



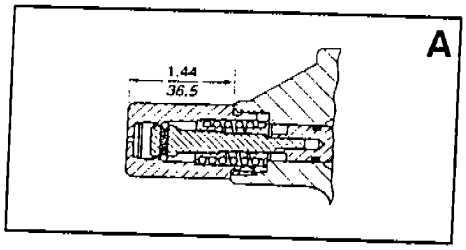
R — **Direct Acting Relief Valve**

Adjustable in 2 Pressure Ranges
50-500/500-3000
(3.5-35/35-207 BA

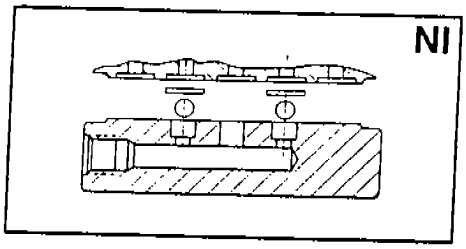


L, M — **Electric Limit Switch on Spool Cap**

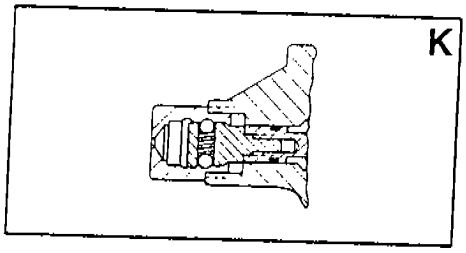
1/4" *(6.35 mm)* Spade Adaptors
L - 3 position
M - 2 position



A — **Spring Center/Detent Position Cap**

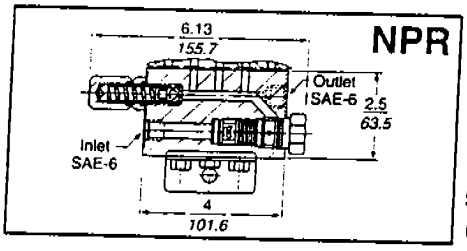


NI — **Load Drop Checks**



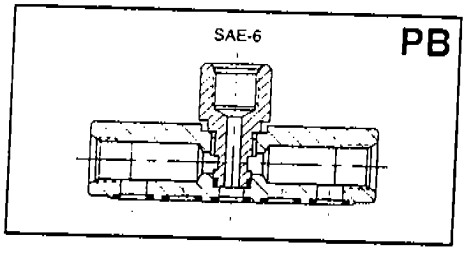
K — **2K, 2-Position Detented Cap**

3K, 3-Position Detented Cap

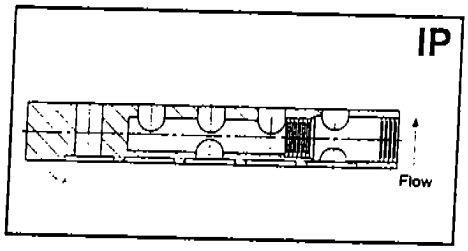


NPR — **Priority Inlet w/ Direct Acting Relief**

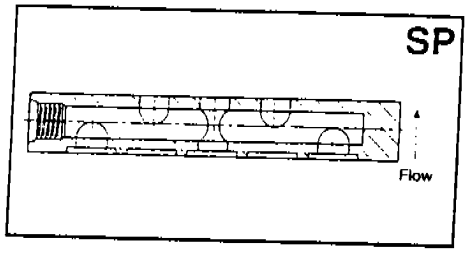
Adjustable in 2 Pressure Ranges
50-500/500-3000 p
(3.5-35/35-207 BA



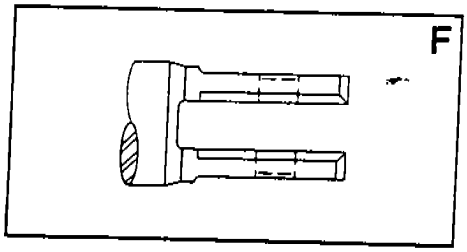
PB — **Power Beyond Outlet Section**



IP — **Isolator Plate**



SP — **Series Conversion Plate**



F — **Forked End Spool**

HOW TO ORDER

FPS Midget Valves are coded by the assembled stack configuration in sequential order from inlet to outlet. Please refer to the ordering chart to select circuit type, inlet options, spool configuration, spool options, circuit conversion options and outlet options as they apply to your application.

EXAMPLE

MV3-NR1000-10K-IP-10FM-SO

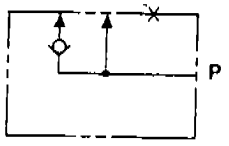
Midget Valve, inlet with direct acting relief (1000 psi) & load drop checks, valve section with detent, isolator plate, valve section with fine metering spool, standard open center outlet.

Note: Special options are available on all Fluid Power Systems Midget Valve assemblies. Please contact your authorized FPS distributor for full technical information.

MV3 -NR

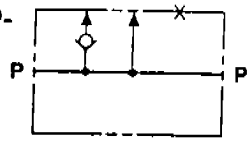
Inlet Body Type

NRI-



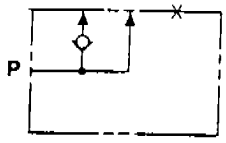
Reverse inlet w/load checks

NDIP-



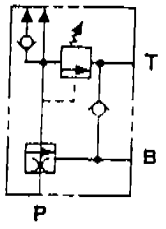
Dual inlet ports w/load checks

NI-



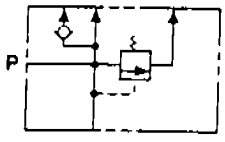
Inlet w/load checks

NPR-



Inlet w/load priority valve and direct acting relief and load checks

NR-



Inlet w/direct acting relief and load checks

1000

Pressure Setting

Omit - If not required

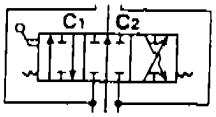
XXXX - 0-3000 psi
(Specify setting)

Handle Kits — Must be ordered separately
MV3-H1 — Right angle handle
MV3-H2 — Straight handle

–10

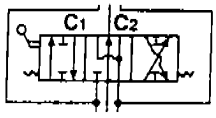
Spool Configurations
(Repeat as necessary)

10-



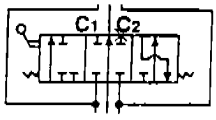
3 position - 4 way
C1 & C2 blocked

14-



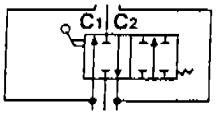
3 position - 4 way motor
C1 & C2 open to tank

17-



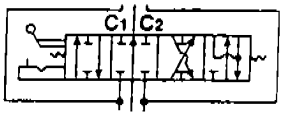
3 position - 3 way (open center only) C1 port only

20-



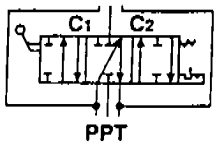
2 position - 4 way motor
C1 & C2 blocked

34-



4 position - 4 way (Float)
C1 & C2 blocked
(Use only w/open center circuit)

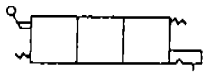
35-



Tool priority "Dead Man" selector

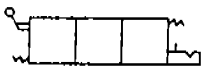
K
Spool Options
Omit – if spring centered

A-



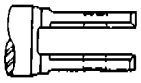
Detented spool in, spring centered

B-



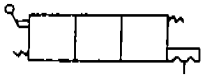
Detented spool out position, spring centered

F-



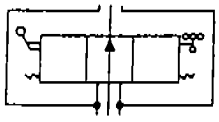
Forked end spool

K-



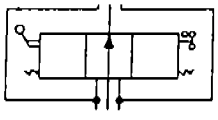
Detented in both operating positions

L-



Micro-switch operated (3 positions)

M-

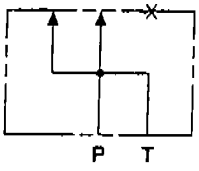


Micro-switch operated (2 positions)

FM- Fine Metering
(10 & 14 sections only)

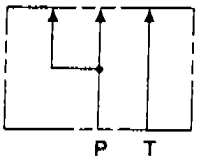
– IP
Circuit Conversions

SP -



Series conversion (not to be used w/inlet relief)

IP -



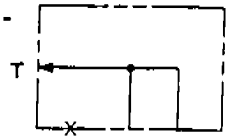
Isolator plate

– 10 FM
Additional Spool Sections

Repeat as required

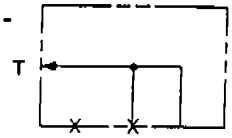
– SO
Outlet Body Type

SO -



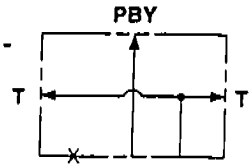
Standard outlet (open circuit)

SC -



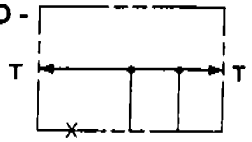
Standard outlet (closed circuit)

PB -



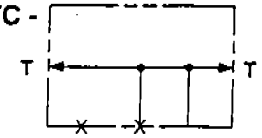
Power beyond (open circuit only)

DTO -



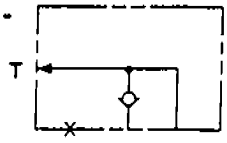
Dual tank outlet (open circuit)

DTC -



Dual tank outlet (closed circuit)

NO -



Std outlet w/reverse check (open circuit only)