MFG: DARTRON INDUSTRIES
NAME: STAR TROOPER
TYPE: NON-KIDDIE

S T A R T R O O P E R

OPERATION AND MAINTENANCE MANUAL

DARTRON INDUSTRIES, INC.

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T A B L E O F C O N T E N T S

INTRODUCTION

This manual is intended to be used as a general guide for the operation and maintenance of your ride. Dartron Industries, Inc. is constantly striving to improve performance, efficiency and safety; therefore, certain improvements may not be reflected in the text of the manual. Any major revisions or additions to the manual will be sent to you free of charge. Specially engineered features purchased for individual rides may not be incorporated in this manual.

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SPECIFICATIONS

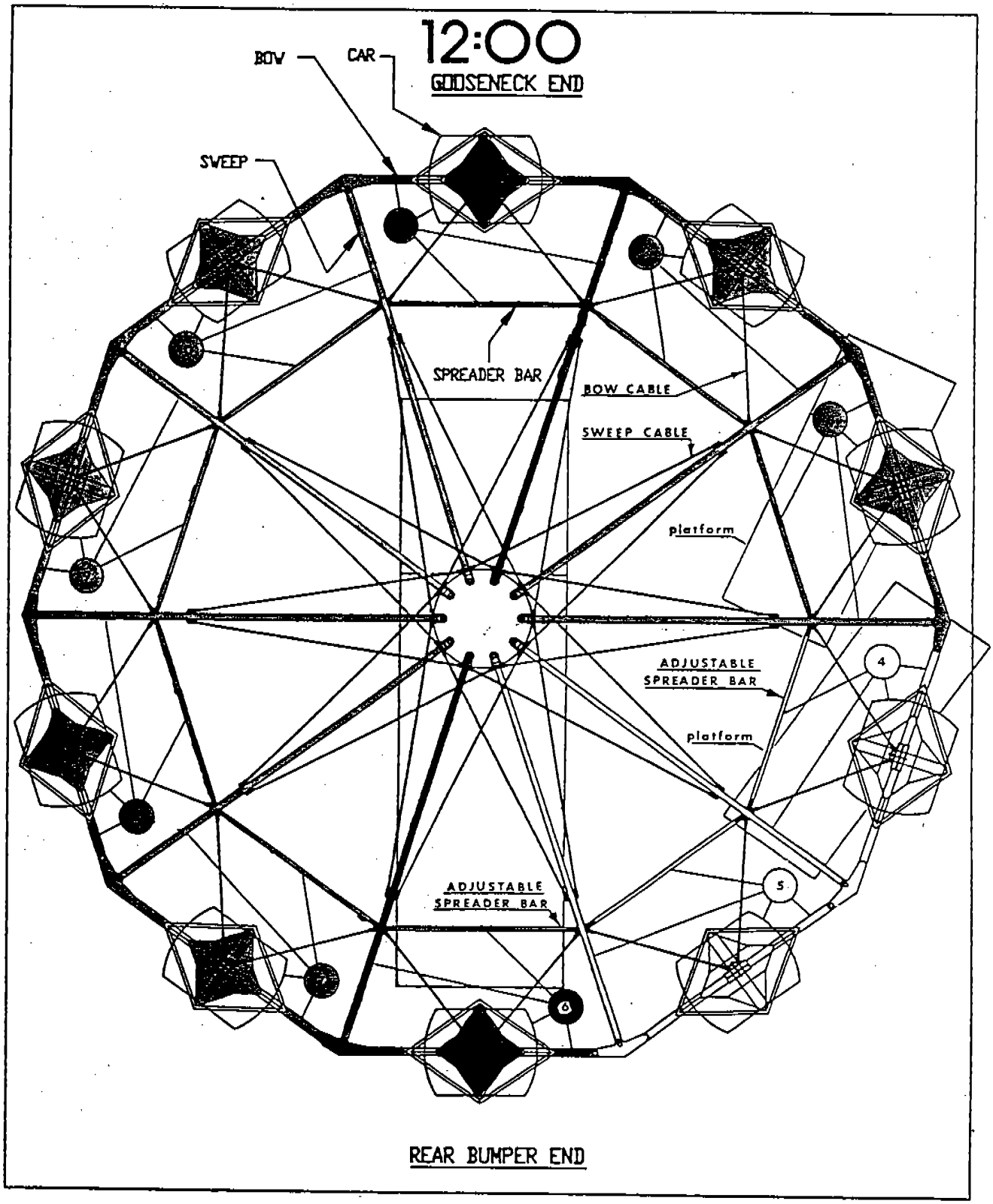
SEATING	Ten cars for 4 adults or 6 children
LIGHTING	Turbo lights - 10 watt bulbs
TOTAL POWER REQUIRED	100 kw
POWERED BY	50 hp, 1750 rpm, TEFC motor
MAXIMUM OPERATING HEIGHT	36 feet, 4 inches
SPACE REQUIRED	53 feet by 57 feet
TRAILER LENGTH	28 feet

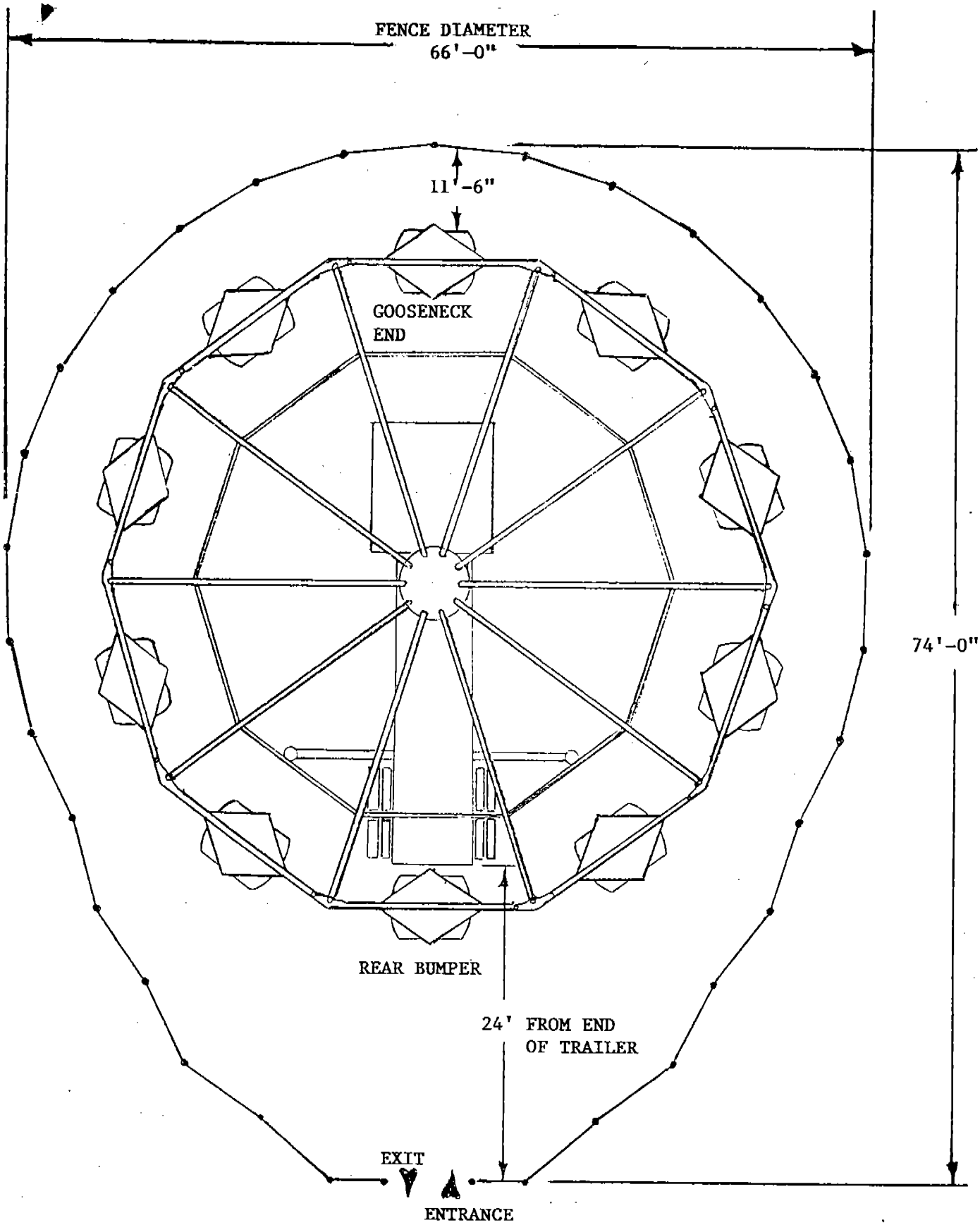
POWER SUPPLY REQUIREMENTS

1. The maximum power needed for the StarTrooper is 100 kw.
2. 210 amps are the maximum required.
3. The StarTrooper requires 220 volt 3 phase <u>with ground</u>.

CAUTION: Failure to supply an adequate ground to the frame can cause serious electric shock hazard. Proper grounding prevents the metal parts of the StarTrooper from being energized (to high voltage) in the event of a short circuit. Another means of grounding is with a ground rod. Check local regulations for ground rod requirements and specifications.

SWEEP, BOW & CAR DIAGRAM





SPACE DIAGRAM

MINUMUM SPACE REQUIRED

DEPTH-------74'-0"
WIDTH-------66'-0"
HEIGHT------40'-0"

QUANTITY OF FENCE

30 LONG
2 SHORT

A. SET UP

1. MISCELLANEOUS ITEMS

a. Electrical power is required to set up StarTrooper. Connect 3 phase 5 wire electrical power.

b. SET UP OPERATOR'S CONTROL STAND. Remove electrical cable for operator's control stand from trailer. Place end of cable at desired location for operator's control stand. Remove operator's control stand, located on the streetside outrigger, and move to the desired location. Connect electrical cord to bottom of operator's control stand.

c. LEVEL AND SUPPORT TRAILER. Using rear landing gear, raise the trailer until weight is transferred to landing gear. CAUTION: DO NOT LIFT TIRES OFF GROUND. Level trailer using front and rear landing gear.

Place blocks underneath screw jacks mounted on rear bumper and lower screw jacks. Screw jacks should be lowered until firmly against the blocks.

Set up rear outriggers by removing pins, rotating outriggers to the open position and pin in place. Remove pins from screw jacks, rotate into position and pin in place. Place blocks underneath outrigger sand shoe and screw sand shoe down until pressure is exerted on blocks.

Maintaining trailer in level position, raise front and rear landing gear so that most of the weight of the ride transfers to rear screw jacks and rear outriggers. Maintain some weight on landing gears.

d. REAR BUMPER. If pintle hook is attached, remove and stow at rear curbside of trailer near landing gear. Push rear bumper in and pin. CAUTION: STARTROOPER MUST NOT BE OPERATED WITH REAR BUMPER IN EXTENDED POSITION. IT MUST BE PUSHED IN.

e. SET UP WHEEL ASSEMBLY PLATFORMS Caution: When removing platforms from possum belly of trailer, lift only one platform at a time. Attempting to lift both platforms could cause injury..

Slide both assembly platforms from the streetside of trailer. Slide platforms partially out of rack, insuring that one side of platform remains supported by possum belly rack, and other side is supported on a board or block so that platform is level.

Remove top platform and carry to position outside the ride circle and place outside where Bow # 3 will be located (see Sweep, Bow & Car diagram, Page 3).

Carry second platform and place outside car circle where Bow # 2 will be located.

Remove fence feet, braces and turnbuckles from second platform and erect the platforms.

f. LOCATE FENCE FEET. Feet, found in platform assembly, are to be located where fence is to be erected (see Diagram, Page 4).

g. SET UP FENCE. Remove fence from rear fenders and install in feet.

h. CHECK ROTATION. Jog motor with START button. Do not start motor. On "C" face flange connected to hydraulic pump is a rotation direction arrow. Fan on electric motor must be rotating in same direction as arrow. If not, switch input leads at generator or main electrical panel.

i. START HYDRAULIC SYSTEM. Be sure rotation switch is in the OFF position. On control stand depress button labeled HYDRAULIC SYSTEM START. See Console Diagram, Page 11.

2. REMOVE 2 CARS FROM GOOSENECK PLATFORM

NOTE: When using hydraulic control levers, located at the rear streetside of gooseneck, to lower cars to the ground, depress override button and hold simultaneously as the lever is being used. **WARNING: BE SURE TO DISCONNECT LOCKING DEVICE ATTACHED TO CAR STORAGE RACK BEFORE LOWERING WITH HYDRAULIC CONTROL LEVER.**

a. Disconnect storage rack safety chain and using the hydraulic control lever and override button, lower car storage rack located on the front of the gooseneck platform until car is slightly above the ground. You must lower front car storage rack before the side racks.

b. Disconnect storage rack safety chain and using the hydraulic control and depressing the override button, lower curbside car storage rack enough to be able to remove Car # 3 (car number is indicated rear of latch on the car). Remove Car # 3 and place outside the circle. After removing Car # 3, lower rack until lowest point touches the ground.

c. Disconnect storage rack safety chain and using the hydraulic control lever, lower the streetside car storage rack enough to be able to remove Car # 10. Remove Car # 10 and place on ground outside the circle. Lower car rack until lowest point touches the ground.

Leave remaining 8 cars on the rack until ready to hang on bows.

3. SPREAD SWEEPS AROUND HUB IN A CIRCLE

a. See diagram for sweep, car, bow numbering and 12:00 orientation.

b. Remove bar brace from between Sweep # 1 and boom. Store bar

on side of boom. Remove bar brace from between Sweep # 10 and boom. Store bar on side of boom.

c. The sweep support beam supports all sweeps while in the travel position. Lower sweep support beam by turning crank of gear jack, located on the streetside. Remove support beam from jacks and store under rear axle of trailer.

d. Rotate Sweeps # 9, 10, 1 and 2 from the rear of trailer to the front gooseneck platform. Once Sweeps # 9, 10, 1 and 2 are to the front, move the split hub pivot wings into place and pin bottom hub plate.

Located on the horizontal brace of front car storage rack is a short brace. Swivel this brace to the vertical position. Remove the pin used to prevent movement of the hub during shipment. Rotate hub until Sweep # 1 is directly above brace. Using the hydraulic system, raise front car storage rack until the brace lifts Sweep # 1 about 1 inch. Lifting Sweep # 1 will allow the split hub wing to be pinned to the top hub plate. Rotate the wheel until Sweep # 5 is directly over the short brace and repeat the above operation.

e. Rotate remaining sweeps forward until the hub cables attached to the sweeps become taut.

NOTE: DO NOT ADJUST CABLES. CABLES ARE PREADJUSTED AT THE FACTORY.

4. ASSEMBLE BOWS, SPREADER BARS, BOW CABLES AND SWEEP CABLES

a. Install H brace

1. Move assembly platforms so that one end is positioned under the end of Sweep # 2 and the other end is under the pinned end of the spreader bar on Sweep # 3 (see Sweep, Car & Bow diagram for platform position).

2. Move second assembly platform so that one end is under the end of Sweep # 3 and the other end is under the pinned end of the spreader bar on Sweep # 4.

3. WITH THE BRAKE IN THE OFF POSITION, ROTATE CIRCLE BY HAND. Rotate circle so that Sweep # 4 is at the 3:00 position. Remove the H-brace from the side of Sweep # 10 and install between Sweep # 4 and 5. Remove nuts from H-brace brackets, install brace and replace nuts. CAUTION: NUTS MUST BE INSTALLED ON H BRACKETS. FAILURE TO INSTALL NUTS COULD RESULT IN DAMAGE TO EQUIPMENT AND POSSIBLE INJURY TO SET UP CREW

b. Install Bow # 4

1. Rotate Sweep # 3 to the 3:00 o'clock position. Unpin Bow # 4

from the side of Sweep # 4. Supporting some of the weight of Bow # 4, swing it to a position close to the end of Sweep # 3. Remove Spreader Bar # 4 from the side of Sweep # 4. Install Spreader bar # 4 between Sweeps # 3 and 4.

2. Remove I brace from the side of Sweep # 10. Install I brace between Sweeps # 3 and 4. I brace installs next to the plate gusset at the end of the sweep.

3. Unpin Bow # 3 from the side of Sweep # 3. Swing Bow # 3 to a position close to the end of Sweep # 2. While one man supports the end of Bow # 3, the other man aligns and pins Bow # 4 to end of Bow # 3. Place R-key in the end of bow pin.

4. Remove I brace from between Sweeps # 3 and 4. Install I brace between Sweeps # 2 and 3.

5. Unattached bow cables are located at the end of sweeps between the plate gussets. Remove unattached bow cables and attach to center of bow using tapered pin.

   Detach hub cable from storing position on sweep 4 and pin at operating position on sweep 4 using tapered pin. Insert R-Key.

c. INSTALL BOW # 3

1. Rotate Sweep # 2 to the 3:00 o'clock position. Remove Spreader Bar # 3 from the side of Sweep # 3. Install Spreader Bar # 3 between Sweeps # 2 and 3.

2. Unpin Bow # 2 from the side of Sweep # 2 and swing it to a position close to the end of Sweep # 1. One person should lift the end of Bow # 2 while another person aligns and pins Bow # 3 to the end of Bow # 2. Place R key in the end of bow pin.

3. Remove I brace from between Sweep #2 and 3. Install I brace between Sweeps # 1 and 2.

4. Remove unattached bow cables and attach to center of bow using tapered pin.

   Detach hub cable from storing position on sweep 3 and pin at operating position on sweep 3 using tapered pin. Insert R-Key.

d. INSTALL BOW # 2

1. Rotate Sweep # 1 to the 3:00 o'clock position. Remove Spreader Bar # 2 from the side of Sweep # 2. Install Spreader Bar # 2 between Sweeps # 1 and 2.

2. Unpin Bow # 1 from the side of Sweep # 1 and swing it to a position close to the end of Sweep # 10. One person should lift the end of Bow # 1 while another person aligns and pins Bow # 2 into the end of Bow # 1. Place R key in the end of Bow pin.

3. Remove I brace from between Sweep #1 and 2. Install I brace between Sweeps # 10 and 1.

4. Remove unattached bow cables and attach to center of bow using tapered pin.

   Detach hub cable from storing position on sweep 2 and pin at operating position on sweep 2 using tapered pin. Insert R-Key.

e. INSTALL BOWS # 10, 9, 8, 7, 6

1. Install Bows # 10, 9, 8, 7 and 6 as explained in B, C and D above.

f. INSTALL BOW # 5

1. Rotate Sweep # 5 to the 3:00 o'clock position. Remove Spreader Bar # 6 from the side of Sweep # 6. Install Spreader Bar # 6 between Sweeps # 6 and 5.

2. Remove H brace from between Sweeps # 4 and 5. Store H brace under trailer.

3. Unpin Bow # 5 from the side of Sweep # 5 and swing it to a position close to the end of Sweep # 4. One person should lift the end of Bow # 5 while another person aligns and pins Bow # 6 into the end of Bow # 5. Place R key in the end of Bow pin.

4. Remove I brace from between Sweep #4 and 5 and store under trailer.

5. Align and pin Bow # 5 into the end of Bow # 4. Place R key in the end of bow pin.

6. Remove Spreader Bar # 5 from the side of Sweep # 5. Install Spreader Bar # 5 between Sweeps # 4 and 5.

7. Remove unattached bow cables and attach to center of bow using tapered pin.

8. Detach hub cable from storing position on Sweep # 5 and pin at operating position on Sweep # 5 using tapered pin. Insert R-Key.

5. INSTALL BONNETS AND HANGER STEMS

Below is the procedure for installing bonnets and car hanger stems.

a. Remove long legs from one assembly platform and replace with shorter 9" legs. Place assembly platform with 9" legs directly to the rear of the trailer underneath the center of the bow. Use platform to install bonnets and hanger stems.

b. INSTALL BONNET. Remove bonnet from storage rack at rear of trailer. Insert 12 volt car electrical cord through round hole in top of bonnet. Install bonnet on hanger block at the center of the bow by inserting two pins. Climb up on fender of trailer and connect electrical plug to top of bonnet.

c. INSTALL CAR HANGER STEM. Remove stem from outrigger and install on hanger block. Position safety strap on lower part of hanger block. Swing shock absorbers down from the bonnet frame to the stem and pin with retaining pin and R-key that are in the bonnet frame. Install small pins through safety straps.

d. Plug wire, hanging through bonnet, into the receptacle at top of stem.

e. After bonnet and hanger stem are installed, rotate wheel so that the next car hanger block is located directly over the platform. Complete the above procedures until all bonnets and car hanger stems are installed.

f. Remove the retaining bracket that the bonnets were stored on and store under trailer.

6. INSTALL CARS ON HANGER STEMS

a. Remove car from car storage rack and install on car hanger stem. Place pin through car hanger stem and car frame and insert R keys in pin and pipe collar to hold pin in place.

b. The safety chain attached to the car frame should be inserted into the slotted hole found in the car hanger stem. Be sure that a link is inserted into the slotted portion of the hole.

c. Pull electrical plug located on the top of the car out enough to be able to plug cord into electrical receptacle found in car hanger stem.

d. Pull pins from headrests, rotate headrests to upright position and pin in place.

e. Repeat the above procedure until all cars are installed.

f. Lower front car storage rack until it rests on the ground.

7. INSTALL SAND SHOES AND TURNBUCKLES on car storage racks.

   a. Remove sand shoes from curbside and streetside outriggers. Raise curbside and streetside car storage racks and install sand shoes on the ends of these racks.

   b. Lower storage racks to the ground by using hydraulic lever control located on streetside rear gooseneck platform.

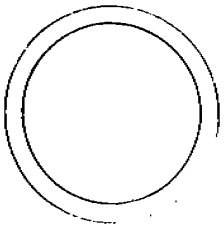
   c. Install turnbuckle rods between the sand shoe and a loop located under gooseneck platform. Turnbuckle rods are located near the main boom racked on top of each of the mainframe trusses.

   d. Pin one end of turnbuckle to outrigger and the other end to the loops located under the gooseneck. Tighten turnbuckle until taut.

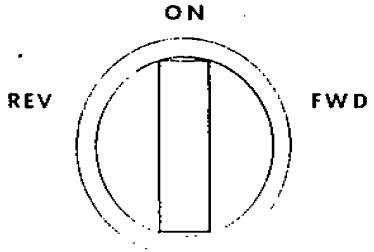
8. INSTALL BALLY SKIRT

   Remove skirt from storage compartment found at rear streetside of gooseneck platform. Install on trailer.

START

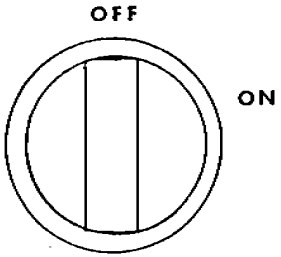


ROTATION

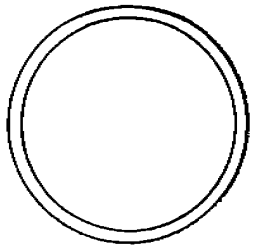


OPERATE W/ BRAKE OFF

BRAKE



EMERGENCY

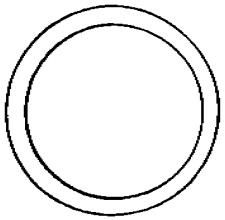


PULL STOP

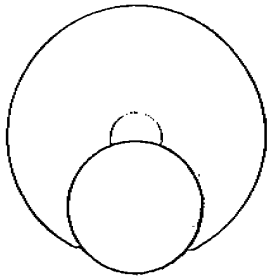
HYD. SYSTEM

BOOM CONTROL

STOP

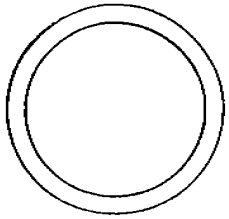


UP



DOWN

JOG



OPERATE W/ BRAKE ON

AND ROTATION SELECTED

Startrooper

CONTROL CONSOLE

The JOG button will override the BRAKE, allowing rotation. When the JOG button is released, the BRAKE will be applied.

When ride is loaded and ready to be operated, place the BRAKE in the OFF position and select rotation direction.

LOADING MUST BE PERFORMED IN A MANNER THAT WILL INSURE THAT THE RIDE LOAD IS BALANCED. FAILURE TO BALANCE THE LOAD COULD CAUSE THE WHEEL TO BE INCAPABLE OF ROTATING.

c. Interruption of power

If power is interrupted from loss of power source or by pushing EMERGENCY STOP mushroom switch, the wheel will immediately free wheel for several seconds.
To lower boom and unload passengers, a pressure release valve can be opened by rotating valve handle located behind hydraulic reservoir. Opening valve will allow fluid from cylinders to leave cylinders through an orifice, lowering the ride slowly to the unload position.

CAUTION: AFTER OPENING VALVE, BOOM CANNOT BE RAISED UNTIL VALVE HAS BEEN CLOSED.

d. Emergency stop

To stop the ride quickly push in the handle labeled EMERGENCY STOP. The ride will stop as explained in Interruption of Power above.

To restart ride the main breaker must be reset and the EMERGENCY STOP handle must be pulled out. After these two events occur, the ride can be restarted.

B. OPERATING INSTRUCTIONS

1. Push button labeled HYDRAULIC SYSTEM START. Operate hydraulic system with no load until hydraulic pump operates quietly. The temperature of the hydraulic fluid should be above 50 degrees before applying load.

   a. Ride operation in the SINGLE-SHOT loading mode.

   CAUTION: WHEEL SHOULD NEVER BE ROTATED WHILE THE WHEEL IS AT GROUND LEVEL. ROTATING THE WHEEL AT GROUND LEVEL COULD CAUSE INJURY TO PASSENGERS OR DAMAGE TO EQUIPMENT. ELECTRONIC CIRCUITRY PROHIBITS THE WHEEL FROM ROTATING UNTIL BOOM HAS RISEN TO A PRE-SET POSITION ABOVE THE GROUND.

   Place switch labeled ROTATION in either the FORWARD or REVERSE position.

   Move joy stick to the UP position. Wheel will rise to a pre-set position and stop, and wheel will begin to rotate.

   Keep joy stick handle to the UP position. Boom will not rise immediately because a timer delays upward movement until adequate rotation speed is achieved. A pre-set rotation speed is achieved. The boom will continue to rise until it reaches its maximum height and will stop. Operator does not need to stop the boom's upward travel.

   Allow wheel to rotate until the buzzer in the control console sounds. Then place ROTATION switch in the opposite position. Ride will stop gently and start rotating in the opposite direction.

   The buzzer will sound again. Turn ROTATION switch to STOP and immediately place joy stick in DOWN position. Boom will lower and then stop at a position several feet above the trailer. The boom will remain at that position several seconds to allow wheel rotation to stop. Keep the joy stick in the DOWN position. After a short pause the boom will continue its downward travel until it rests against its stop. After boom downward movement stops, release joy stick.

   b. Operating ride in the wheel upright mode

   Start and load the ride as in 1.a. above.

   Move assembly platform with 9" legs installed to a position underneath the lowest car directly to the rear of the trailer. The lowest car on the wheel will be loaded and unloaded from this platform.

   To load the ride use the JOG and BRAKE buttons to position the car over the center of the loading platform. Place the BRAKE in the ON position. Select the direction of rotation and push the JOG button.

RACKING

Prepare to rack ride.

1. Leave power connected to ride.

2. Remove turnbuckle rods and sand shoes from car storage racks. Store one sand shoe on each rear outrigger. Stow turnbuckles on pins welded to the main frame trusses near boom.

3. Rotate ride until junction for the two split hubs is in the center of the gooseneck platform.

4. Remove bonnet retaining bracket from underneath rear axle of trailer. Insert into tube found above rear bumper and pin in place.

Remove Cars

1. Remove Cars # 3 and # 10 and place on ground outside of circle.

2. Remove the remaining cars and place on car storage racks. Replace in original positions.

Remove Car Hanger Stems and Bonnets

1. Place assembly platform with 9" legs under car hanger stem to the rear of trailer.

2. As explained in the assembly instructions, remove all car hanger stems and bonnets.

Disassemble Wheel

1. STOW BOWS

   a. Move assembly platforms so that one end is positioned under the end of Sweep # 2 and the other end is under the pinned end of the spreader bar on Sweep # 3 (see Sweep, Car & Bow diagram for platform position).

   b. Move second assembly platform so that one end is under the end of Sweep # 3 and the other end is under the pinned end of the spreader bar on Sweep # 4.

   c. Stow Bow # 5

      1. Rotate Sweep # 5 to the 3:00 position.

      2. Remove bow cables from bow and stow bow cable at end of sweep between plate gussets. Pin to ring welded to the top of the sweep.

3. Unpin hub cable from spreader bar attaching bracket. Remove only the hub cable pinned with an R key. Do not remove hub cables pinned with cotter keys. Pin end of cable in ring welded on lower beam of sweep located toward the hub.

4. Remove spreader bar # 5. Stow spreader bar # 5 on side of Sweep # 5.

5. Remove I brace from underneath the trailer and install between Sweep # 5 and Sweep # 6.

6. Remove pin that connects Bow 5 to Bow 4.

7. Remove pin that connects Bow # 6 to Bow # 5.

8. Swing Bow # 5 inward until it touches Sweep # 5 and pin to Sweep # 5. Car and bonnet electrical cords should be wrapped around bonnet plugs and tied tightly to sweep to insure that cords do not swing away from sweeps during transit.

9. Remove the H-brace from underneath the trailer and install between Sweep # 4 and 5. Remove nuts from H-brace brackets, install brace and replace nuts. CAUTION: NUTS MUST BE INSTALLED ON H BRACKETS. FAILURE TO INSTALL NUTS COULD RESULT IN DAMAGE TO EQUIPMENT AND POSSIBLE INJURY TO SET UP CREW

d. Stow Bow # 6

1. Rotate Sweep # 6 to the 3:00 position.

2. Remove I brace from between Sweeps 5 and 6 and install between Sweep # 6 and Sweep # 7.

3. Remove bow cables from bow and stow bow cable at end of sweep between plate gussets. Pin to ring welded to the top of the sweep.

4. Unpin hub cable from spreader bar attaching bracket. Remove only the hub cable pinned with an R key. Do not remove hub cables pinned with cotter keys. Pin end of cable in ring welded on lower beam of sweep located toward the hub.

5. Remove spreader bar # 6. Stow spreader bar # 6 on side of Sweep # 6.

6. Remove pin that connects Bow # 7 to Bow # 6.

7. Swing Bow # 6 inward until it touches Sweep # 6 and pin to Sweep # 6.

e. Stow Bows # 7, 8, 9, 10, 1, 2, 3, and 4 in the same method.

f. Remove I brace and H brace and stow on the side of Sweep # 10.

2. STOW SWEEPS TO REAR OF TRAILER

a. Move to gooseneck platform. Using brace located on front car storage rack, lift Sweeps # 1 and 10, allowing upper hub to pivot wing pins to be removed.

b. Remove sweep support beam from under the trailer and install on top of sweep support beam jacks. Raise jacks until all sweeps are supported on the beam.

c. Use flatbar brace to attach Sweep # 1 to trailer frame. Use second flatbar brace to attach Sweep # 10 to trailer frame.

3. STOW CARS ON GOOSENECK PLATFORM

a. Using hydraulic controls located on rear streetside of gooseneck platform, raise curbside and streetside car storage racks enough to be able to insert Cars # 3 and 10 on prong pointing toward ground. Install Cars # 3 and 10 on prong and pin in place. Raise car storage racks to stowed position on top of gooseneck platform.

b. Using hydraulic controls, raise car storage rack located on the front of the gooseneck platform to its stowed position.

c. Safety chains are located at the base of all car storage racks. Insert a link of the safety chain into the slotted hole in the car storage rack. **TRAILER MUST NOT BE MOVED WITHOUT SAFETY CHAIN IN PLACE AND TIGHT.**

4. STOW MISCELLANEOUS ITEMS

a. Install half of fence on curbside on rear fender and remaining fence on streetside rear fender. Hold in place with brackets located in those positions.

b. Turn both tables upside down and remove legs, braces, and turnbuckles. Carry one table to streetside of ride and insert table open side up in possum belly tracks and prop up other end with blocks. Carry all legs, turnbuckles, braces, and fence feet to table and store in indented areas. Carry second table and install open side down on top of other table. Pin table halves together. Shove into possum belly once outrigger is stowed it will retain the platform in its position.

c. Using rear landing gear, raise the trailer until screw jacks mounted under rear bumper are loose. Screw jacks until they retract fully.

d. Stow rear outriggers by loosening sand shoes, removing pins, rotating screw jacks upward, and pinning in place. Remove pins from rotation points and rotate outriggers against trailer and pin in place. Retract rear landing gear until it is in the travel position and all trailer weight is on the rear tires.

e. Pull rear bumper from its position against the trailer to its travel position and pin in place. If needed, install pintle hook on rear of bumper.

f. Disconnect electrical power. Disconnect power cord from bottom of ride control stand and store. Disconnect power cord from generator and store.

g. Stow ride control stand on streetside outrigger.

LUBRICATION SPECIFICATIONS

1. RECOMMENDED OIL FOR HYDRAULICS

   ATW 46 Hydraulic Fluid

2. LUBRICANT FOR ALL ZERK FITTINGS

   Chevron Ultra Duty Grease EP # 2 or Equivalent

3. LUBRICANT FOR MAIN DRIVE GEAR

   Chevron Open Gear Lube or Equivalent

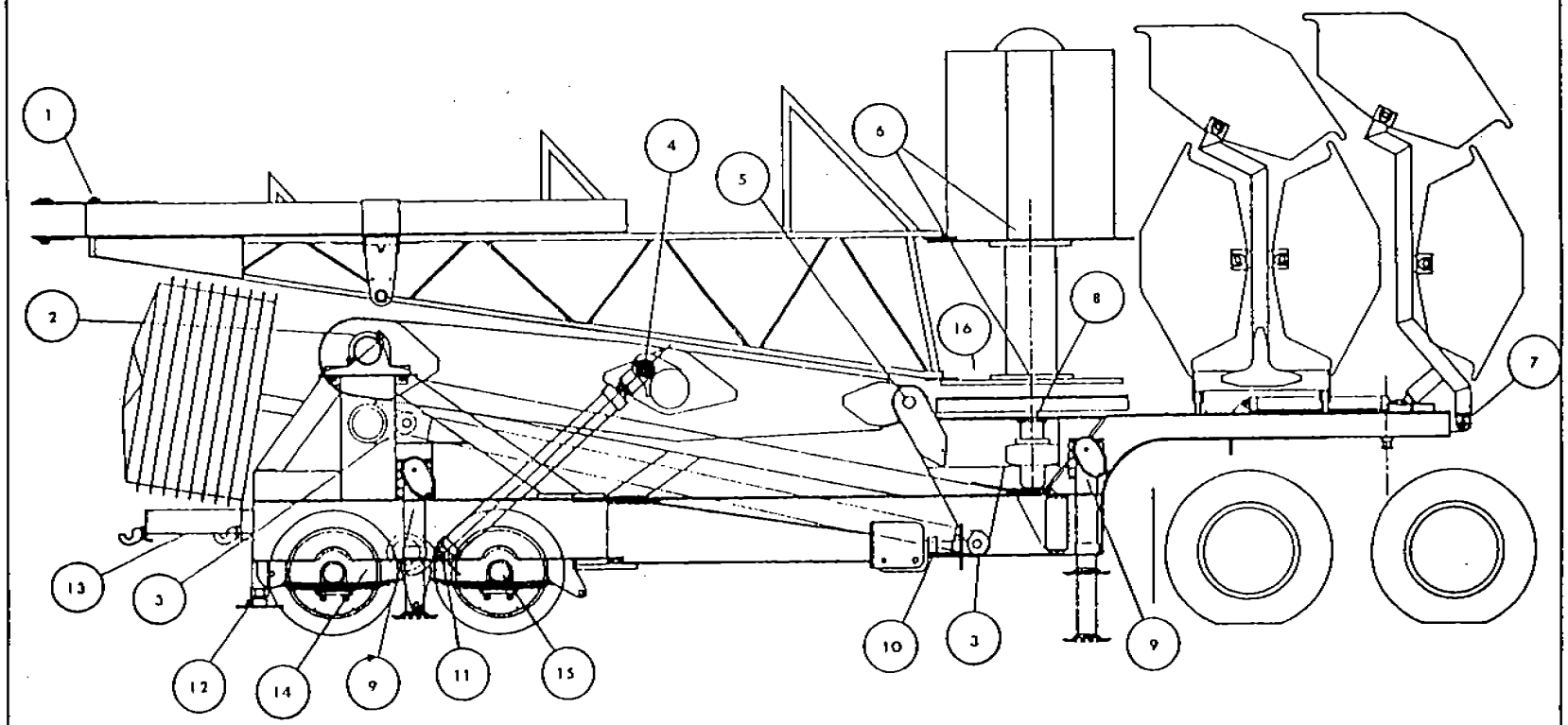
4. PIVOT POINTS WITHOUT GREASE ZERKS

   Multi-purpose machine oil 20 W

LUBRICATION CHART

ITEM	LOCATION	LUBE	FREQUENCY
1	Bow pivot pin	Grease	Monthly
2	Boom pillow block bearings	Grease	Daily
3	Link arm ends	Grease	*Weekly
4	Upper cylinder pin	Grease	Weekly
5	Boom platform pivot pin	Grease	*Weekly
6	Upper & lower center hub bearings	Grease	Weekly
7	Car storage racks	Grease	Monthly
8	Main drive gear	Grease	*Weekly
9	Landing gear	Grease	Monthly
10	Outrigger screw jack	Grease	Monthly
11	Lower cylinder pin	Grease	*Weekly
12	Rear screw jacks	Grease	Weekly
13	Rear bumper	Silicone	Monthly
14	Rear brake slack adjusters	Grease	Monthly
15	Hydraulic Tank	Hyd. fluid	Daily

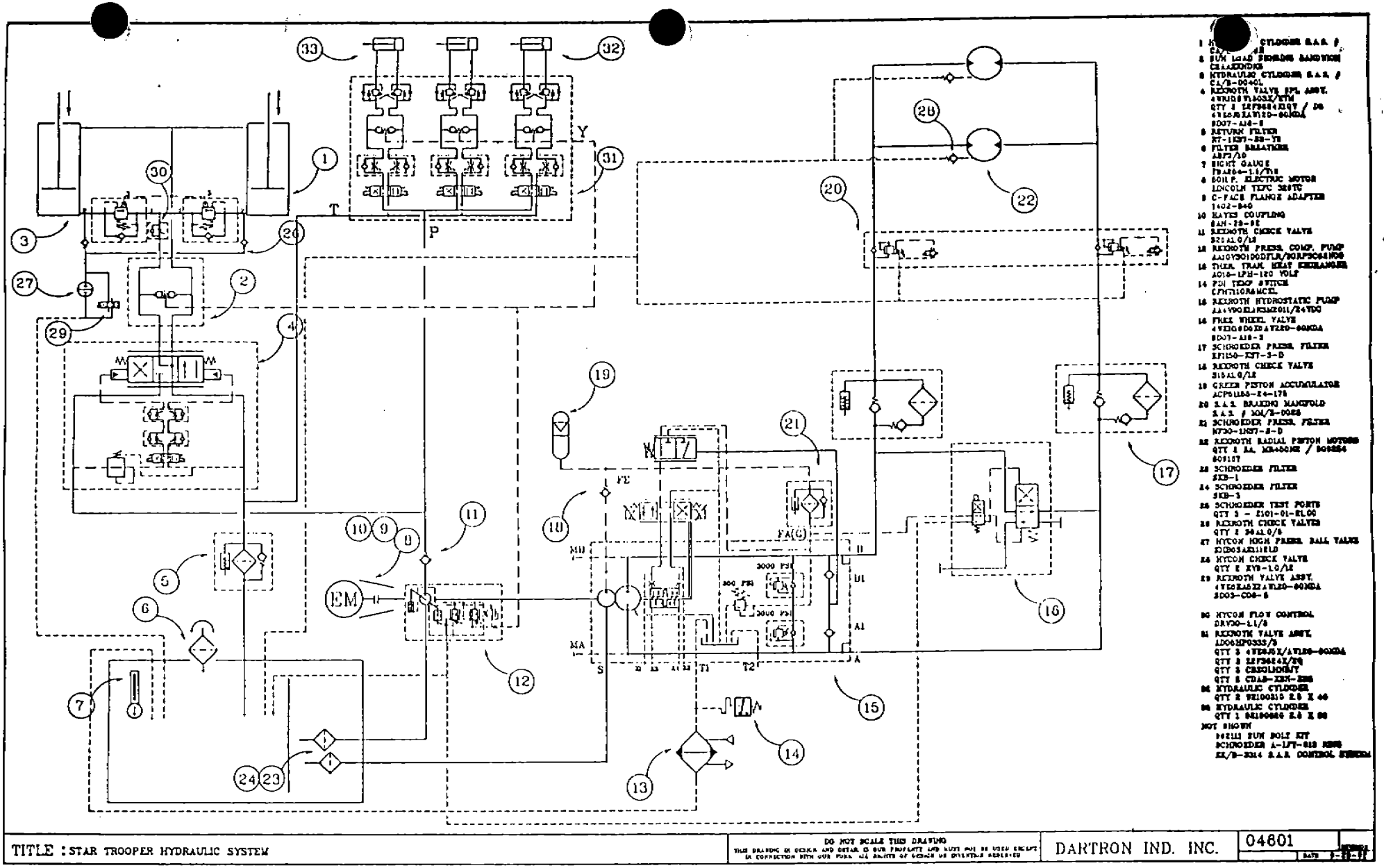
* Every set up if shorter than one-week interval



STARTROOPER - Lubrication Chart

INSPECTION AND MAINTENANCE CHART

COMPONENT	PERFORM	FREQUENCY
Hydraulic System		
Suction line screens (2) Pressure filters (2)	Clean or change Check Change	Annually Monthly Annually
Hydraulic Oil	Check oil level; add if needed. Replace	Weekly; daily if running constantly Annually
All Grease Points	Grease with specified grease.	See Lube Chart
Car Stem & Car Ass'y	Check for wear on pins Make sure R-Keys, push pin, and safety chains are in place.	Daily
Lap Bar	Open & shut to check latch mechanism. Check lock to make sure it works and catches in two positions.	Daily
Ride Controls on Console	Run ride and check all switches to make sure they are operating correctly.	Daily
Sweep & Bow	Check to see if cables are taunt. Make sure R-keys & cotter keys are in place.	Daily
Cables	Contact manufacturer on cable adjustments.	
Trailer Tires & Axles	Check tires for air pressure and any road damage. Tire pressure is 140 psi cold. Check oil level in axles; add if needed.	Weekly
Commutator Brushes & Rings	Check for wear. Replace as needed	Monthly



TITLE : STAR TROOPER HYDRAULIC SYSTEM

DO NOT SCALE THIS DRAWING
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DARTRON IND. INC.

04601

REVISED

DATE 3-21-97

THE REXROTH CORPORATION
INDUSTRIAL HYDRAULICS DIVISION, P.O. Box 2407, 2315 City Line Road, Bethlehem, PA 18017-2131, Phone (215) 694-8300, Telex 84-7498
MOBILE HYDRAULICS DIVISION, P.O. Box 394, 1700 Old Mansfield Road, Wooster, OH 44691-0394, Phone (216) 263-3400, Telex 98-6335

DATE: 12/07/92
TIME: 15:47:43

S.A.S. FLUID POWER, INC.
ASSORTMENT PARTS LIST

.O. NUMBER:

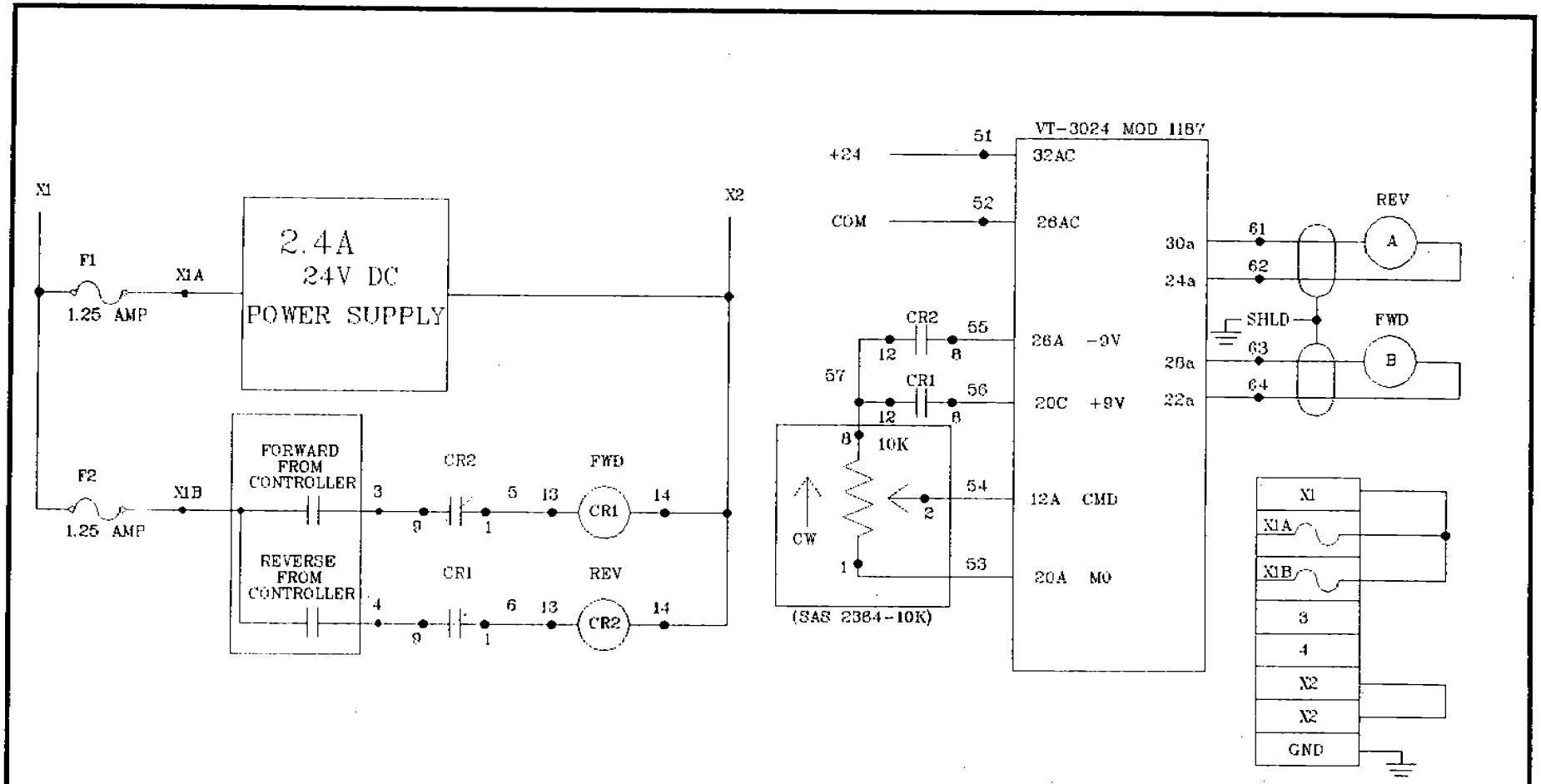
DRAWING NUMBER: EE/B-3314A

P.O. NUMBER:

JOB NUMBER: SAS JOB # 20237

DRAWING NAME: ALL DARTRON/STAR TROOPER CONTROLS

F/N	SAS MODEL NO.	DESCRIPTION	MANUFACTURER	QTY
1	A161410CH	16" X 14" X 10" ELE BOX	NORTH COAST ELECTRIC	1.00
2	A16P14	BACK PANEL	NORTH COAST ELECTRIC	1.00
3	HC24-2.4A	POWER SUPPLY	CONDOR	1.00
4	MOE-1187	VT-3024 MOD/EXTENDS RAMP TIME	SAS FLUID POWER	1.00
5	RY42S-UL/AC120V	120V AC RELAY	IDEC	2.00
6	700HN128	RELAY BASE, 11 PIN	ALLEN BRADLEY	2.00
7	B-2364-10K	POTENTIOMETER 10K	SAS FLUID POWER	1.00
8	700HN125	RELAY BASE, 14 BLADE	ALLEN BRADLEY	1.00
9	1492-F1	TERMINAL BLOCK	ALLEN BRADLEY	15.00
10	1492-H6	FUSEABLE SWITCH	ALLEN BRADLEY	2.00
11	1492-N37	END BARRIER	ALLEN BRADLEY	1.00
12	1492-N23	TERMINAL STRIP END ANCHOR	ALLEN BRADLEY	4.00
13	1492-N13	JUMPER	ALLEN BRADLEY	2.00
14	MDL 1 1/4	1 1/4 AMP SLOW BLOW FUSE	SAS FLUID POWER	2.00
15	E1X2LG6	1"X2" DUCT	SAS FLUID POWER	4.00
16	C1LG6	DUCT COVER 1"	PANDUIT	4.00
17	DR1	DIN RAIL	ALLEN BRADLEY	1.00
18	1492-N1	MOUNTING CHANNEL	ALLEN BRADLEY	.70
19	VT-03	63012/SKP-32/ID	NORSTAT, INC.	1.00

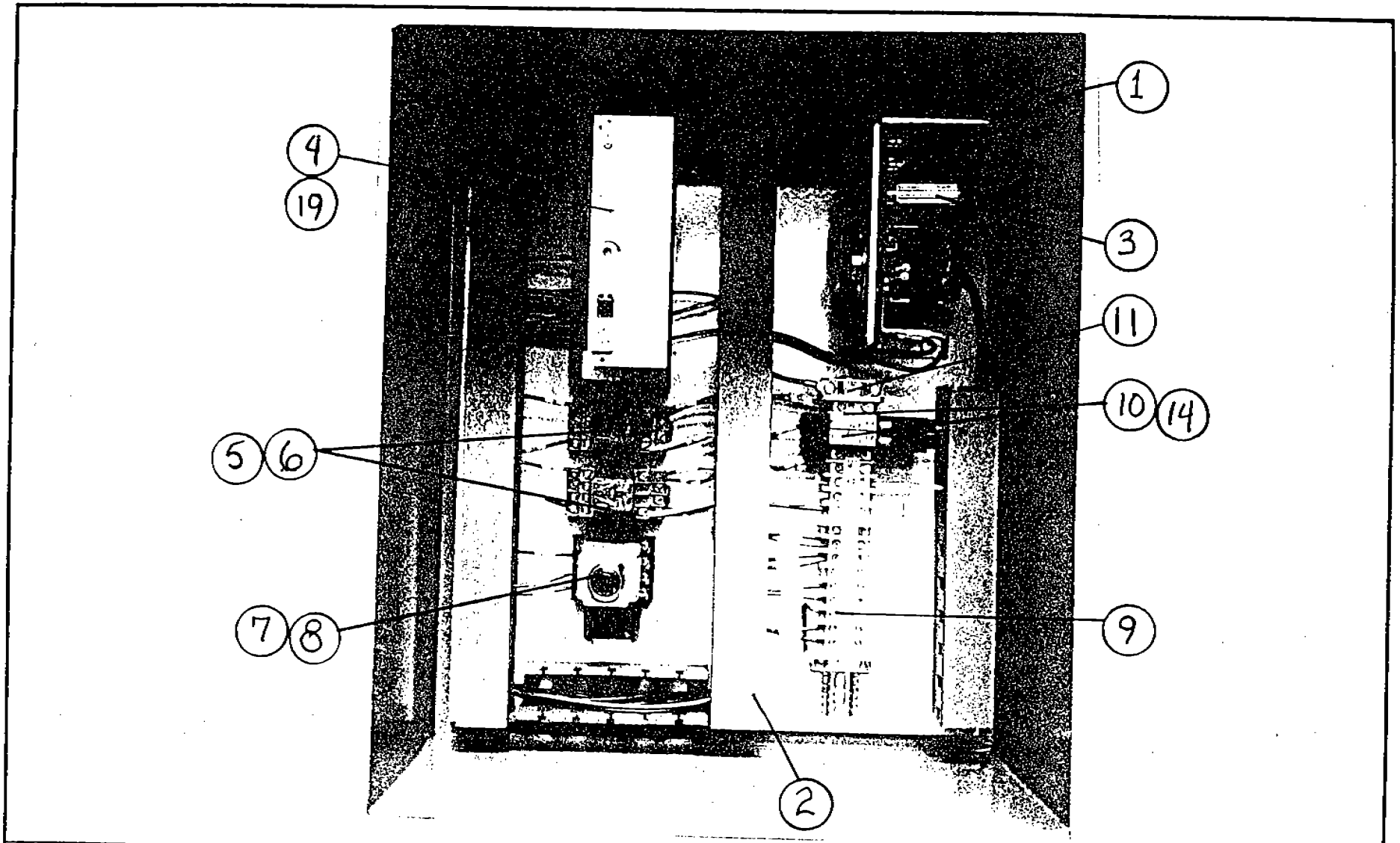


TITLE : WIRING DIAGRAM DARTRON STARTROOPER JOB # 20234

S.A.S. FLUID POWER, INC.
910 HOUSER WAY NORTH
RENTON, WA 98055

EE/B-3314 | A REVISION

LB HOLMES | DATE: 10-15-92



PARTS LOCATION DIAGRAM for JOB #STAR TROOPER | DRAWN BY: L. Holmes | DATE: 12-7-92

S.A.S. FLUID POWER, INC.
919 HOUSER WAY NORTH
RENTON, WA 98055

STAR TROOPER DRAWING NUMBER | REV.

All Dartron Star Trooper Parts Location Diagram

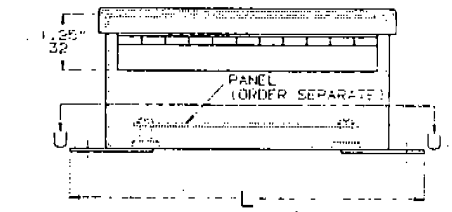
Standard Sizes (Cont.)

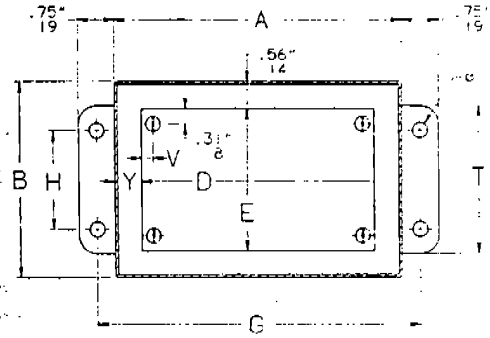
"CH" Continuous Hinge Clamp Cover Boxes

Box Catalog Number	Gauge	Box Size AxBxC	*Panel Catalog Number	Panel Size DxE	Mounting GxH	Overall LxW	F	J	P	T	V	Y
A-10106CH	14	10.00x10.00x6.00 (254x254x152)	A-10P10	8.75x8.88 (222x226)	10.75x8.00 (273x203)	11.50x10.94 (292x278)	5.50 (140)	5.56 (141)	1.00 (25)	9.00 (229)	0.25 (6)	0.62 (16)
A-1212CH	14	12.00x12.00x6.00 (305x305x152)	A-12P12	10.75x10.88 (273x276)	12.75x10.00 (324x254)	13.50x12.94 (343x329)	5.50 (140)	5.56 (141)	1.00 (25)	11.00 (279)	0.25 (6)	0.62 (16)
A-14086CH	14	14.00x8.00x6.00 (356x203x152)	A-14P8	12.75x6.88 (324x175)	14.75x6.00 (375x152)	15.50x8.94 (394x227)	5.50 (140)	5.56 (141)	1.00 (25)	7.00 (178)	0.25 (6)	0.62 (16)
A-1412CH	14	14.00x12.00x6.00 (356x305x152)	A-14P12	12.75x10.88 (324x276)	14.75x10.00 (375x254)	15.50x12.94 (394x329)	5.50 (140)	5.56 (141)	1.00 (25)	11.00 (279)	0.25 (6)	0.62 (16)
A-1412CHS	14	14.00x12.00x6.00 (356x305x152)	A-14P12	12.75x10.88 (324x276)	14.75x10.00 (375x254)	15.50x12.94 (394x329)	5.50 (140)	5.56 (141)	1.00 (25)	11.00 (279)	0.25 (6)	0.62 (16)
A-16106CH	14	16.00x10.00x6.00 (406x254x152)	A-16P10	14.75x8.88 (375x226)	16.75x8.00 (425x203)	17.50x10.94 (445x278)	5.50 (140)	5.56 (141)	1.00 (25)	9.00 (229)	0.25 (6)	0.62 (16)
A-1614CH	14	16.00x14.00x6.00 (406x356x152)	A-16P14	14.75x12.88 (375x327)	16.75x12.00 (425x305)	17.50x14.94 (445x379)	5.50 (140)	5.56 (141)	1.00 (25)	13.00 (330)	0.25 (6)	0.62 (16)
A-1614CHS	14	16.00x14.00x6.00 (406x356x152)	A-16P14	14.75x12.88 (375x327)	16.75x12.00 (425x305)	17.50x14.94 (445x379)	5.50 (140)	5.56 (141)	1.00 (25)	13.00 (330)	0.25 (6)	0.62 (16)
A-12108CH	14	12.00x10.00x8.00 (305x254x203)	A-12P10	10.75x8.88 (273x226)	12.75x8.00 (324x203)	13.50x10.94 (343x278)	7.50 (191)	7.56 (192)	1.00 (25)	9.00 (229)	0.25 (6)	0.62 (16)
A-14128CH	14	14.00x12.00x8.00 (356x305x203)	A-14P12	12.75x10.88 (324x276)	14.75x10.00 (375x254)	15.50x12.94 (394x329)	7.50 (191)	7.56 (192)	1.00 (25)	11.00 (279)	0.25 (6)	0.62 (16)
A-16148CH	14	16.00x14.00x8.00 (406x356x203)	A-16P14	14.75x12.88 (375x327)	16.75x12.00 (425x305)	17.50x14.94 (445x379)	7.50 (191)	7.56 (192)	1.00 (25)	13.00 (330)	0.25 (6)	0.62 (16)
A-161410CH	14	16.00x14.00x10.00 (406x356x254)	A-16P14	14.75x12.88 (375x327)	16.75x12.00 (425x305)	17.50x14.94 (445x379)	9.50 (241)	9.56 (243)	1.00 (25)	13.00 (330)	0.25 (6)	0.62 (16)

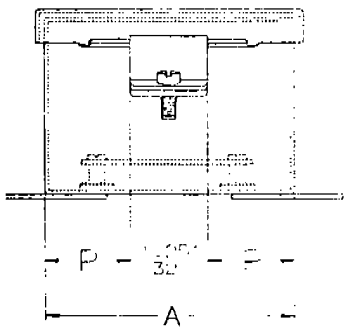
Millimeter dimensions ( ) are for reference only; do not convert metric dimensions to inch. Catalog numbers ending in "S" are hinged on short side.

* Panels must be ordered separately. Optional stainless steel and aluminum panels are available for most sizes. See Accessories.

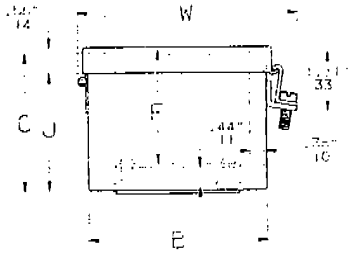




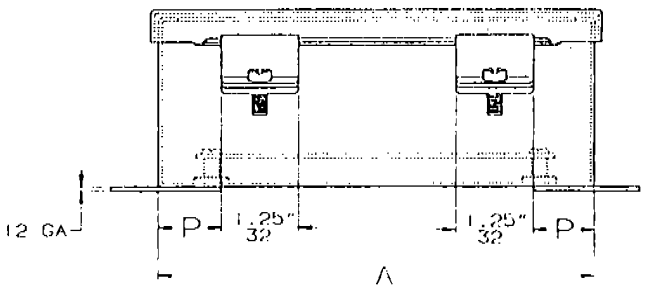
SECTION U-U



View showing clamp end of box when one clamp is used.

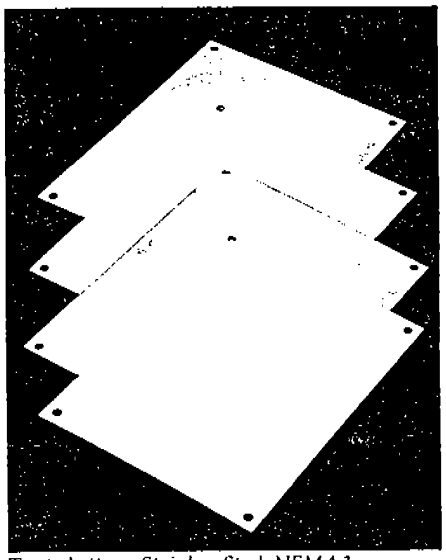


NOTE: 1. Panels are 14 gauge steel.
2. Panel screws are # 10-32 pan head.



View showing clamp end of box when two clamps are used. When B=8.00 (203) or more use two clamps.

Inch
Millimeter



Top to bottom: Stainless Steel, NEMA 1, Aluminum, and Steel panels

Panels for JIC and NEMA 1 Enclosures

Steel panels are 14 gauge and have a white enamel finish.

Stainless steel panels are 14 gauge Type 304 and have a commercial #2B finish which is protected on one side with a plastic film.

Aluminum panels are 5052-H32 aluminum alloy .080-inch (2 millimeters) thick and protected on one side with a plastic film.

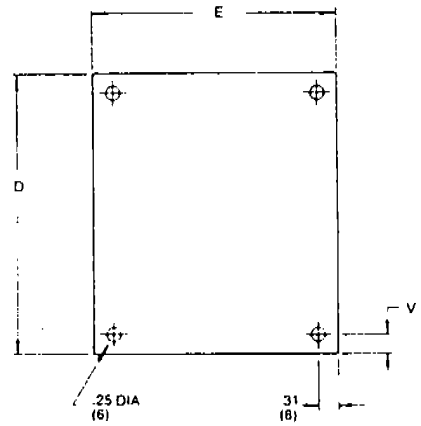
Panel mounting hardware is furnished with all enclosures which accept these panels.

JIC Panel

Catalog Numbers			Panel Size	
Steel	Stainless Steel	Aluminum	DxE	V
A-6P4	A-6P4SS	A-6P4AL	4.88x2.88 (124x73)	0.31 (8)
A-6P6	A-6P6SS	A-6P6AL	4.88x4.88 (124x124)	0.31 (8)
A-8P6	A-8P6SS	A-8P6AL	6.75x4.88 (171x124)	0.25 (6)
A-12P6	—	—	10.75x4.88 (273x124)	0.25 (6)
A-8P8	—	—	6.75x6.88 (171x175)	0.25 (6)
A-10P8	A-10P8SS	A-10P8AL	8.75x6.88 (222x175)	0.25 (6)
A-14P8	—	—	12.75x6.88 (324x175)	0.25 (6)
A-10P10	—	—	8.75x8.88 (222x226)	0.25 (6)
A-12P10	A-12P10SS	A-12P10AL	10.75x8.88 (273x226)	0.25 (6)
A-16P10	—	—	14.75x8.88 (375x226)	0.25 (6)
A-12P12	A-12P12SS	—	10.75x10.88 (273x276)	0.25 (6)
A-14P12	A-14P12SS	A-14P12AL	12.75x10.88 (324x276)	0.25 (6)
A-16P14	A-16P14SS	A-16P14AL	14.75x12.88 (375x327)	0.25 (6)

Millimeter dimensions ( ) are for reference only; do not convert metric dimensions to inch.

C888-C



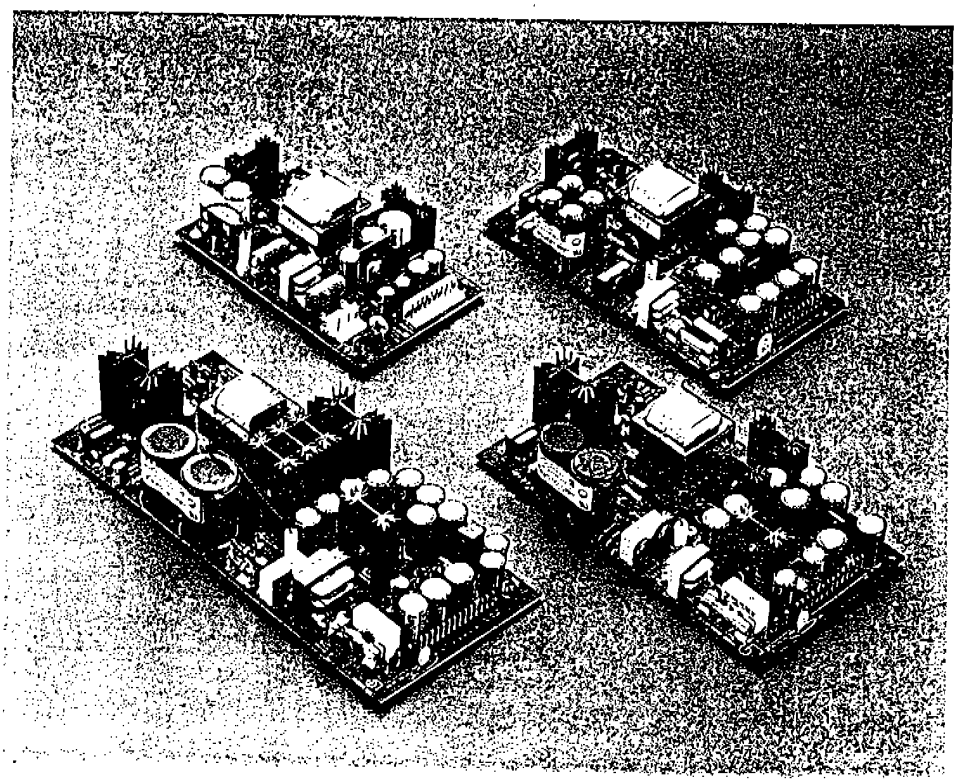
NEMA 1 Panel

Catalog Number	Panel Size DxE	V
A-6N6P	4.25x4.25 (108x108)	0.31 (8)
A-8N6P	6.25x4.25 (159x108)	0.31 (8)
A-8N8P	6.25x6.25 (159x159)	0.31 (8)
A-10N8P	8.25x6.25 (210x159)	0.31 (8)
A-10N10P	8.25x8.25 (210x210)	0.31 (8)
A-12N10P	10.25x8.25 (260x210)	0.31 (8)
A-12N12P	10.25x10.25 (260x260)	0.31 (8)
A-14N12P	12.25x10.25 (311x260)	0.31 (8)
A-16N12P	14.25x10.25 (362x260)	0.31 (8)
A-20N12P	18.25x10.25 (464x260)	0.31 (8)
A-24N12P	22.25x10.25 (565x260)	0.31 (8)

Millimeter dimensions ( ) are for reference only; do not convert metric dimensions to inch.

Inch
Millimeter

"V" SERIES VALUE LINE



FEATURES

- 19 models . . . 4 power levels . . . 45 to 125 watts
- Multi-output . . . up to 5 outputs
- Clean, low-cost, open-frame design
- VDE, IEC, UL, and CSA approved
- FCC Class A and VDE 0871 Class A conducted EMI filtering
- Industry standard packages with extra power
- Worldwide AC input ranges 90-132/180-264 VAC
- Full load burn-in and 2-year warranty
- High peak current disk drive outputs as well as 3-terminal-type closely regulated outputs
- Extremely versatile output configurations for tough applications

SPECIFICATIONS

AC INPUT: 90-132/180-264 VAC user selectable, 47-63 Hz single phase.

DC OUTPUTS: See output rating chart.

HOLD UP TIME: 20mS minimum @ full load and nominal input voltage.

OUTPUT REGULATION: See output rating chart for individual output regulation ratings. Regulation ratings shown are for combined line and load variations with the line varied from either 90-132 or 180-264 VAC and the load on the output under test varied from 50% to either 20% or 100% with the other loads held constant at 50%.

MINIMUM LOAD: A minimum load is required on the + 5V output to maintain proper operation of the other outputs. VCA series: 0.8A; VFA series: 2A; VHA series: 2.5A; VKA series: 3A. Operation down to no load will not cause damage and the + 5V ouput will generally remain within regulation.

OUTPUT NOISE AND RIPPLE: 0.5% RMS, 1.5% P-P maximum on all outputs.

TRANSIENT RESPONSE: + 5V output only. 1.0 milliseconds typical response time for a 50% to 100% or 100% to 50% load change. Maximum voltage deviation: 6.0%.

TEMPERATURE COEFFICIENT: 0.03% typical for all outputs.

OVERVOLTAGE PROTECTION: Built in on + 5V outputs with firing point set at 6.2V ± 0.6V.

VOLTAGE ADJUSTMENT: Built in potentiometer adjusts voltage from 4.5V to overvoltage firing point (6.2V nominal).

CURRENT LIMIT ADJUSTMENT: Built in potentiometer factory set to begin current limiting at the following peak power outputs minimum under nominal line conditions. VCA series: 65W; VFA series: 130 watts; VHA series: 140 watts; VKA series: 155 watts.

EFFICIENCY: 70% ± 5% depending on model and load distribution. Measured at 100% of rated power.

OVERSHOOT: No output overshoot on turn on or turn off.

OVERLOAD PROTECTION: Fully protected against output overload and short circuit. Automatic recovery after removal of fault.

REVERSE VOLTAGE PROTECTION: All outputs protected against inadvertent application of reverse voltage.

INPUT PROTECTION: Internal AC fuse provided on all units.

INRUSH CURRENT: Inrush current is limited by an internal thermistor for maximum protection of input rectifiers. Peak inrush current averaged over first half cycle = 12A (115 VAC input), 24A (230 VAC input).

TEMPERATURE RATING: 0 to 50 °C at full rated output power with natural convection cooling in a non-restricted environment. For operation in a confined space moving air is recommended. For operation above 50 °C it is important that the cooling vs. loading profile is such that the heat sinks do not operate above 100 °C for extended periods.

SWITCHING POWER SUPPLIES

OUTPUT RATING CHART

45 WATTS (58W PK) — PRICE: $62.00 EA. @ 1-9 PC.

MODEL	OUT-PUT	VOLTAGE	CURRENT	INITIAL SETTING (+/-)	OUTPUT REGU-LATION (+/-)	NOTES
VCA 326	1	+ 5V	4.0A	ADJ.	1.5%	E
	2	+ 12V	3.0A (3.5 PK)	3.0%	1.5%	E
	3	- 12V	0.8A	4.0%	1.0%	C
VCA 426	1	+ 5V	4.0A	ADJ.	1.5%	E
	2	+ 12V	3.0A (3.5 PK)	3.0%	1.5%	E
	3	- 12V	0.8A*	4.0%	1.0%	C
	4	- 5V	0.2A	4.0%	1.0%	C
VCA 423	1	+ 5V	4.0A	ADJ.	1.5%	E
	2	+ 15V	2.0A (2.5 PK)	3.0%	1.5%	E
	3	- 15V	0.7A*	4.0%	1.0%	C
	4	- 5V	0.15A	4.0%	1.0%	C
VCA 420	1	+ 5V	4.0A	ADJ.	1.5%	E
	2	+ 12V	3.0A (3.5 PK)	3.0%	1.5%	E
	3	- 12V	1.8A	3.0%	4.0%	B
	4	- 5V	0.25A	4.0%	1.0%	C

*0.6A if - 5V used.

85 WATTS (130W PK) — PRICE: $95.00 EA. @ 1-9 PC.

MODEL	OUT-PUT	VOLTAGE	CURRENT	INITIAL SETTING (+/-)	OUTPUT REGU-LATION (+/-)	NOTES
VFA 420	1	+ 5V	8.0A	ADJ.	0.5%	A
	2	+ 12V	2.5A (4.5A PK)	3.0%	4.0%	B
	3	12V ISOLATED	2.5A (4.5A PK)	3.0%	4.0%	B, D
	4	- 12V	2.5A	3.0%	4.0%	B
VFA 421	1	+ 5V	8.0A	ADJ.	0.5%	A
	2	+ 12V	2.5A (4.5A PK)	3.0%	4.0%	B
	3	12V ISOLATED	2.5A (4.5A PK)	3.0%	4.0%	B, D
	4	- 5V	2.5A	3.0%	4.0%	B
VFA 423	1	+ 5V	6.0A	ADJ.	0.5%	A
	2	+ 15V	2.5A (3.5A PK)	3.0%	4.0%	B
	3	15V ISOLATED	2.5A (3.5A PK)	3.0%	4.0%	B, D
	4	- 5V	2.5A	3.0%	4.0%	B
VFA 430	1	+ 5V	8.0A	ADJ.	0.5%	A
	2	+ 12V	2.5A (4.5)	3.0%	4.0%	B
	3	24V ISOLATED	2.0A (4.0)	5.0%	4.0%	B, D
	4	- 12V	2.5A	3.0%	4.0%	B

NOTES:

A: Full regulated output. Voltage adjustable from 4.5V to OVP trip point. Initial setting of + 5.0V is ± 1.0%.

B: Quasi-regulated output requires 20% minimum load to meet regulation specs. An additional cross-regulation factor of ± 3% must be added in those applications where the main + 5V output varies ± 25%.

C: Fully regulated output utilizing fixed, 3-terminal regulator.

D: Fully isolated output. May be connected in series with any output, and may be connected for (-) or (+) output. May be paralleled when same output voltage and reg. type. (Quasi-reg. and 3-pin outputs will not share loads if connected together.)

E: Dual-sensed, regulated output. + 5V and + 12V outputs are sensed in combination to provide tighter regulation of the + 12V output. An additional cross-regulation factor ± 2.0% must be added in those applications where the + 5V output varies ± 25%. Initial setting of + 5V output is ± 1.0%.

100 WATTS (140W PK) — PRICE: $115.00 EA. @ 1-9 PC.

MODEL	OUT-PUT	VOLTAGE	CURRENT	INITIAL SETTING (+/-)	OUTPUT REGU-LATION (+/-)	NOTES
VHA 420	1	+ 5V	10.0A	ADJ.	0.5%	A
	2	+ 12V	3.0A (4.5A PK)	3.0%	4.0%	B
	3	12V ISOLATED	3.0A (4.5 PK)	3.0%	4.0%	B, D
	4	- 12V	2.0A	3.0%	4.0%	B
	5	- 5V	0.5A	4.0%	1.0%	C
VHA 426	1	+ 5V	10.0A	ADJ.	0.5%	A
	2	+ 12V	3.0A (4.5A PK)	3.0%	4.0%	B
	3	12V ISOLATED	1.0A	4.0%	1.0%	C, D
	4	- 12V	1.0A	4.0%	1.0%	C
	5	- 5V	0.2A	4.0%	1.0%	C
VHA 427	1	+ 5V	10.0A	ADJ.	0.5%	A
	2	+ 12V	3.0A (4.5A PK)	3.0%	4.0%	B
	3	15V ISOLATED	1.0A	4.0%	1.0%	C, D
	4	- 15V	1.0A	4.0%	1.0%	C
	5	- 5V	0.2A	4.0%	1.0%	C
VHA 423	1	+ 5V	7.0A	ADJ.	0.5%	A
	2	+ 15V	2.5A (4.0A PK)	3.0%	4.0%	B
	4	- 15V	2.5A (4.0A PK)	3.0%	4.0%	B
	5	- 5V	0.2A	4.0%	1.0%	C
VHA 428	1	+ 5V	13.0A	ADJ.	0.5%	A
	3	12V ISOLATED	3.0A (4.5A PK)	3.0%	4.0%	B, D
	4	- 12V	3.0A (4.5A PK)	3.0%	4.0%	B
	5	- 5V	0.5A	4.0%	1.0%	C
VHA 430	1	+ 5V	10.0A	ADJ.	0.5%	A
	2	+ 12V	3.0A (4.5)	3.0%	4.0%	B
	3	24V ISOLATED	2.5A (4.0)	5.0%	4.0%	B, D
	4	- 12V	2.0A	3.0%	4.0%	B
	5	- 5V	0.5A	4.0%	1.0%	C

125 WATTS (155W PK) — PRICE: $125.00 EA. @ 1-9 PC.

MODEL	OUT-PUT	VOLTAGE	CURRENT	INITIAL SETTING (+/-)	OUTPUT REGU-LATION (+/-)	NOTES
VKA 420	1	+ 5V	15.0A	ADJ.	0.5%	A
	2	+ 12V	4.0A (6.0A PK)	3.0%	4.0%	B
	3	12V ISOLATED	3.0A	3.0%	4.0%	B, D
	4	- 12V	3.0A	3.0%	4.0%	B
	5	- 5V	0.5A	4.0%	1.0%	C
VKA 426	1	+ 5V	15.0A	ADJ.	0.5%	A
	2	+ 12V	4.0A (6.0A PK)	3.0%	4.0%	B
	3	12V ISOLATED	1.0A	4.0%	1.0%	C, D
	4	- 12V	1.0A	4.0%	1.0%	C
	5	- 5V	0.2A	4.0%	1.0%	C
VKA 427	1	+ 5V	15.0A	ADJ.	0.5%	A
	2	+ 12V	4.0A (6.0A PK)	3.0%	4.0%	B
	3	15V ISOLATED	1.0A	4.0%	1.0%	C, D
	4	- 15V	1.0A	4.0%	1.0%	C
	5	- 5V	0.2A	4.0%	1.0%	C
VKA 423	1	+ 5V	10.0A	ADJ.	0.5%	A
	2	+ 15V	3.0A (4.0A PK)	3.0%	4.0%	B
	4	- 15V	3.0A (4.0A PK)	3.0%	4.0%	B
	5	- 5V	0.4A	4.0%	1.0%	C
VKA 430	1	+ 5V	15.0A	ADJ.	0.5%	A
	2	+ 12V	4.0A (6.0)	3.0%	4.0%	B
	3	24V ISOLATED	3.0A (4.5)	5.0%	4.0%	B, D
	4	- 12V	3.0A	3.0%	4.0%	B
	5	- 5V	0.5A	4.0%	1.0%	C

REXROTH
WORLDWIDE HYDRAULICS
THE REXROTH CORPORATION
INDUSTRIAL HYDRAULICS
DIVISION
Bethlehem, PA 18017
(215) 694-8300

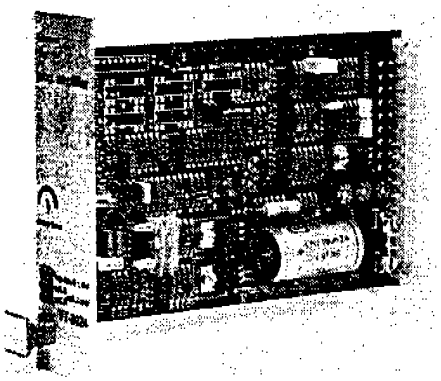
Electronic amplifier type VT 3024, Series 4X for the control of proportional directional valves without spool position feedback

RA
29 938/5.86
(metric)
Replaces: 10.85

Amplifier type VT 3024 is used for controlling directional proportional valves, without spool position feedback.

It basically consists of:

- voltage stabiliser
- ramp generator
- step function generator
- summator
- 2 pulse with modulated output stages
- differential amplifier input



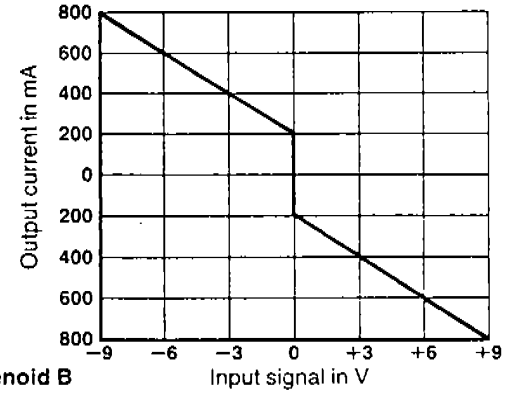
R 85/100
VT 3024 S 4X

Suitable card holders:

- VT 3002-1X, see RE 29916
- VT 1516-1X, see RE 29915
- VT 1700-1X, see RE 29917

Output curve:

Solenoid A



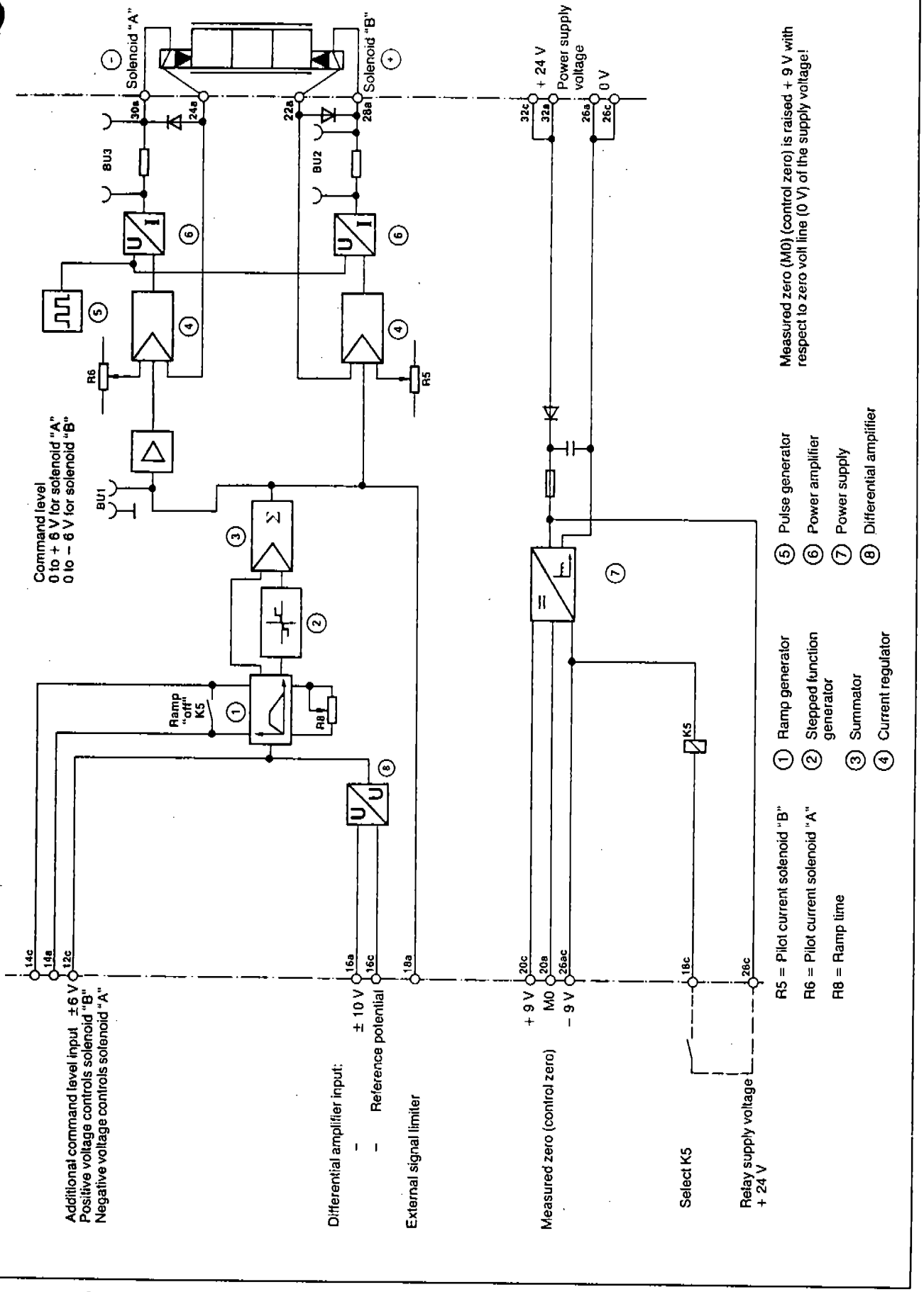
Solenoid B

Technical data:

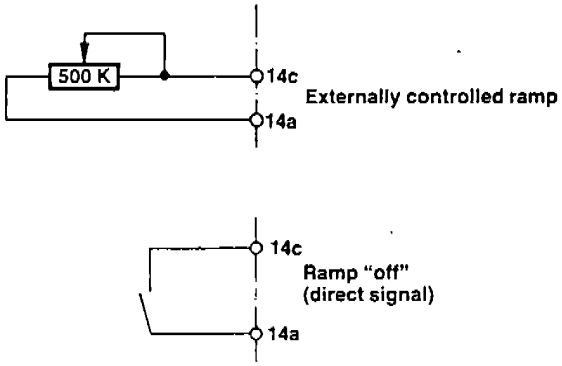
Supply voltage	(U):	
Full wave rectification		24 V_{eff} ± 10 %
Rectified 3phase supply		28 V_{eff} to 35 V_{eff}
Regulated voltage	(U):	± 9 V with centre tapping
Max. load of controlled voltage	(R):	≥ 500 Ω
Max. coil resistance	(R):	19.5 Ω
Power requirement	(P):	30 VA
Pilot current	(I):	20 mA
Max. output current	(I_{max}):	800 mA
Frequency range (output stage)	(f):	160 to 180 Hz
Fuse	(I_s):	2.5 Ampere M
Space required, conductor side	:	1 division
component side	:	7 divisions
		1 div. ≙ 5.08 mm
Temperature drift	:	0.5 ‰ (from I_{max})/°K
Permissible ambient temp. range	(T):	0 to 50 °C
Weight	(m):	0.13 kg

For applications outside these parameters, please consult us!

Terminal Connections VT 3024 S 4X



External time potentiometer



Note:

When using an external time potentiometer, the internal ramp time potentiometer must be set to maximum!

Description of function

Amplifier type VT 3024 S 40 has a differential amplifier input (16a - 16c).

The command level voltage is not taken from an internal source, but from an external supply. For this purpose, the differential amplifier input (8) is utilised. When using the differential amplifier input, it is important to note that both connections must be made and broken simultaneously!

The ramp generator (1) converts a stepped input signal into a slowly increasing output signal. The rise time (gradient) of the output signal is set via R8. The ramp time stated can only be achieved over the full voltage range (from 0 to ± 6 V measured at the command level test points).

A command level of ± 10 V at the input of the differential amplifier, develops a voltage of ± 6 V at the test points. If a lower command level than ± 10 V is selected then the ramp time will be correspondingly reduced.

The ramp time can also be set via an external time potentiometer (see external time potentiometer). When using an external potentiometer, the internal potentiometer acts as a limiting value.

The output signal of the ramp generator (1) is passed to the summator (3) and the step function generator (2). The step function generator (2) generates a step function at its output, which is added to the outgoing signal by the summator (3). This step function is included in order to cause the valve to pass through the overlap zone as quickly as possible.

At signal levels below approximately 100 mV, only the step function is transmitted.

The output signal from the summator is then passed to the two output stages with current regulators (4), the pulse generator and the power amplifiers. With a positive signal, at the input of the differential amplifier, solenoid B is energised, whilst a negative signal controls solenoid A.

Ordering code

VT 3024	S	4X /		*

32 pin linear plug to DIN 41612 Form C = S
(for installation in Euro-magazines or cardholders)

Series 4X = 4X
(40 to 49 ≙ installation and connection dimensions remain unchanged)

Further details in clear text

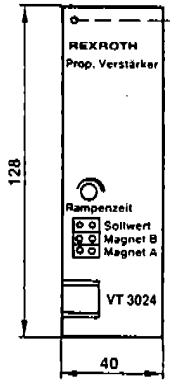
No desig. = German front plate
E = English front plate

R1 = Ramp time up to 1 sec
R5 = Ramp time up to 5 sec

Additional information

- The amplifier may only be unplugged when switched off!
- Measurements to be made with a high resistance meter set on the DC voltage range!
- Measured (control) zero (M0) is raised + 9 V with respect to 0 V of the power supply!
- M0 may not be connected to 0 V of the power supply!
- Radio transmitters may not be placed within 1 m of this card!
- Command level inputs may only be switched with contacts suitable for currents of < 1 mA!
- Screen all input lines. Leave one end of the screen open. Connect one end to 0 V of the supply line!
- Do not lay solenoid lines close to power lines!
- When using the internal relays, terminal 28c must be used as the power supply line!

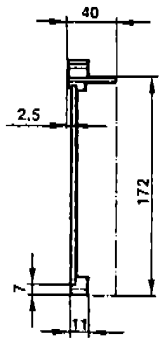
Unit Dimensions (in mm)

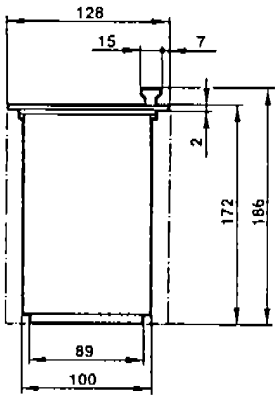


Viewing window for card place number in Euro-card magazine

Ramp time setting ≺ from 0.03 to 1 sec ≙ R1
from 0.03 to 5 sec ≙ R5

Test point 1 = Measurement of Command voltage
Test point 2 = Measurement of solenoid current B
Test point 3 = Measurement of solenoid current A
≻ mV ≙ mA





THE REXROTH CORPORATION
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MOBILE HYDRAULICS DIVISION P.O. Box 394, 1700 Old Mansfield Road, Wooster, OH 44691 Phone (216) 263-3300 Telex: 98-6335

SETUP INSTRUCTIONS
VT3024-S-3X/..

REFERENCE DATA SHEET: RA29938

1. CONNECT POWER SUPPLY 24VDC ± 10%

Positive (+) to terminal 32ac
Negative (-) to terminal 26ac

2. CONNECT SOLENOIDS

Solenoid A - terminals 24a and 30a
Solenoid B - terminals 28a and 22a

3. CONNECT INPUT SIGNAL

3a. ANALOG SOURCE (From PLC, Computer)

Connect a ±10V analog signal to the differential input. Use shielded cable.

Solenoid A	Solenoid B
+10v - terminal 16a COM - terminal 16c	-10v - terminal 16a COM - terminal 16c
or	or
COM - terminal 16a -10v - terminal 16c	COM - terminal 16a +10v - terminal 16c

4. RAMP OFF RELAY

Energize relay with 24vdc. Standard contacts may be used, terminal 28c provides a nominal 24v source that is provided by the card. The ramp is disabled when this relay is energized.

Ramp-off coil K5 - terminal 18c

5. ADJUST RAMP

The ramp time potentiometer controls the valve's acceleration and deceleration rate. This pot is located through the faceplate. Turning the ramp potentiometer clockwise will increase ramp time. Standard ranges are 1 second or 5 seconds.

6. TEST POINTS

INPUT: Internal voltage to amplifier stage may be checked across test points BU1, on faceplate, or between terminals 18a and 20a (M0). 6 volts = 100%

0 to +6vdc for solenoid-A
0 to -6vdc for solenoid-B

SOL A: Output to solenoid-A may be tested with a voltmeter across test points BU3. Voltage on meter numerically corresponds to current to solenoid (through 1 ohm test resistor, mV = mA). Typical solenoid current ranges from 30mA to 700mA.

SOL B: Output to solenoid-B may be tested with a voltmeter across test points BU2. Typical solenoid current ranges from 30mA to 700mA.

VT-Patch cords are available from test points to standard jacks. Rexroth 807707 - Red Rexroth 807708 - Black

NOTES:

1. Terminals identified with the suffix 'ac' are internally connected on the VT-card.

2. Do not operate radios within 3 feet of the amplifier card.

3. The signal common or measured zero (M0 - terminal 20a) is not connected to the negative side of 24vdc. This is a floating ground on the card. Do not ground M0.

4. Contacts for switching analog input signals must handle currents under 1 mA. Use dry circuit or sealed contacts.

5. External, analog command lines should be wired with shielded cable. Connect one end of shield to ground. Normally, panel ground is used.

6. Terminals 26a and 26c (26ac) are called -9v with respect to signal common, M0. These same terminals also serves as power supply common (0v). Like psig and psia, the reference points for ±9v and 24vdc are different.

The Rexroth Corporation
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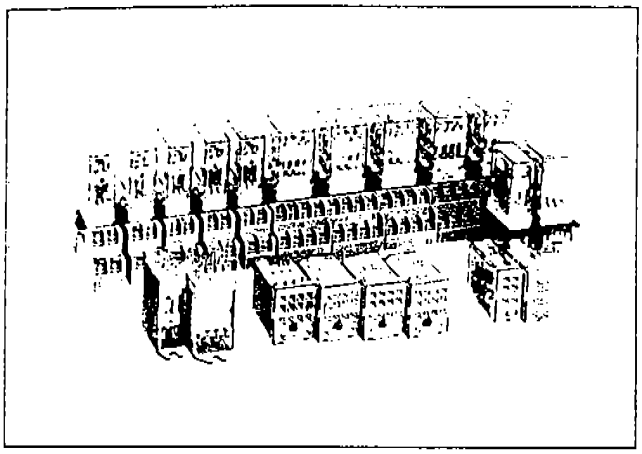
(215) 694-8403 service
(215) 954-8660 electronics

\vt3024.wp

General Purpose "Miniature" Relays
3A Contact Ratings
2 & 4 Form C Bifurcated Contacts



Features

- Compact miniature size saves space
- 2PDT and 4PDT models, available with bifurcated cross-bar contacts, ensure reliable low-current switching for dry circuit applications
- Choice of plug-in/solder or PCB type terminals
- Options include check button for test operation and indicator lights on 4PDT models
- UL recognized and CSA certified
- DIN rail, suface, panel and PCB type sockets avaialble for flexible mounting applications

UL Recognized
File No.E64245
E59804

CSA Certified
File No. LR35144

RY Series Type List

Termination	Contact Configuration	Basic Part No.	Basic Part No. w/Indicator Light	Basic Part No. w/Check Button	Basic Part No. w/Indicator Light & Check Button	Basic Part No. w/Top Bracket
S (Solder)	DPDT	RY2S-U	—	—	—	RY2S-UT
	DPDT (Bifurcated Contacts)	RY22S-U	—	—	—	RY22S-UT
	4PDT	RY4S-U	RY4S-UL	RY4S-UC	RY4S-ULC	RY4S-UT
	4PDT (Bifurcated Contacts)	RY42S-U	RY42S-UL	RY42S-UC	RY42S-ULC	RY42S-UT
V (pcb .032"(0.8mm) wide)	DPDT	RY2V-U	—	—	—	—
	DPDT (Bifurcated Contacts)	RY22V-U	—	—	—	—
	4PDT	RY4V-U	RY4V-UL	RY4V-UC	RY4V-ULC	—
	4PDT (Bifurcated Contacts)	RY42V-U	RY42V-UL	RY42V-UC	RY42V-ULC	—
V1 (pcb .060"(1.5mm) wide)	4PDT	RY4V1	*RY4V1-L	*RY4V1-C	—	—

Note: RY4V1 is CSA certified.
*RY4V1-C and RY4V1-L are not CSA certified.

Contact Ratings

UL Ratings (Single Contacts)		
Voltage (V)	Resistive (A)	General Use (A)
240 AC	3	0.8
120 AC	—	1.5
100 DC	0.2	*
30 DC	3	*

Note: *DC general use rating is not to exceed equivalent DC resistive rating.

CSA Ratings (Single Contacts)		
Voltage (V)	Resistive (A)	General Use (A)
240 AC	3	0.8
120 AC	3	1.5
100 DC	—	0.2

Contact Ratings (Cont'd)

Nominal Ratings (Single Contact)		
Voltage (V)	Resistive (A)	Inductive (A)
220 AC	3	0.8
110 AC	3	1.5
30 DC	3	1.5

UL/CSA Ratings (Twin Contact)		
Voltage (V)	Resistive (A)	General Use (A)
240 AC	0.8	0.4
120 AC	1	0.5
30 DC	1	0.5

Note: Inductive load cos φ = 0.4; L/R = 7msec.

Coil Ratings

	Rated Voltage (V)		Rated Current (mA) ± 15% @ 20°C				Coil Resistance (Ω) ± 10% @ 20°C	
			60 Hz		50Hz			
	DPDT	4PDT	DPDT	4PDT	DPDT	4PDT	DPDT	4PDT
AC	6	6	150	200	170	240	18.8	9.4
	12	12	75	100	86	121	76.8	39.3
	24	24	37	50	42	60.5	300	153
	120	120	7.5	11	8.6	13.1	7680	4170
	—	240	—	5.5	—	6.6	—	15210
DC	DPDT	4PDT	DPDT	4PDT	DPDT	4PDT	DPDT	4PDT
	6	6	128		150		47	40
	12	12	64		75		188	160
	24	24	32		36.9		750	650
	48	48	18		18.5		2660	2600
	—	110	—		9.1		—	12100

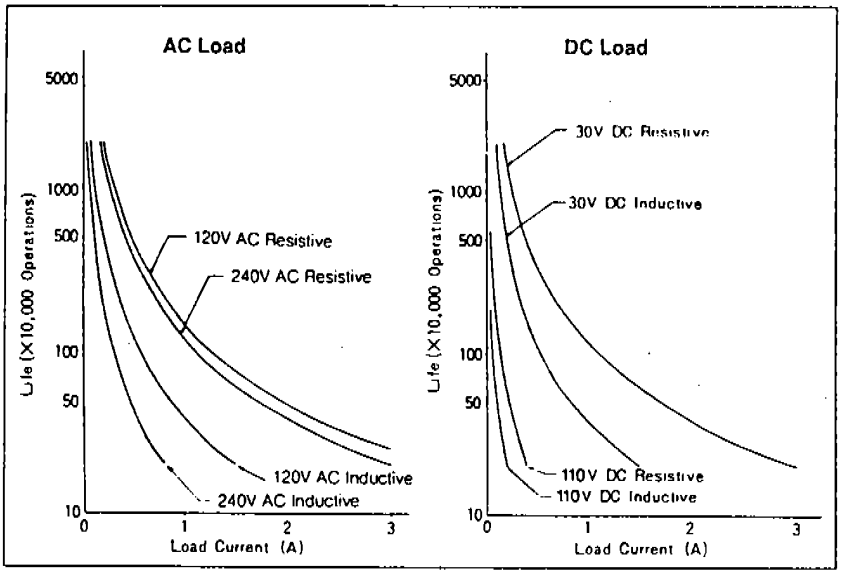
Note: Maximum continuous applied voltage (AC/DC) @20°C: 110% of rated voltage .
Minimum operate voltage (AC/DC) @20°C: 80% of rated voltage.
Drop-out voltage (AC): 30% (or more) of the rated voltage.
Drop-out voltage (DC): 10% (or more) of the rated voltage.

Specifications

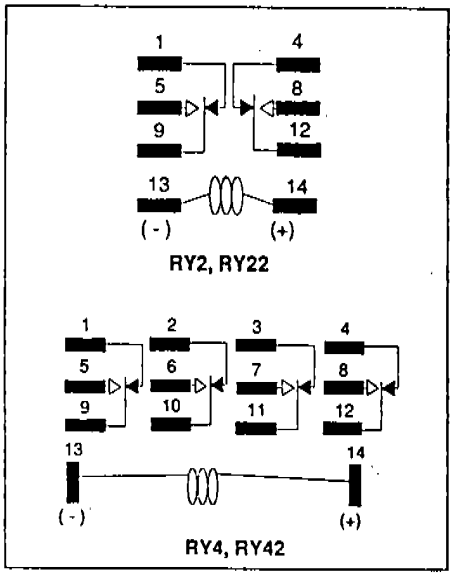
Contact Material	RY2, RY4: Fine Silver (Ag), Gold-Plated RY22, RY42: Ag-Pd alloy
Contact Resistance	RY2, RY4: 50mΩ maximum RY22, RY42: 100mΩ maximum
Operate Time	20ms maximum
Release Time	20ms maximum
Power Consumption	RY2, RY22: AC: Approx. 1.1VA (50Hz), 1VA(60Hz) DC: Approx. 0.8W RY4, RY42: AC: Approx. 1.4VA (50Hz), 1.2VA (60Hz) DC: Approx. 0.9W
Insulation Resistance	100MΩ minimum (measured with 500V DC megger)

Frequency Response	1,800 operations/hr
Temperature Rise	Coil: 85°C maximum Contact: 65°C maximum
Vibration Resistance	0 to 6g (55Hz maximum)
Shock Resistance	RY2, RY22: 10g minimum RY4, RY42: 20g minimum
Life Expectancy (Operations)	RY2, RY4: Electrical: Over 200,000 (120VAC, 3A) Mechanical: Over 50,000,000 RY22, RY42: Electrical: Over 200,000 (120V AC, 1A) Mechanical: Over 50,000,000
Operating Temperature	-30° to +70°C

Electrical Life Curve (RY4)



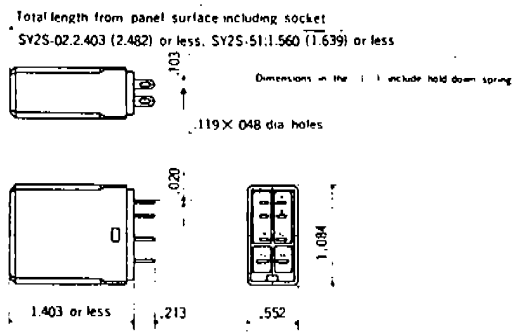
Internal Circuit



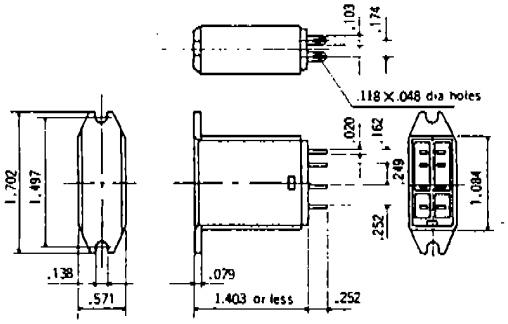
Dimensions

Dimensions in inches (mm).

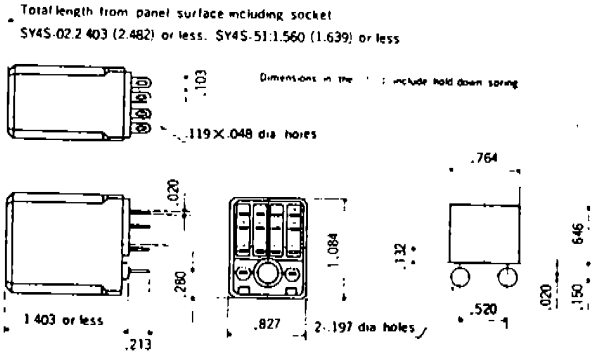
Solder Terminal (Plug-In Type)
RY2S
RY22S



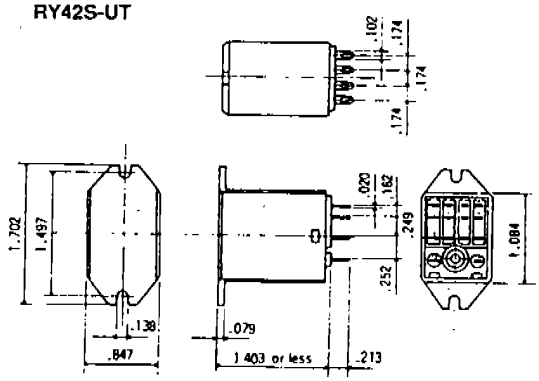
w/Top Bracket (Plug-In Type)
RY2S-UT
RY22S-UT



RY4S
RY42S



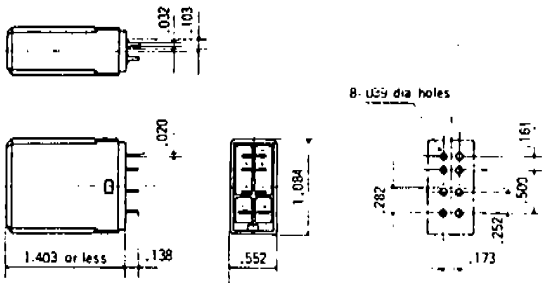
RY4S-UT
RY42S-UT



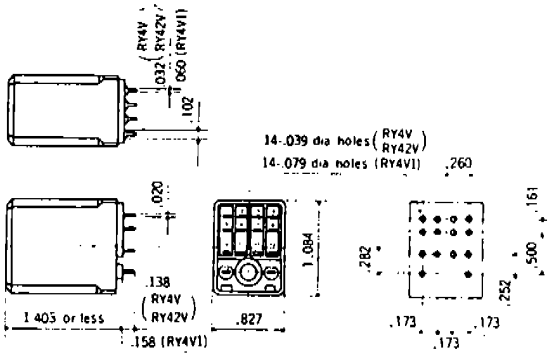
elay Dimensions

Dimensions in inches (mm).

P.C. Board Terminal
RY2V, RY22V



P.C. Board Terminal
RY4V, RY42V



ockets

For more details on socket dimensions and accessories, see Section F, Sockets, pages F11 thru F15.

Recognized, File No. E64245
SA Certified, File No. LR53144

D

nap-Mount (DIN Rail)

SY2S-05
•SY2S-05C
For: RY2S, RY22S
*SY2S-02F1
*SFA-202

SY4S-05
•SY4S-05C
For: RY4S, RY42S
*SY4S-02F1
*SFA-101, SFA-202

te: •New finger-safe DIN rail mount socket, see SECTION F, SOCKETS on page F7 for more details.
*Indicates hold-down spring/clip.

Panel Mount

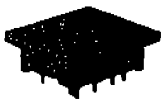
SY2S-51
For: RY2S, RY22S
*SY4S-51F1
*SFA-301, *SFA-302

SY4S-51
For: RY4S, RY42S
*SY4S-51F1
*SFA-301, *SFA-302

Note: *Indicates hold-down spring/clip.

C Mount

SY2S-61
For: RY2S, RY22S
*SY4S-51F1
*SFA-301, *SFA-302



SY4S-61
For: RY4S, RY42S
*SY4S-51F1
*SFA-301, *SFA-302

lote: *Indicates hold-down spring/clip.

Hold-Down Springs/Clips

SY4S-51F1

SY4S-02F1

SFA-302

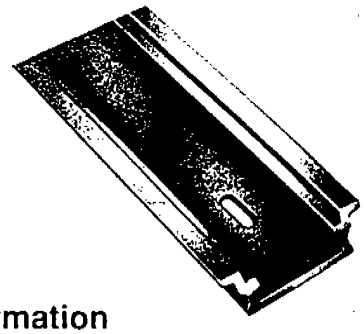
SFA-202

SFA-101

SFA-301

DIN Rail

BND-1000
DIN/Screw Mount



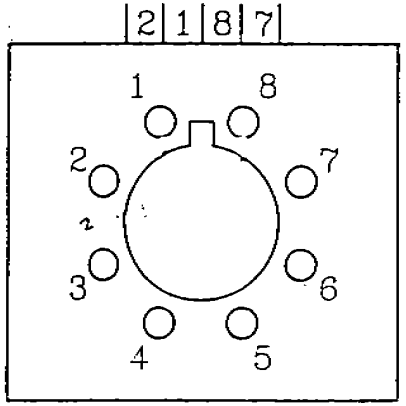
Ordering Information

When ordering RY Series relays, specifiy Basic Part No. and Coil Voltage.

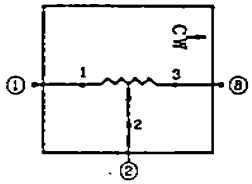
Example: RY4S-U - AC120V

Basic Part No. — RY4S-U

Coil Voltage — AC120V



SOCKET SIDE PIN OUT



SB-2364-10K = 10K OHM
SB-2364-100K = 100K OHM

PARTS:
1. KEYSTONE #664 RELAY CAN
2. BOURNS 534-11-103
   10 TURN 10K POT
3. BOURNS H-492-003
   TURN COUNTING DIAL
4. IN4004 DIODE

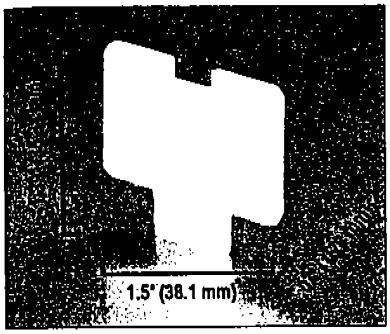
TITLE : POTENTIOMETER ASSEMBLY

S.A.S. FLUID POWER, INC.
919 HOUSER WAY NORTH
RENTON, WA 98055

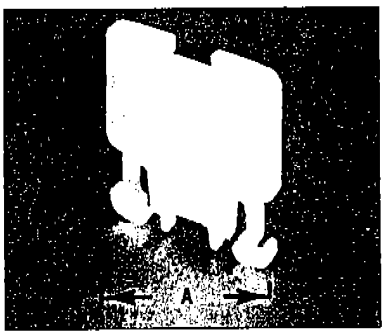
SB-2364

C.E. FEASEL | DATE: 02-14-91 | REVISION

END BARRIERS

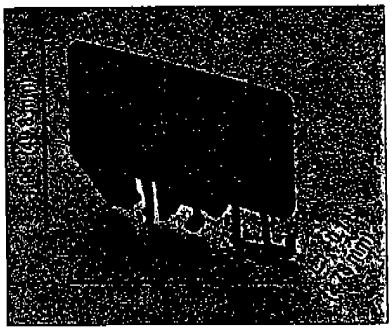


1492-NM16
1492-NM16BL
1492-NM16GL

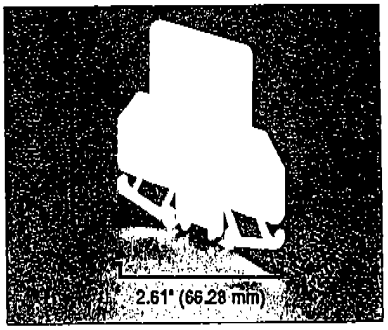


1492-N16, 1492-N17
1492-N18, 1492-N36
1492-NM36, 1492-NM40

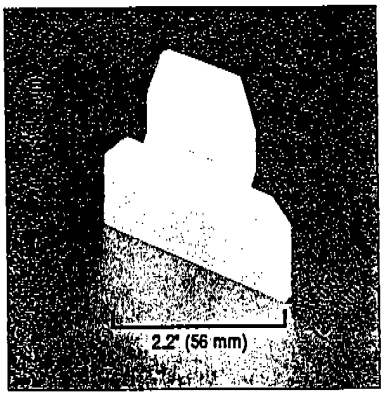
Catalog Number	A	B	C
1492-N16	1.5" (38.1 mm)	1.78" (45.21 mm)	0.11" (2.8 mm)
1492-N17	1.75" (44.45 mm)	2" (50.8 mm)	0.14" (3.56 mm)
1492-N18	1.25" (31.75 mm)	1.13" (28.7 mm)	0.11" (2.8 mm)
1492-N36	1.56" (39.62 mm)	1.81" (46 mm)	0.11" (2.8 mm)
1492-NM36	—	—	0.07" (1.78 mm)
1492-NM40	—	—	0.07" (1.78 mm)



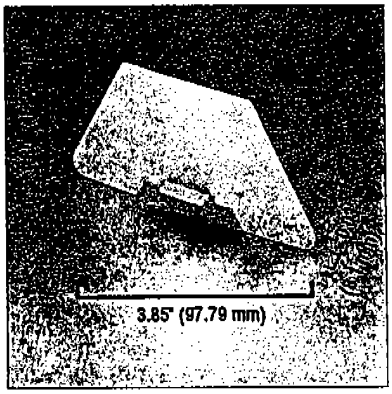
1492-N37



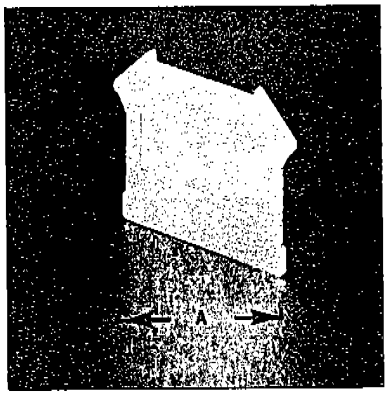
1492-N40



1492-N53

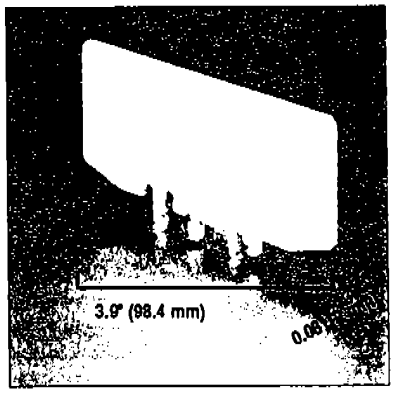


1492-N94

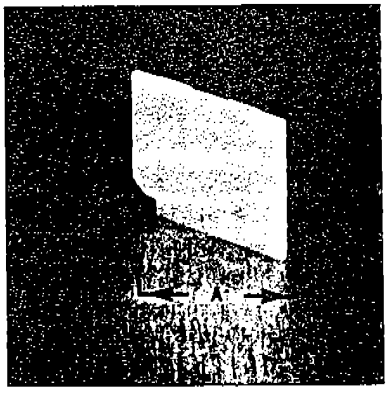


1492-N50, 1492-N51
1492-N52, 1492-N54

Catalog Number	A	B	C
1492-N50	1.48" (37.6 mm)	1.20" (30.7 mm)	0.06" (1.5 mm)
1492-N51	1.65" (42.5 mm)	1.41" (35.9 mm)	0.07" (1.8 mm)
1492-N52	1.66" (42.5 mm)	1.68" (42.7 mm)	0.06" (1.5 mm)
1492-N54	1.82" (46.2 mm)	1.13" (28.7 mm)	0.04" (1 mm)



1492-N96

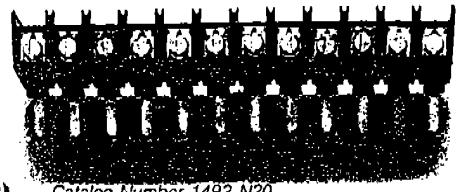


1492-N55, 1492-N56

Catalog Number	A	B	C
1492-N55	0.96" (24.4 mm)	0.82" (20.8 mm)	0.04" (1.0 mm)
1492-N56	0.96" (24.4 mm)	0.82" (20.8 mm)	0.04" (1.0 mm)

JUMPERS/FANNING STRIP

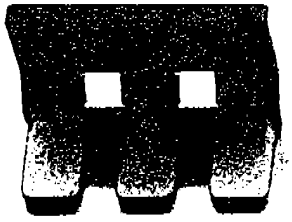
Catalog Number 1492-N65



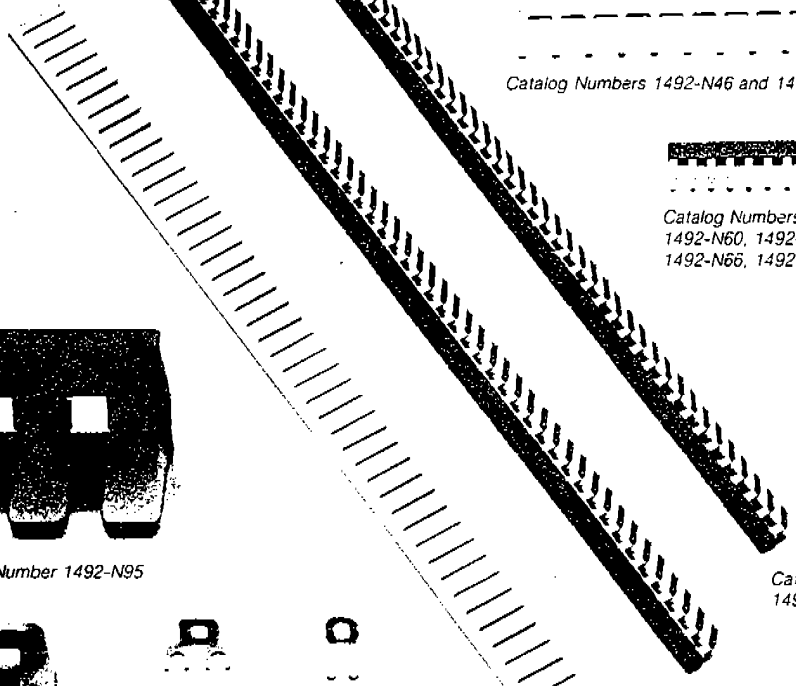
Catalog Number 1492-N20

Catalog Numbers 1492-N46 and 1492-N49

Catalog Numbers 1492-N59, 1492-N60, 1492-N63, 1492-N64, 1492-N66, 1492-N67 and 1492-N902



Catalog Number 1492-N95



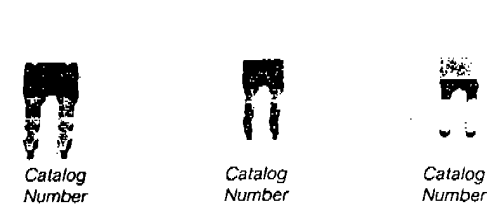
Catalog Number 1492-N900RE

Catalog Number 1492-N900B

Catalog Number 1492-N21

Catalog Numbers 1492-N14, 1492-N15 and 1492-N35

Catalog Numbers 1492-N3, 1492-N13 and 1492-N38



Catalog Numbers 1492-N24, 1492-N30 and 1492-N39

Catalog Number 1492-N62

Catalog Number 1492-N61 1492-N903

Catalog Number 1492-N42

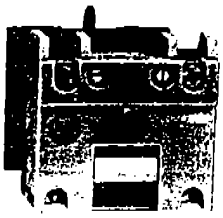
PE F RELAYS ● IEC STANDARDS ● 660V MAXIMUM AC ● 300V MAXIMUM DC

E SUPPRESSOR —

Catalog Number 199-FSMA1

Volts	Catalog Number	Price
120V AC 240V AC Diode For DC	199-FSMA1 FSMA2 FSMZ	$25

CH ATTACHMENT —



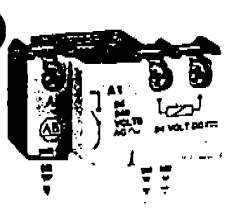
Unlatch VA (continuously rated)
Inrush: 14.4 at 60 Hz, 13.0 at 50 Hz
Sealed: 3.7 at 50/60 Hz

Catalog Number	Price
197-FL [1]	$70

[1] Latch coils are available for the voltages listed in the table below. To complete the catalog number, add a coil voltage-frequency designation from the table below.

Volts	Code 60 Hz	Code 50 Hz
24	A24	B24
110	—	A1
120	A1	—
220	—	A2
240	A2	B2
380	—	B3
415	—	B41

C NTERFACE MODULE —

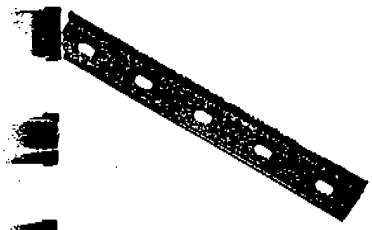


A 12 or 24V DC, 0.5 watt, or 48V DC, 0.7 watt input signal can be used to operate the 24-240V AC coil of Type F relays or Bulletin 100 contactors, size A09 thru A30.

Total Operational Times
Pick-up: 22-31 ms Drop-out: 14-20 ms

Catalog Number	Volt	Price
199-FIMZ12 FIMZ24 FIMZ48	12 24 48	$45

IN MOUNTING RAIL —



Sold only in standard packages of 5 rails.

Length	Catalog Number	Standard Package Quantity	Standard Package Price [2]
1 Meter	199-DR1	5	$35
333.3mm	DR1-33		17
500.0mm	DR1-50		22
666.6mm	DR1-66		27

[2] Discount Schedule W3.

STAB CONNECTOR KIT —

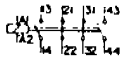
alog Number 199-SC1

Catalog Number 199-SC2

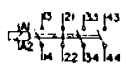
0.250" Stab Connector Kit	Catalog Number	Standard Package Quantity	Standard Package Price
For power terminals 50 terminals per package	199-SC1	50	$25
For coil terminals 20 terminals per package.	199-SC2	20	10

WIRING DIAGRAMS —
(See Applicable Codes and Laws)

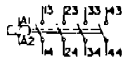
RELAYS



Catalog Number 700-F220 [3]



Catalog Number 700-F310 [3]



Catalog Number 700-F400 [3]

[3] Voltage-frequency designation required to complete Catalog Number — See Page 262, footnote [1].

TIMER ATTACHMENT

Catalog Number 196-FTA

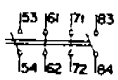
Catalog Number 196-FTB

ADDER DECKS

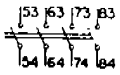
Catalog Number 195-FA20

Catalog Number 195-FA02

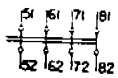
Catalog Number 195-FA11



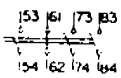
Catalog Number 195-FA22



Catalog Number 195-FA40

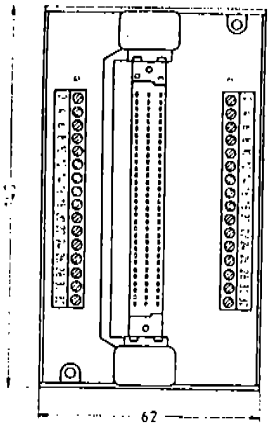


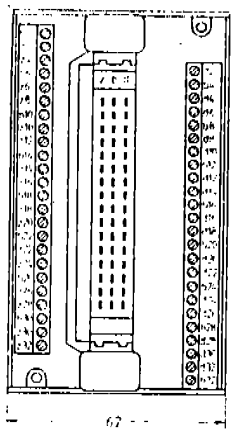
Catalog Number 195-FA04

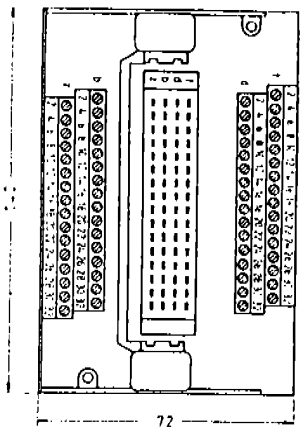


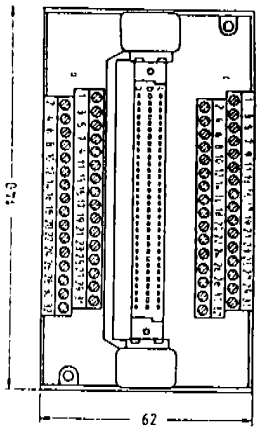
Catalog Number 195-FA31

LOGIC

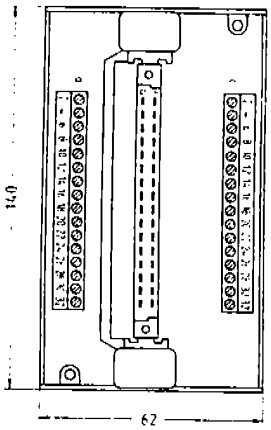


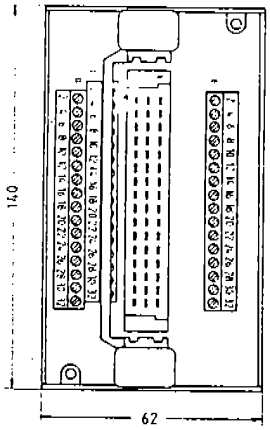


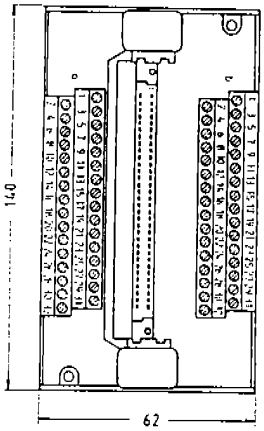


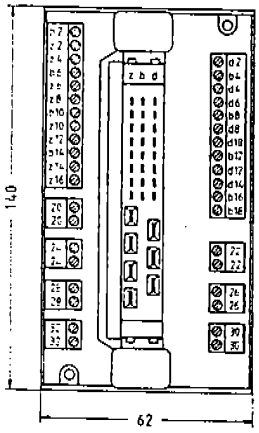


DIN 41612	DIN 41612	DIN 41612	DIN 41612
Type/Part No.	**Type/Part No.**	**Type/Part No.**	**Type/Part No.**
SKP 32/IC 63016	SKP 48/IF 63020	SKP 64/IG 63040	SKP 64/IC 63043
SKP 32/IC F 63017	SKP 48/IFF 63021		
250V AC	250V AC	250V AC	125V AC
1A	4A	4A	1A
C/32	F/48	G/64	C/64
Alternate pins, rows a, c	all pins, rows, d, b, z	all pins, rows f, d, b, z	rows a, c
0,7 x 0,6 mm	1 x 0,6 mm	1 x 0,6 mm	0,7 x 0,6









DIN 41612	DIN 41612	DIN 41612	DIN 41612
Type/Part No.	**Type/Part No.**	**Type/Part No.**	**Type/Part No.**
SKP 32/ID 63012	SKP 48/IE 63030	SKP 64/IB 63042	SKP 24/7 63048
SKP P32/ID F 63013	–	–	–
250V AC	250V AC	125V AC	250V AC
4A	4A	1A	4A 15A
D/32	E/48	B/64	AM/24 + 7
Alternate pins a, c	all pins, rows a, c, e	all pins, rows a, b	24 7
1 x 0,6 mm	1 x 0,6 mm	0,7 x 0,6 mm	1 x 0,6 6,3x0,8

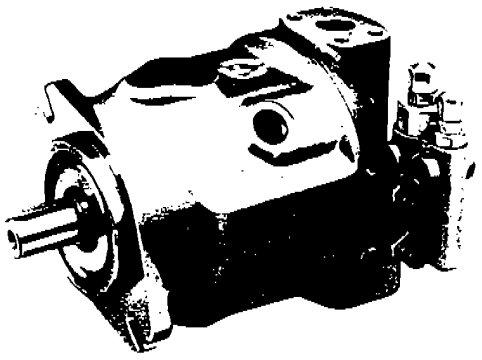
REXROTH
WORLDWIDE HYDRAULICS

Variable Axial Piston Pump, Swashplate Design Model AA10VSO (Series 30) for Open Circuit Applications

Sizes 28 to 100	...4570 PSI (...315 bar)	...6.10 in^3/rev (...100 cm^3/rev)

RA 06 291/06.87

- 2-bolt mounting flange to SAE standards
- SAE flanged connections with UNC threads (SAE J 518)
- Special slot-controlled swashplate design
- High power to weight ratio
- Heavy duty roller bearings for extremely long pump life
- Various control options for pressure. flow and power regulation
- Fast response times and low noise level
- Continuous operating pressure of 3625 PSI (250 bar), peak pressure to 4570 PSI (315 bar)
- Axial and radial loading of the drive shaft possible
- Good self-priming suction characteristics
- Cast iron housing, aluminium free construction
- Operation on water based fluids 95/5 (HFA emulsions) possible with de-rated performance parameters

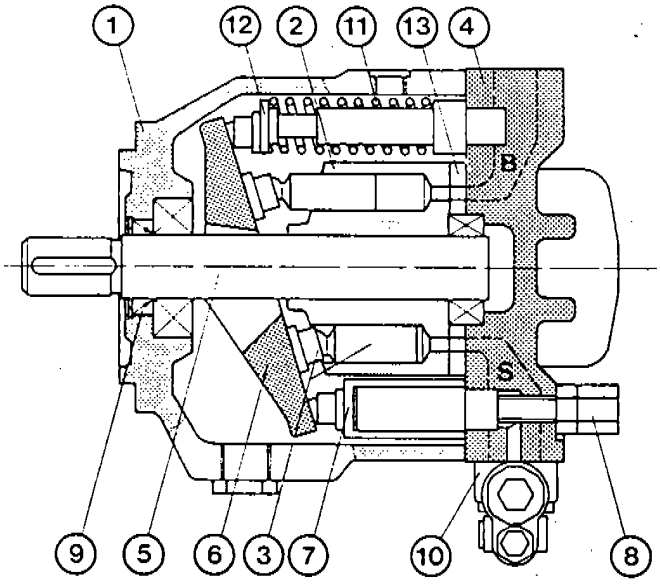


Functional Description

Axial piston pumps model AA10VSO are swashplate design, variable displacement pumps. They are designed for hydrostatic transmission in open circuit applications. The pump generates fluid flow and imparts to that fluid the necessary pressure forces up to 4570 PSI (250 bar).
They basically consist of the housing (1), cylinder barrel (2), piston and shoes (3), port plate (4), drive shaft (5), swash plate (6), control piston (7), mechanical stroke limiter adjustment (8), shaft seal (9) and compensator control (10).
Rotation of the drive shaft (5) causes a linear piston movement as the piston shoe (3) slides along the tilted swashplate (6).
As the piston retracts in the cylinder bore (2), fluid fills the developing vacuum cavity from the suction port »S« via the suction kidney in valve plate (13). At maximum retraction of the piston, shaft rotation causes the piston to go beyond the suction kidney and begin communication with the pressure kidney. Continuing rotation then extends the piston into the cylinder bore, forcing fluid into the pressure port »B«.
The stroke length of the piston is directly related to the swashplate angle, which swivels up to a maximum of 17 degrees for stepless flow adjustment.

Pressure and flow regulation

The swashplate is normally held at maximum swivel angle by a spring (11) as well as system pressure working on the stroking piston (12).
System pressure is also working on the pressure compensator against a setting spring. When system pressure overcomes the spring force, the spool shifts allowing system pressure into the control piston (7). This causes the pump to destroke to a regulating point sufficient to maintain compensator set pressure and lubricating fluid flow.
When the pressure setting is reached, only the amount of fluid necessary to satisfy the load conditions is delivered. If the load condition is such that no flow is required, only cooling and lubricating fluid is delivered. Power usage and heating of the fluid are thus kept to a minimum.
When system pressure falls below the compensator setting, spring force returns the spool back to its normal position, which drains control piston (7) to the pump case. The swashplate is then forced on stroke by the spring (11) and stroking piston (12). The flow control spool FR, also known as load sensing control, functions generally the same as the compensator spool. In the case of the FR spool, however, its response is due to a differential pressure across a flow control device. The spring setting only determines the differential pressure required to maintain constant output flow through a given orifice size.
Many control options including constant power control, electronic proportional flow and/or pressure control, etc. are available.



Variable Axial Piston Pump AA10VSO, Series 30

Ordering Code

	A	A10VS	O			/	30		–		K	C	62	

Hydraulic Fluid

Petroleum oils no designation	
HFA- HFB- and HFC-fluids	E-

Version

SAE *	A

Axial Piston Unit

Variable displacement, swashplate design for industrial use	A10VS

Function

Pump operation, open circuit	O

Size

Sizes		28	45	71	100
Displacement	in^3/rev	1.71	2.75	4.33	6.10
	(cm^3/rev)	28.0	45.0	71.0	100.0

Controls and Control Options

Pressure compensator				DR
Pressure/flow compensator**				DFR
Constant power control***				DFLR
Electrical flow control	FE			FE
	FE	D		FED
with pressure compensation				

** A bleed orifice to drain is installed in X-port standard; if plug is to be installed state in clear text.

*** When ordering please state power requirements in clear text ex. 1 1/2 HP at 1800 rpm (5 kW at 1500 rpm)

Design

Series	30

Direction of Rotation

looking at shaft end	clockwise	R
	counter-clockwise	L

Seals

Buna-N	P
Viton	V

Shaft End

Keyed parallel, SAE	K

Mounting Flange

SAE 2-bolt	C

Port Connections

Pressure port B: SAE Suction port S: SAE	on opposite sides, with UNC threads	62

Through-drive Configurations

			28	45	71	100	
Without through-drive			●	●	●	●	N00
mounting flange	shaft/coupling	to fit:					
SAE A, 2-bolt	SAE A, spline	G2[1], S15[1], S20[1], AA 10 V 16	●	●	●		K01
SAE B, 2-bolt	SAE B, spline	G3[1], S20[1], S30[1], AA10 VO 28		●	●		K02
SAE B, 2-bolt	SAE B, keyed	AA 10 VSO 28, S30[1]	●	●	●		K03
SAE B-B, 2-bolt	SAE B-B, keyed	AA 10 VSO 45		●	●		K05
SAE C, 2-bolt	SAE C, keyed	AA 10 VSO 71, V2/50...100			●		K08

Please note: The mechanical stroke limitation from full displacement to 50 % full displacement is only available at model »N00« without through drive

[1]See the following data sheets, for further informations on the combination pumps: ● = available
G2- RA 10 030, G3- RA 10 038, S15- RA 64 756, S20- RA 64 774, S30- RA 64 789, V2/50...100- RA 10 337

Hydraulic Fluid

Before project design, please see our data sheet RA 90220 or RA 90223 for detailed information on the selection of hydraulic fluids and their application limits.

Operating viscosity range:

For optimum efficiency and pump life, we recommend that the operating viscosity (at operating temperature) be selected in the range of

ν_{opt} = optimum operating viscosity
81...167 SUS (16...36 mm²/s)

taking into consideration the reservoir temperature range.

Viscosity limits:

The following values are valid for extreme operating conditions of short duration.

ν_{min} = 60 SUS (10 mm²/s)
for short periods at max. permissible drainage oil temperature of 194° F (90° C)

ν_{max} = 4635 SUS (1000 mm²/s)
for short periods upon cold start up

Example:
VG 22 =
Viscosity grade of 22 centistokes
at 104° F (40° C)

Notes on the selection of the hydraulic fluid:

For correct selection of the hydraulic fluid, it is assumed that the operating temperature in the reservoir (open circuits) in relation to the ambient temperature is known.

The hydraulic fluid should be selected so that, within the operating temperature range, the operating viscosity lies within the optimum range ν_{opt} (see shaded area of selection diagram). We recommend that the higher viscosity grade is selected in each case.

Example: At some ambient temperature of X°, the operating temperature in the reservoir is 140° F (60° C). In the optimum operating viscosity range (ν_{opt}, shaded section), this corresponds to viscosity grades VG 46 or VG 68; VG 68 should be selected.

Important: The drainage fluid temperature is influenced by pressure and speed and is always higher than the reservoir temperature. At no point in the system, however, must the temperature be higher than 194° F (90° C).

If it is not possible to comply with the above conditions because of extreme operating parameters or high ambient temperature, please consult us.

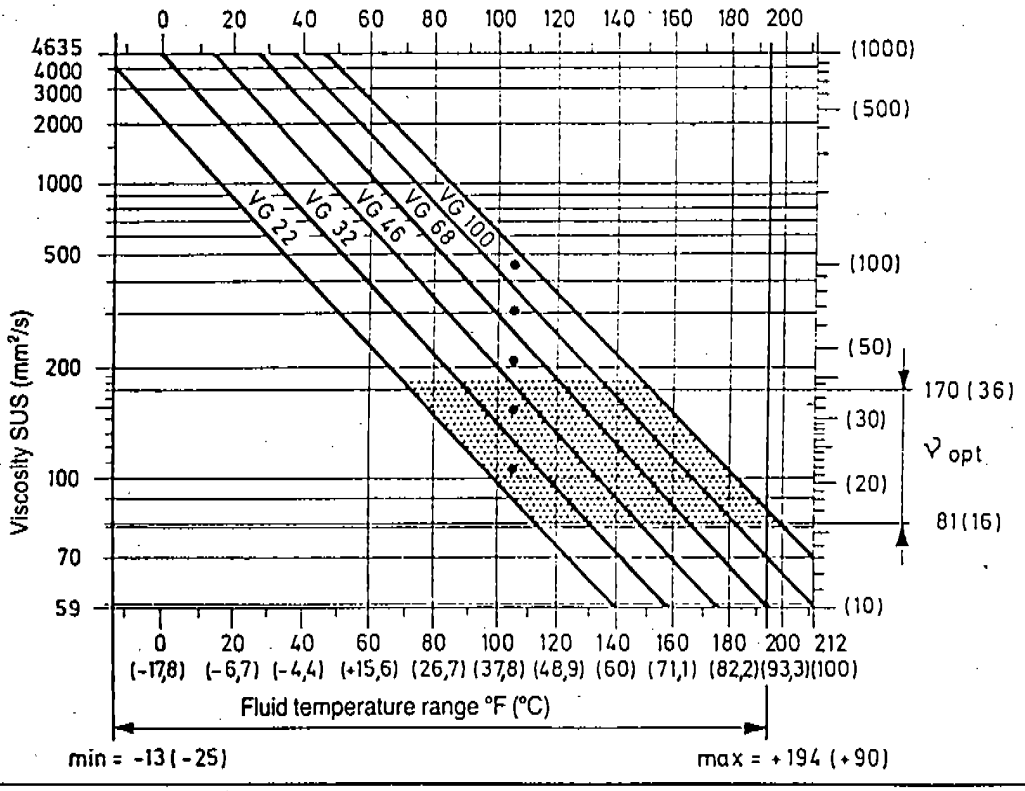
Filtration

In order to guarantee proper and reliable function, the operating fluid must be maintained to a minimum cleanliness grade of 9 to NAS 1638, 6 to SAE, ASTM, AIA or ISO grade 16/15.

This can be achieved, e.g., with filter elements type ... D 020 ... (see RA 31278).

A beta value of $\beta_{20} \geq 100$ is thereby achieved.

Selection Diagram



Technical Data

Values are valid for petroleum oils for water-content and synthetic fluids please see data sheet RA 90223 for detailed fluid information

Operating pressure range – Inlet Side

Absolute pressure at port S (suction inlet)

$p_{abs\ min}$ ——— 12 PSIA (0.8 bar)
$p_{abs\ max}$ ——— 435 PSIA (30 bar)

Operating pressure range – Outlet Side

Pressure at port B

Nominal pressure p_N ——— 3625 PSI (250 bar)
Peak pressure p_{max} ——— 4570 PSI (315 bar)

Drainage fluid:

Maximum permissible pressure of the case drain (port L): 7 PSI (0.5 bar) maximum higher than inlet pressure at port »S«, but not higher than 30 PSI (2 bar) absolute.

Direction of flow:

Port »S« to port »B«

Speed in relation to inlet pressure and displacement:

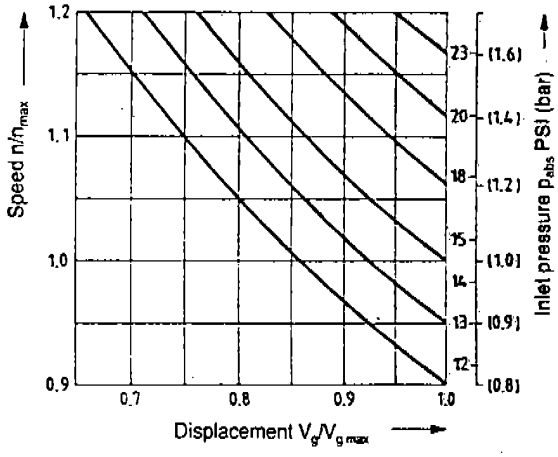


Table of Values

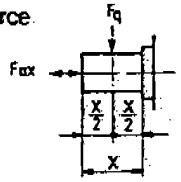
Theoretical values, without considering mechanical η_{mh} and volumetric η_v efficiencies

Size				28	45	71	100
Displacement: $V_{g\,max}$			in³/rev (cm³)	1.71 (28)	2.75 (45)	4.33 (71)	6.10 (100)
Nominal flow*:							
at n_E = 1750 rpm			GPM (l/min)	12.7 (48)	20.1 (76)	32.0 (121)	45.0 (170)
at $n_{o\,max}$			GPM (l/min)	21.4 (81)	29.9 (113)	40.2 (152)	51.3 (194)
Maximum speed**: (flooded suction)		$n_{o\,max}$	rpm	3000	2600	2200	2000
Max. power:	– n_E = 1750 rpm		HP (kW)	27.5 (20.5)	44.3 (33.0)	69.9 (51.9)	98.2 (73.1)
Δp = 3625 PSI (250 bar)	– $n_{o\,max}$	$P_{o\,max}$	HP (kW)	47.0 (35.0)	65.8 (49.0)	87.2 (65.0)	111.4 (83.0)
Max. torque:	Δp = 3625 PSI (250 bar)		lb-ft (Nm)	81.9 (111)	132 (179)	208 (282)	293 (397)
Torque	Δp = 1450 PSI (100 bar)		lb-ft (Nm)	33 (45)	53 (72)	83 (113)	117 (159)
Moment of inertia about the drive axis		J	lb-ft² (kgm²)	0.0403 (0.0017)	0.0783 (0.0033)	0.1968 (0.0083)	0.3960 (0.0167)
Filling volume:			Pints (l)	1.48 (0.7)	2.11 (1.0)	3.38 (1.6)	4.64 (2.2)
Weight: (approx)			lbs (kg)	33.0 (15)	46.2 (21)	72.6 (33)	99 (45)
Permissible loading on drive shaft: (see below)							
max. axial force F_{ax}			lbs (N)	225 (1000)	337 (1500)	540 (2400)	900 (4000)
max. radial force F_q			lbs (N)	540 (2400)	810 (3600)	1350 (6000)	2250 (10000)
Mounting Position:				See page 5			
Fluid temperature range:				See diagram, page 3			
Viscosity range:	SUS (mm²/S)			60-4640 (10...1000) Optimum 81-167 (16...36)			

* 3% loss of volume included

** The values shown are measured with an absolute pressure of 14.5 PSI (1 bar) at the suction inlet «S»

Direction of applied force



Sizing Calculations

Flow $Q = \frac{V_g \cdot n \cdot \eta_v}{231}$ $(Q = \frac{V_g \cdot n \cdot \eta_v}{1000})$

Drive torque $M = \frac{V_g \cdot \Delta p}{24 \cdot \pi \cdot \eta_{mh}}$ $(M = \frac{1.59 \cdot V_g \cdot \Delta p}{100 \cdot \eta_{mh}})$

Drive power $P = \frac{M \cdot n}{5252} = \frac{Q \cdot \Delta p}{1714 \cdot \eta_t}$

$(\frac{2\pi \cdot M \cdot n}{60000} = \frac{M \cdot n}{9549} = \frac{Q \cdot \Delta p}{600 \cdot \eta_t})$

V_g = geom. displacement in³/rev (cm³/rev)
Δp = pressure differential PSI (bar)
M = torque lb-ft (Nm)
Q = flow GPM (l/min)
P = drive power HP (kW)
n = speed rpm
η_v = volumetric efficiency
η_{mh} = mechanical efficiency
η_t = overall efficiency ($\eta_t = \eta_v \cdot \eta_{mh}$)

Mounting position

The unit can be mounted in a number of optional positions. The pump housing must be filled prior to start-up.
In order to achieve optimum noise level values, all connecting lines (suction, pressure and leakage) should be elastically connected to the reservoir.
Check valves in leakage return lines should be avoided. Exceptions are possible, subject to our approval in advance.

1. Vertical installation (shaft pointing upwards)

The following installation parameters should be considered:

1.1 Pump submerged in Reservoir

Prior to installation, the pump should be filled while in a horizontal position.

a) The minimum fluid level must be level with or higher than the pump face flange. Connections »L« + »L_1« should be left open (see illustration #1)

b) If the minimum fluid level is lower than the pump face flange, then connection »L_1« and possibly the suction (»S«) port must be piped, as per Illustration # 2. Conditions as per item 1.2.1. Port »L« is plugged.

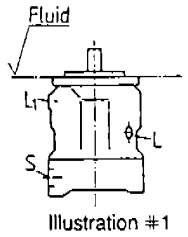


Illustration #1

1.2 Pump mounted outside of Reservoir

Prior to installation, the pump should be filled while in a horizontal position. Above-tank mounting as per Illus. # 2.

1.2.1 Operational paramaters. Minimum pump inlet pressure $p_{e\,min}$ =12 PSI (0.8 bar) under static and dynamic loads.
Note: Avoid above-tank mounting whenever a low noise level is desired.

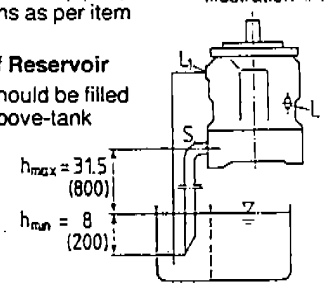


Illustration #2

The allowable suction height is a factor of the total pressure loss; it must, however not be greater than h_{max} = 31.5" (800 mm). Submerged depth $h_{T\,min}$ = 8" (200 mm).

Total Pressure loss $\Delta p_{TOTAL} = \Delta p_1 + \Delta p_2 + \Delta p_3 \leq (1 - p_{E(min)})$ = 2.9 PSI (0.2 bar)
with Δp_1: Pressure loss in piping due to acceleration of the fluid column.

$$\Delta p_1 = \frac{\varrho \cdot l \cdot dv}{dt} \cdot 10^{-5} \text{ (bar)}$$

ϱ = thickness of fluid (kg/m³)
l = pipe length (m)
dv/dt = Suction speed differential (m/s²)

Δp_2: Pressure loss through geographic altitude differences

$$\Delta p_2 = h \cdot \varrho \cdot g \cdot 10^{-5} \text{ (bar)}$$

h = altitude (m)
ϱ = thickness of fluid (kg/m³)
g = acceleration of gravity (9.81 m/s²)

Δp_3: line losses (elbows, etc.)

This calculation is valid for controls DR, DFR, DFLR

2. Horizontal Installation

Installation should be so that port »L« or »L_1« is at the top of the unit.

2.1 Pump submerged in Reservoir

a) The minimum fluid level on the same level as or higher than the unit's upper surface: Connections »L/L_1« and »S« must be open (see illustration #3)

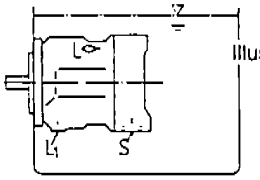
b) The minimum fluid level lower than the unit's upper surface: Connection »L« (or »L_1«) and possibly »S« must be piped, as per Illustration #4. Operating parameters as per Item 1.2.1.

2.2 Pump mounted outside of Reservoir

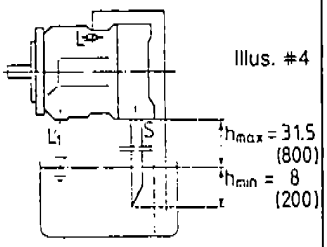
Pump housing must be filled prior to start up.

a) Above tank mounting as per Illustration #4. Operating parameters as per item 1.2.1.

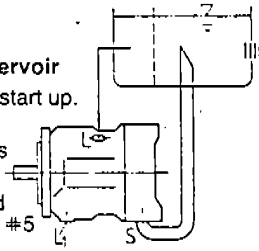
b) Below tank mounting Ports »L« and »S« must be piped as per Illustration #5



Illus. #3



Illus. #4

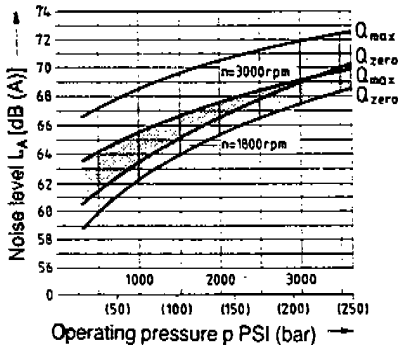


Illus. #5

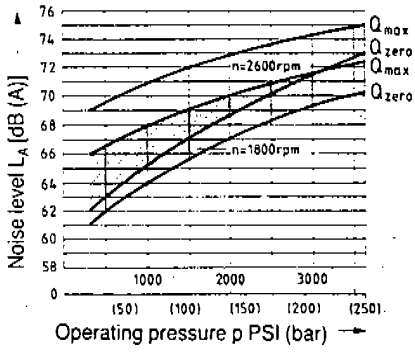
Operating curves with pressure compensator DR

Noise level (standard range)

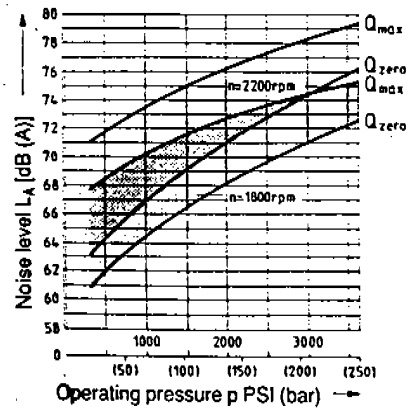
Measured in an anechoic chamber
Distance from microphone to pump = 3.28 ft (1 m)
Measurement error ±2 dB (A)
Fluid used: petroleum oil per ISO VG 46, DIN-standard #51519; temperature: 122° F (50° C)



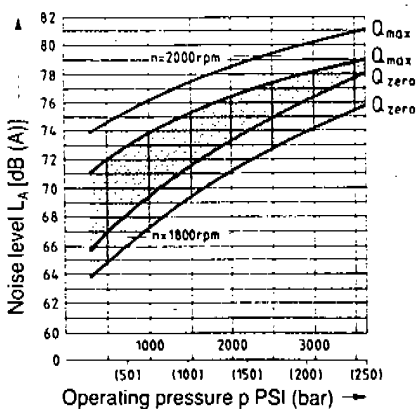
Size 28



Size 45



Size 71



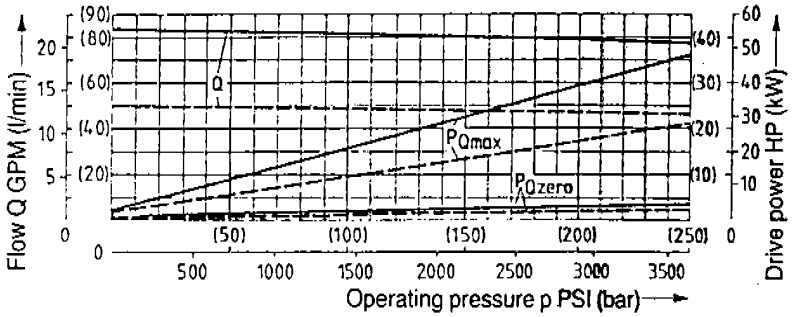
Size 100

Drive power and output flow

(Fluid: petroleum oil per ISO VG 46, DIN-standard #51519, temperature 122° F (50° C)

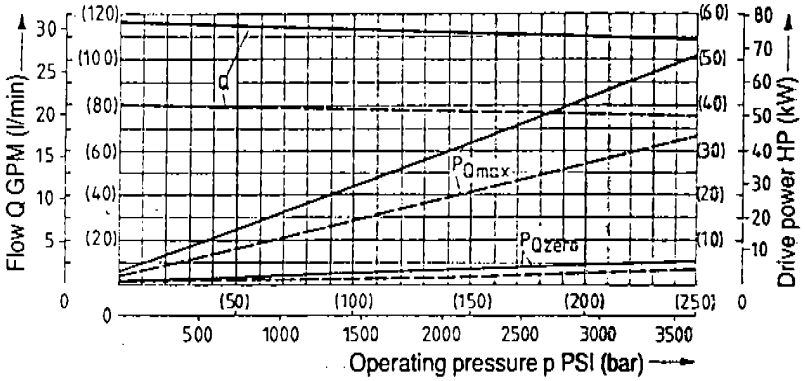
Size 28

_____ n = 1800 rpm
_____ n = 3000 rpm



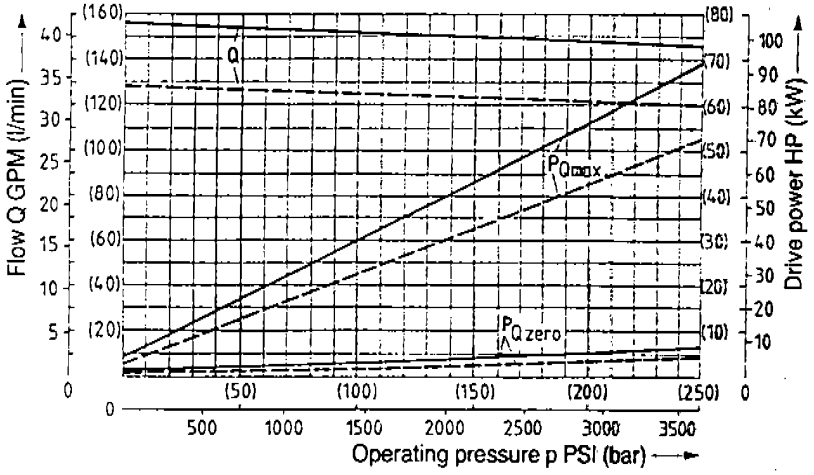
Size 45

_____ n = 1800 rpm
_____ n = 2600 rpm



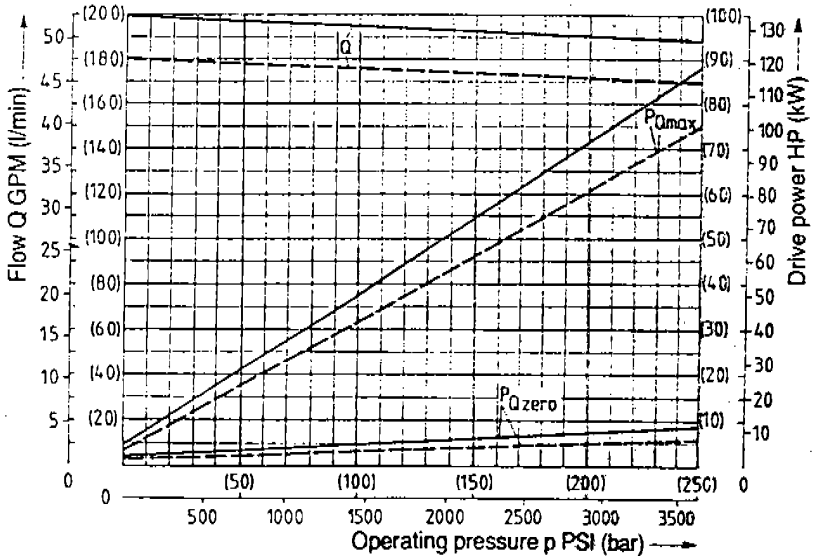
Size 71

_____ n = 1800 rpm
_____ n = 2200 rpm



Size 100

_____ n = 1800 rpm
_____ n = 2000 rpm



Overall efficiency:

$$\eta_t = \frac{Q \cdot p}{p_{Q\,max} \cdot 1714} \left(\frac{Q \cdot p}{p_{Q\,max} \cdot 600} \right)$$

Volumetric efficiency:

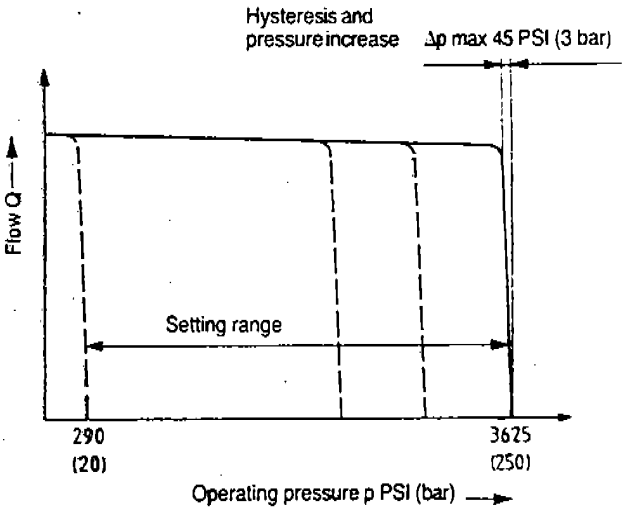
$$\eta_t = \frac{Q}{Q_{theor}}$$

Constant pressure compensator DR

The constant pressure compensator serves to maintain a constant pressure in a hydraulic system, within the control range of the pump. The pump supplies only the amount of hydraulic fluid required. Pressure may be steplessly set at the pilot valve.
Adjustable mechanical flow limiter from $V_{g\,max}$ to 50 % $V_{g\,max}$ only possible on model without through drive (N00).

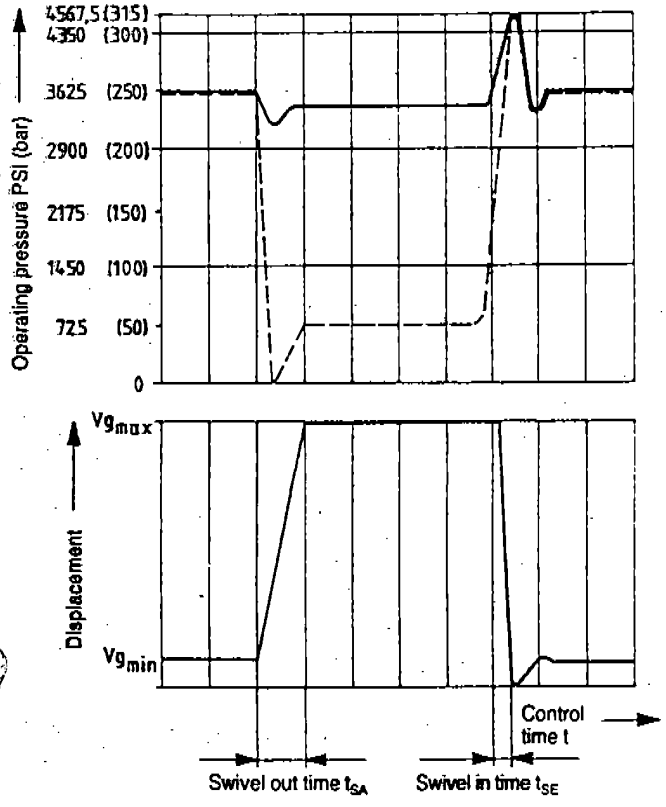
Static operating curve

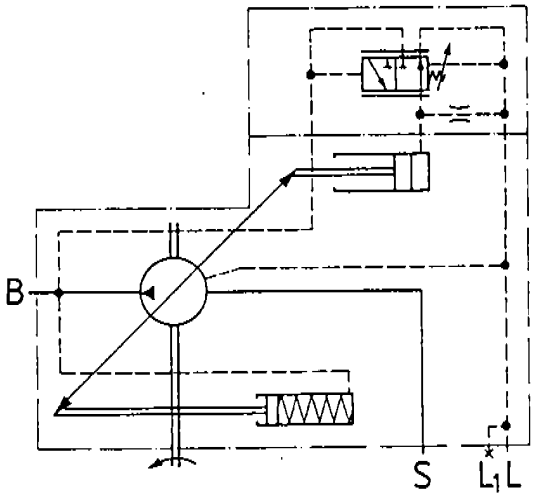
at n_1 = 1500 rpm; t_{oil} = 122° F (50° C)



Dynamic operating curves

Curves are measured average values under testconditions, with unit submerged.
Conditions: n_1 = 1500 rpm;
t_{oil} = 122° F (50° C)
relief set at 4570 PSI (315 bar)
Sudden closing of the pressure line. via relief valve DBD, approx. 3.28 ft (1 m) from the port plate of the pump.





0.80 GPM (3 l/min) pilot flow is required, taken from the high pressure side of the circuit.

Remote pressure control via port X of the flow control valve see page 9.

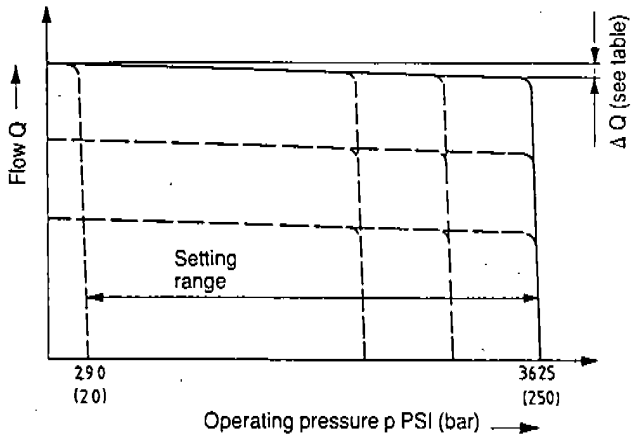
Size	t_{SA} (ms) toward 725 PSI (50 bar)	t_{SA} (ms) toward 3625 PSI (250 bar)	t_{SE} (ms) o-Displacement 3625 PSI (250 bar)
28	60	30	20
45	80	40	20
71	100	50	25
100	200	100	25

Constant pressure/flow compensator DFR

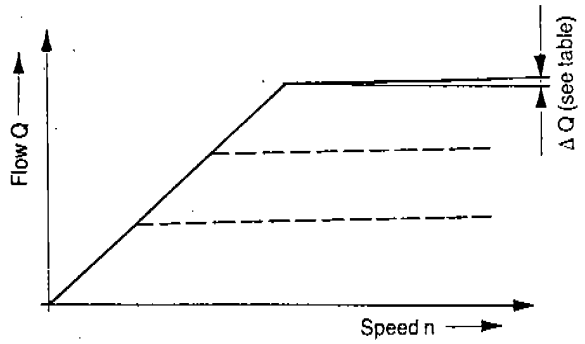
In addition to the constant pressure control, the pump flow may be regulated by means of a differential pressure (e. g. an orifice installed in the service line) »load sensing«. Adjustable mechanical flow limiter from $V_{g\,max}$ to 50 % $V_{g\,max}$ only possible on model without through drive (N00).

Static operating curve

at n_1 = 1500 rpm; t_{oil} = 122° F (50° C)



Static operating curve at variable speed



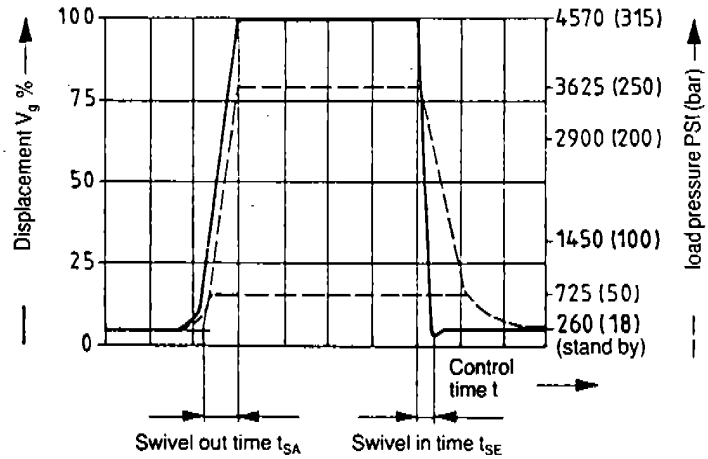
Max. flow variation

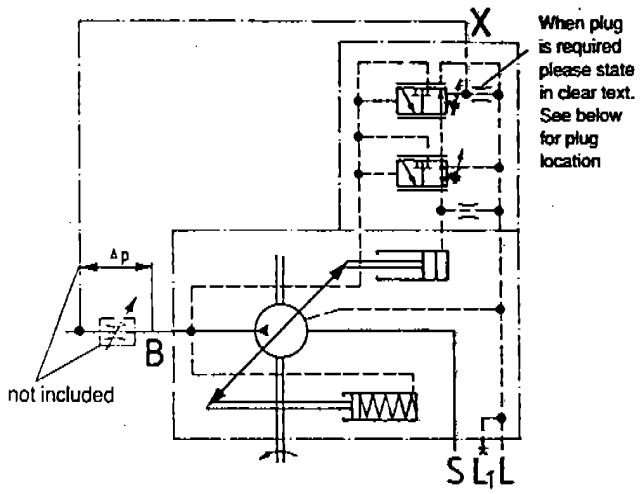
(Hysteresis and increase)
measured at drive speed n = 1500 rpm

Size		28	45	71	100
ΔQ	Gpm (l/min)	0.26 (1)	0.48 (1.8)	0.74 (2.8)	1.06 (4.0)

Dynamic operating curve

Curves are measured average values under test conditions, with unit submerged.





A maximum of 1.32 GPM (5 l/min) is required for pilot flow.

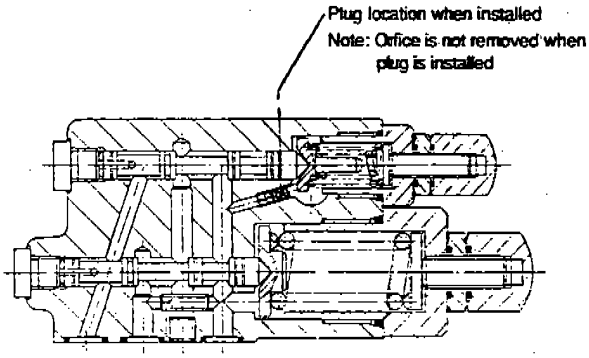
Differential pressure Δp:
settable between 145 and 435 PSI (10 and 30 bar)
standard setting 205 PSI (14 bar)

By unloading port X to tank, a zero stroke (deadhead) pressure of 260 PSI (18 bar) ± 30 PSI (2 bar) is achieved.

Valve options at Port »B«

(not included in pump, to be ordered separately)

Mobile valve block SP 12 (RA 64144)
Mobile valve block SP 18 (RA 64147)
Mobile valve block MP 18 (RA 64594)
Mobile valve block MP 22 (RA 64598)
Proportional valve 4WRE (RA 29060)



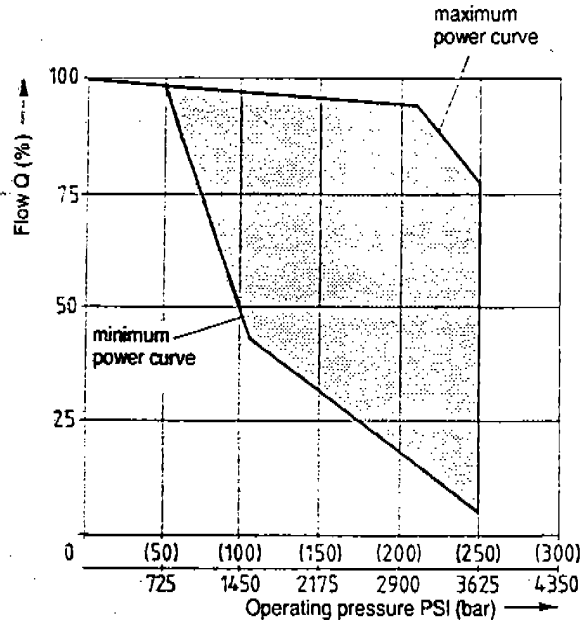
Size	t_{SA} (ms) stand by–250 bar 3625 PSI	t_{SE} (ms) 250 bar–stand by 3625 PSI	t_{SE} 50 bar–stand by 725 PSI
28	40	20	40
45	50	25	50
71	60	30	60
100	120	60	120

Constant pressure/flow/power control DFLR

In order to achieve a constant drive torque with a varying operating pressure, the swivel angle and with it the output flow of the axial piston pump is varied so that the product of flow and pressure remains constant.

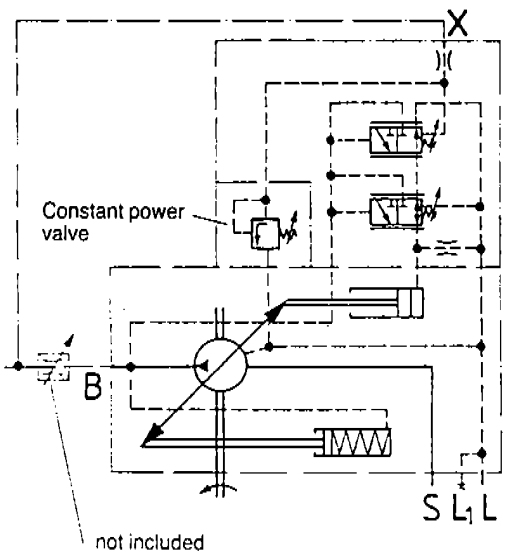
Below the power curve, it is possible to control the output flow.
Adjustable mechanical flow limiter from $V_{g\,max}$ to 50 % $V_{g\,max}$ only possible on model without through drive (N00).

Static operating curve



Begin of regulation at 725 PSI (50 bar)

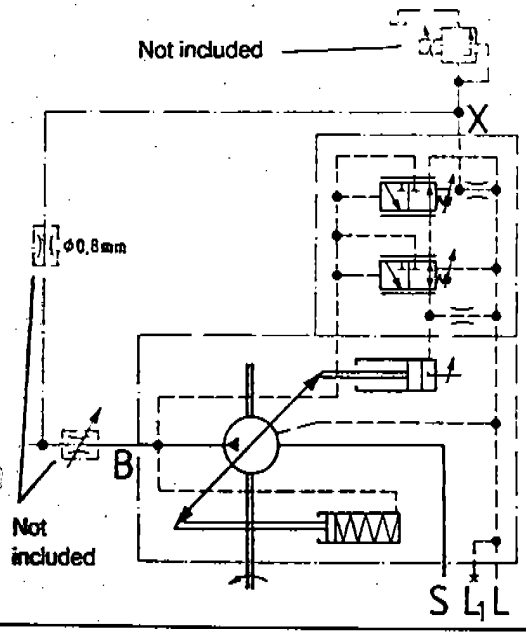
When ordering, please state power setting in clear text, e. g. 7 1/2 HP at 1800 rpm (5 kW at 1500 rpm).



A maximum of 1.45 GPM (5.5 l/min) pilot flow is required.

By unloading port X to tank, a zero stroke (deadhead) pressure of 260 PSI (18 bar) ± 30 PSI (2 bar) is achieved (»stand by«).

Optional remote pressure compensation (by using the DFR valve)



This option is assembled by customer at time of installation. Therefore the pressure relief valve, throttle valve and orifice ø0.031in (ø0.8mm) are not included with the DFR control. As a pressure relief valve we would recommend:

DBDH-6 hydraulic (RA 25 402);
DBET-30 electrical (RA 29 142);
DBETR electrical (RA 29 166).

Note that remote relief valve is used as a pilot on the "X" port of FR valve. So the FR spool must function even if load sensing is not needed.

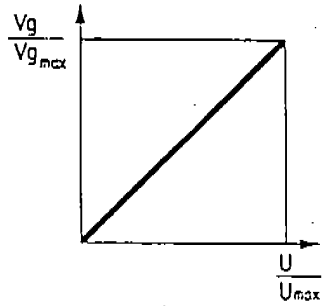
Throttle valve at "B" port is only used to illustrate load sensing or flow control if desired. This throttle is not necessary for proper operation of remote pressure control. The ø0.031in (ø0.8mm) orifice in the sensing line is needed, and must be supplied by the customer.

Max. line length should not exceed 6-1/2 ft (2m).

Electrical flow control FE

The pump displacement is controlled via an electrically operated proportional pilot valve.
The pump position feedback is realized via an inductive positional transducer.
The amplifier card VT 5036 (see page 11 and also RA 29957) regulates the pumpflow. This card is not an integral part of the pump and must be ordered separately.
Adjustable mechanic flow limiter from $V_{g\,max}$ to 50 % $V_{g\,max}$ only possible on model without throughdrive (N00).

Static operating curve

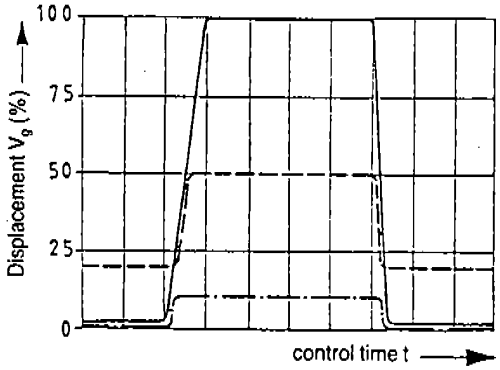


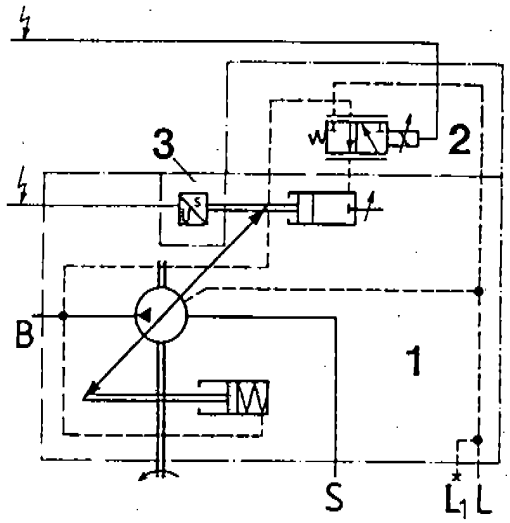
Hysteresis: ≤ ± 1 % of $V_{g\,max}$
Repeatibility: ≤ ± 1 %

Dynamic operating curve

Flow step between two different orifices upon sudden changeover.

Flow/time-curve





Design elements

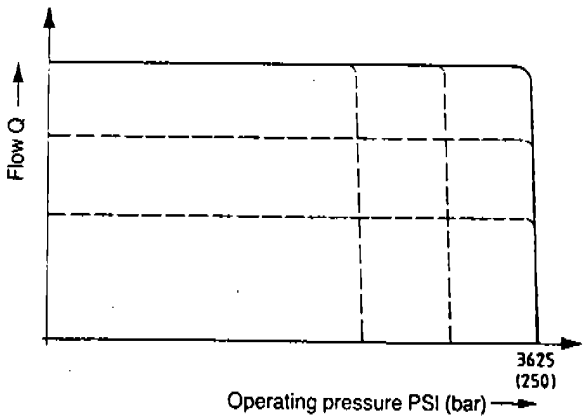
1) AA10VSO with hydraulic control
2) Control valve ENV 202-4-0
3) Inductive positional-transducer (feedback) type IW9-03-01

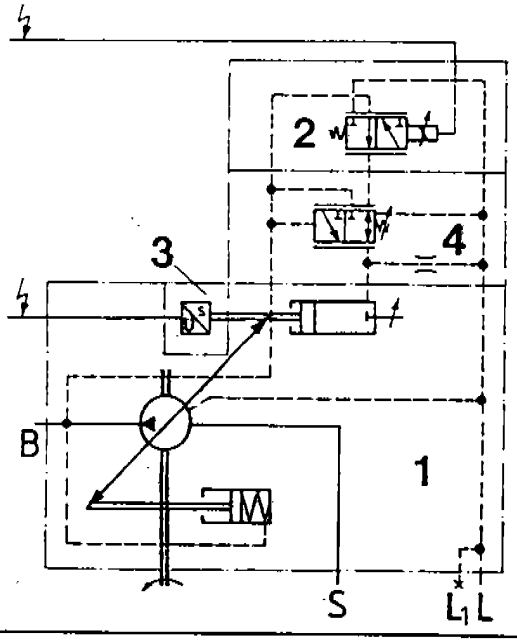
Technical Data

min. required pilot pressure	290 PSI (20 bar)
Control Valve	
current type	DC
supply voltage	24 V
load resistance at 68°F (20°C)	12 Ω
operating time	100%
ambient temperature	...122°F (50°C)
spool temperature	...302°F (150°C)
insulation per DIN 40050	IP 65
isolation class per VDE 0580	F
Inductive positional transducer:	
frequency range	1000 Hz... 5000Hz
inductivity	9.5 mH

Variation: electrical flow control with pressure compensation FED

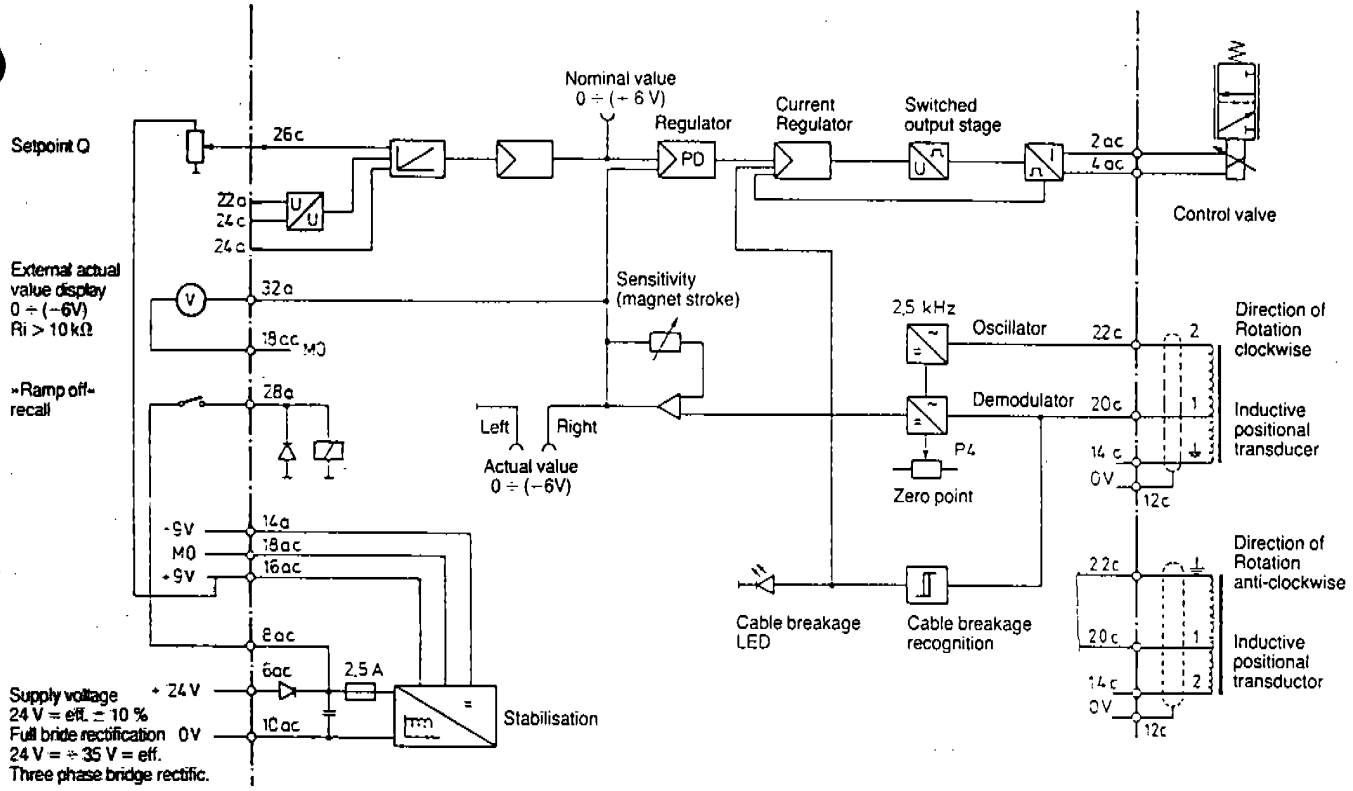
This variation incorporates an additional valve (Pos. 4) into the control, so that a hydraulic pressure compensation function is also available.





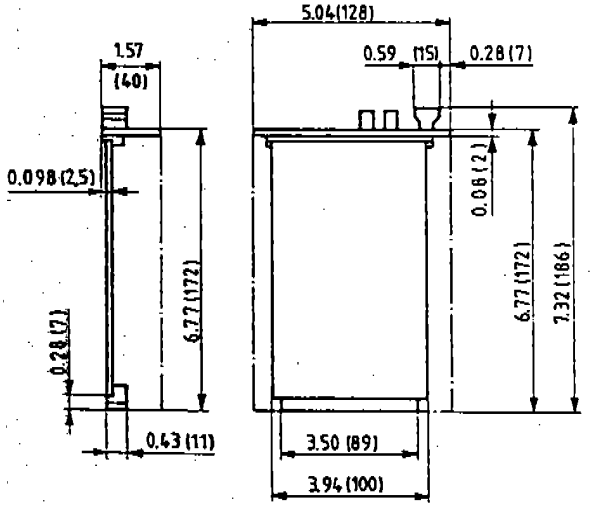
Proportional amplifier card VT 5036

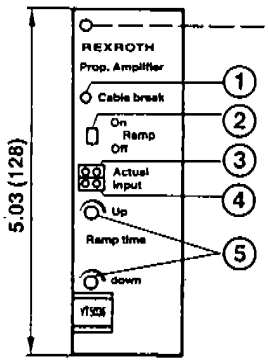
(see RA 29957)



- The amplifier may only be unplugged when switched off!
- Measurements to be made with a high resistance meter set on the voltage range!
- Measured (control) zero (M 0) is raised + 9 V with respect to 0 V of the power supply!
- M 0 may NOT be connected to 0 V of the power supply!
- The »earth« sign of the inductive positional transducer may NOT be connected to (0 V) of the supply voltage!
- Radio transmitter may not be placed within 3.6 Ft (1M) of this card!
- Command level inputs may only be switched with dry contact switches suitable for currents of < 1 mA.
- Screen all input lines. Leave one end of the screen open. Connect one end to 0 V of the supply line!
- Do not lay solenoid lines close to power lines!

Dimensions





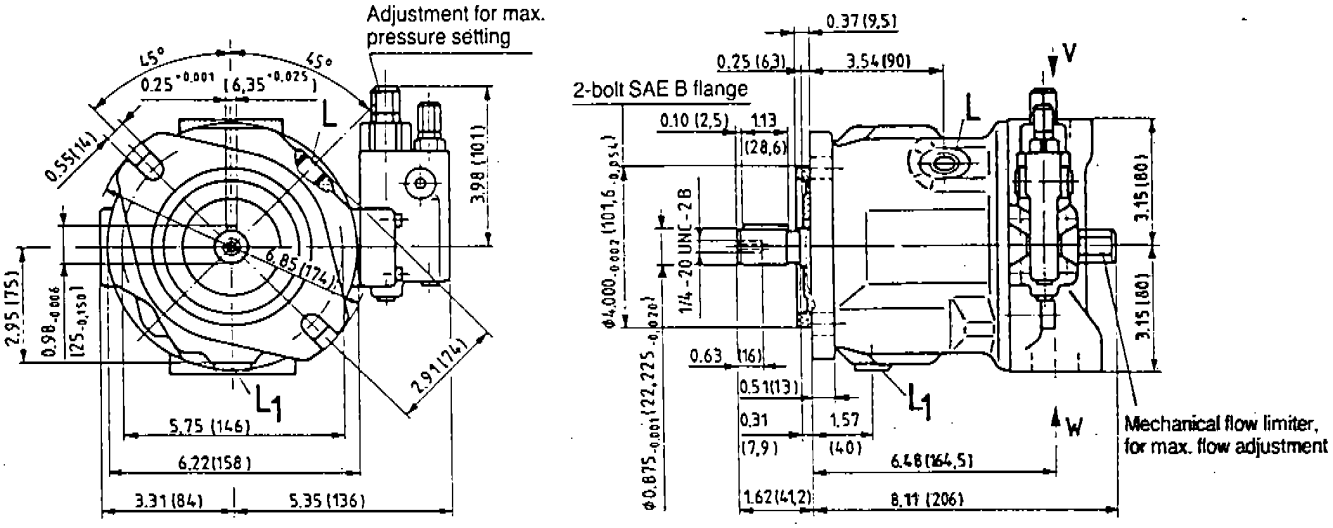
1 LED indicator for cable break
2 Ramp "on" or "off" switch
3 Test point 1 Feedback (actual voltage) 0.... 6V
4 Test point 2 Input (signal voltage) 0... + 6V
5 Ramp time setting from 0.03 to 5 sec = R5

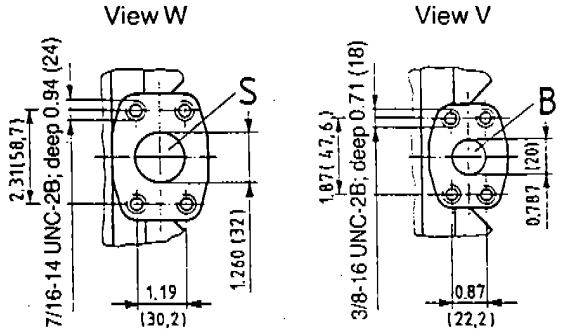
"up" or "down"

Unit dimensions, Size 28

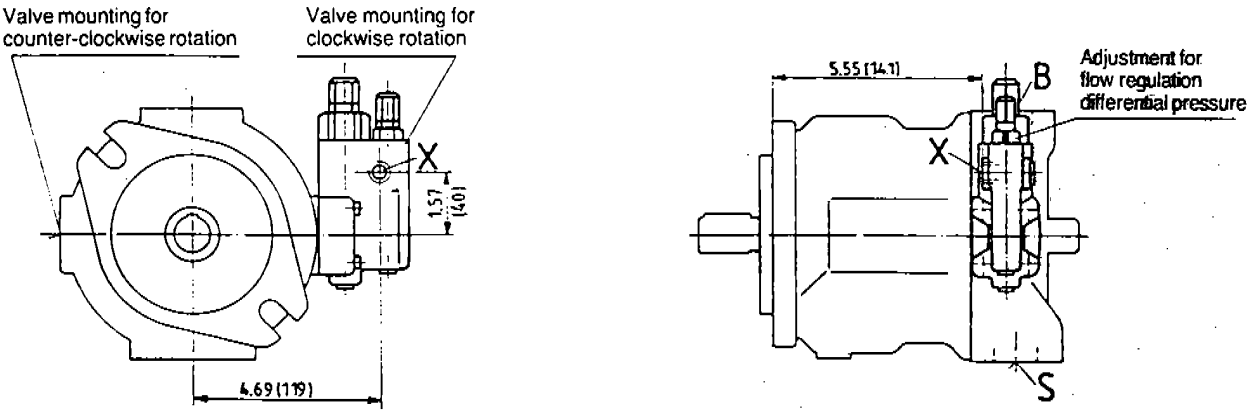
Model **N00** (without through drive)

Constant pressure compensator DR

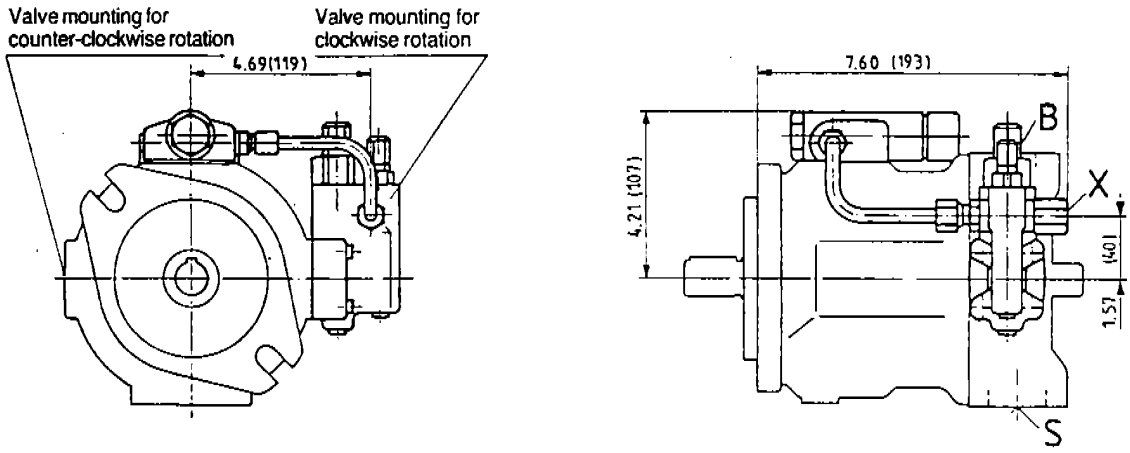




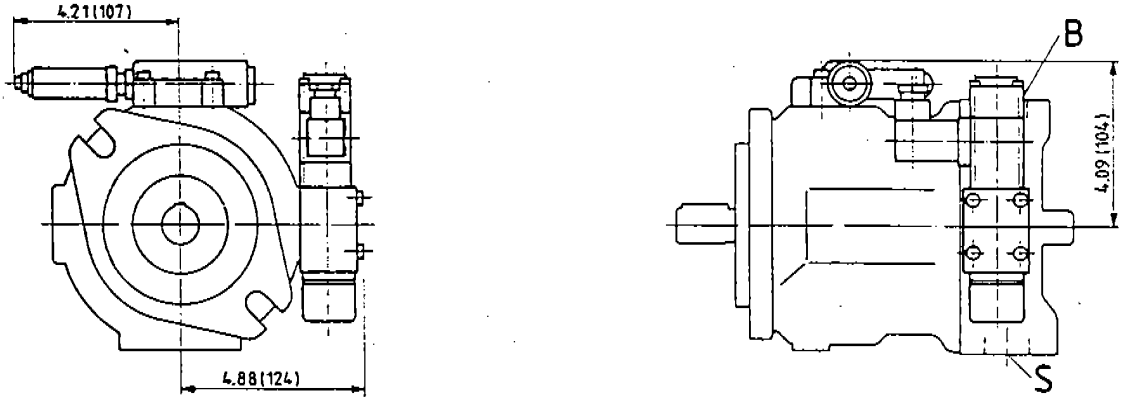
Constant pressure/flow compensator DFR



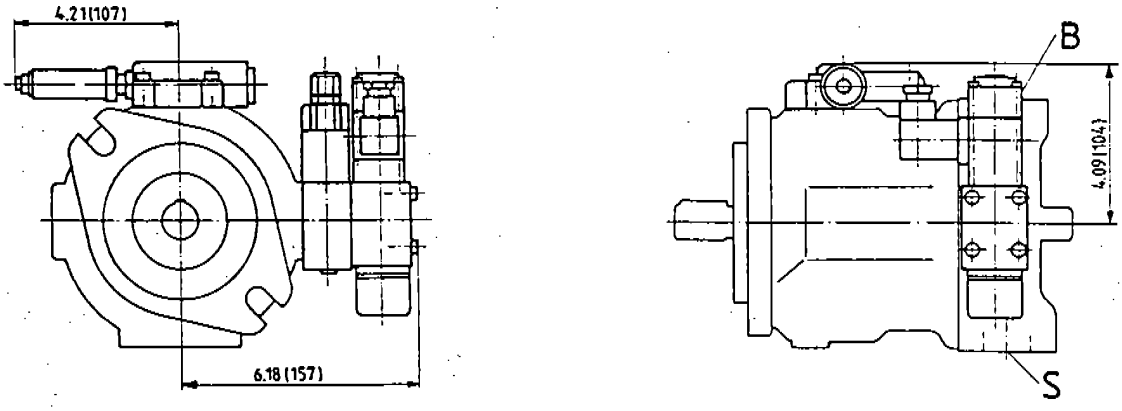
Constant pressure/flow/power control DFLR



Electrical flow control FE



Electrical flow control with pressure compensation FED



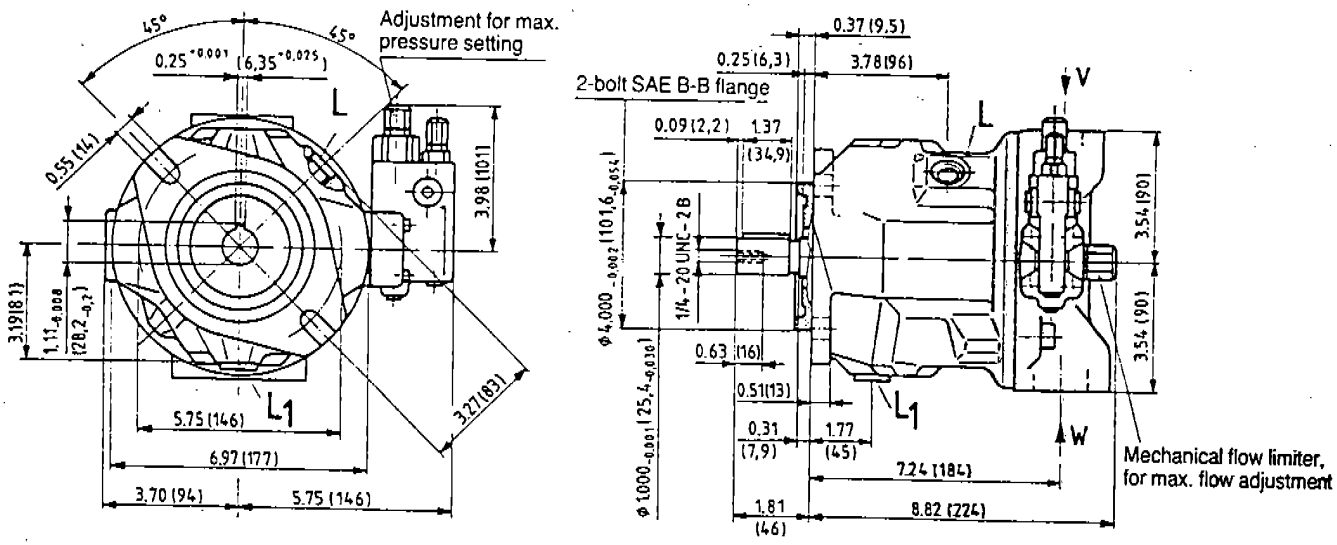
Port connections

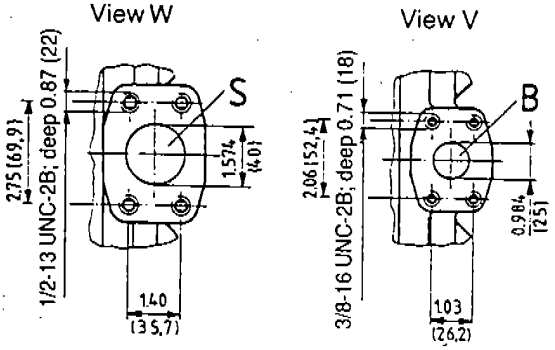
B	pressure port:	3/4" SAE flange (standard pressure range)
S	suction port:	1 1/4" SAE flange (standard pressure range)
X	pilot pressure port:	(for DFR and DFLR) 7/16-20 UNF-2B; deep 0.39(10)
L, L_1	case draining ports:	3/4-16 UNF-2B

Unit dimensions, Size 45

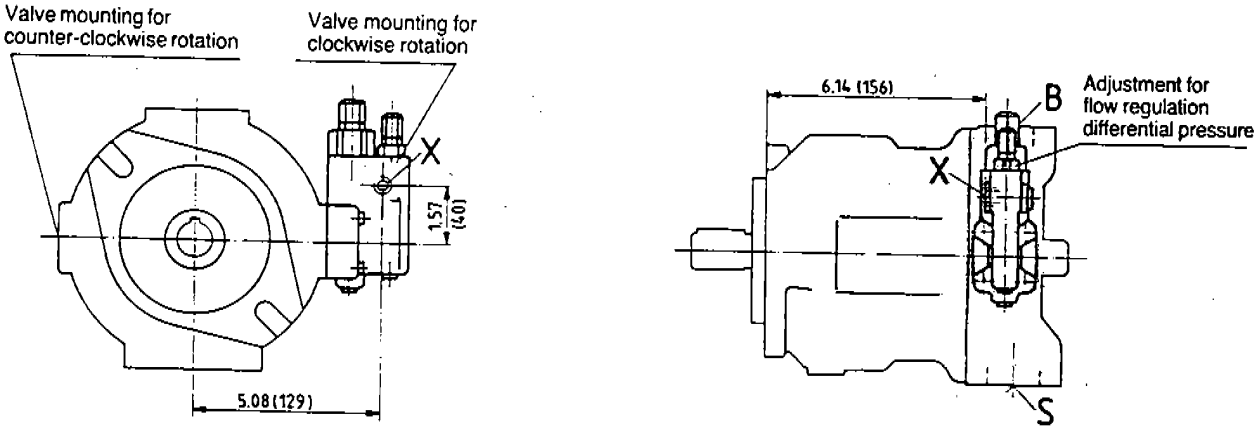
Model **N00** (without through drive)

Constant pressure compensator DR

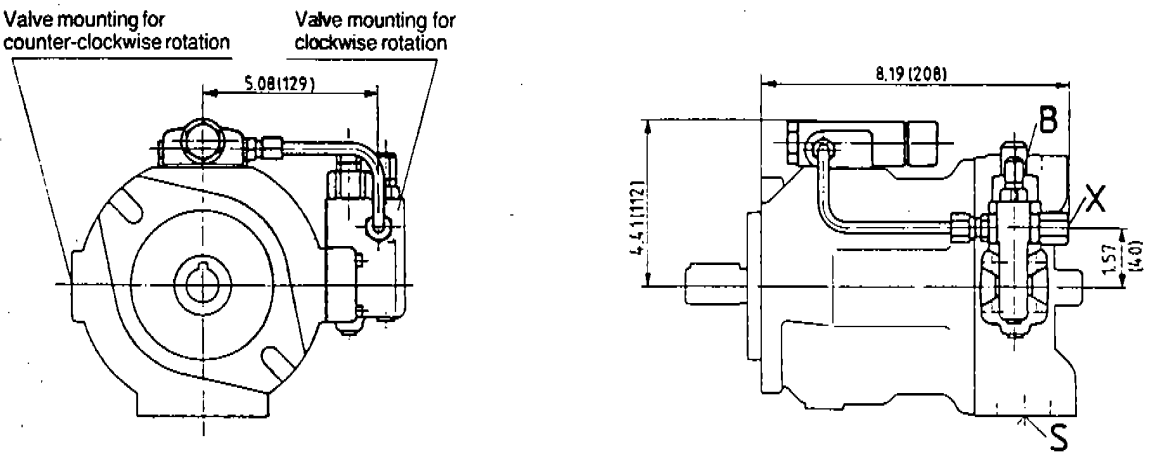




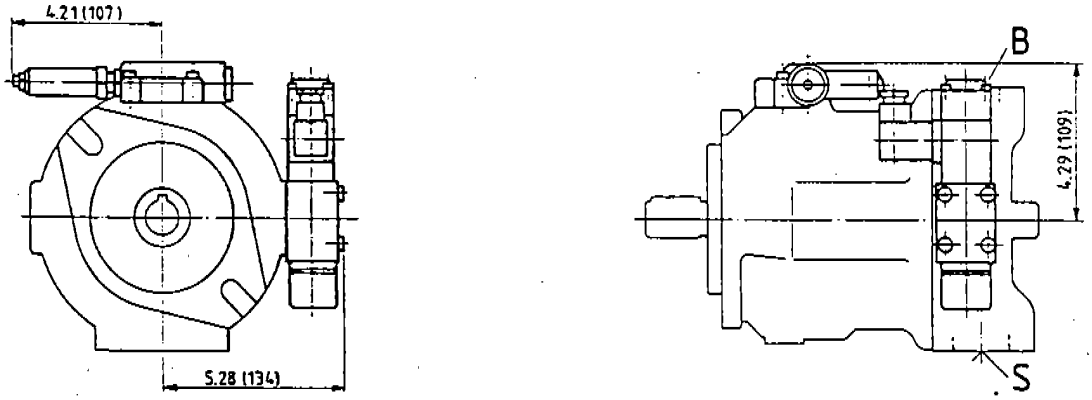
Constant pressure/flow compensator DFR



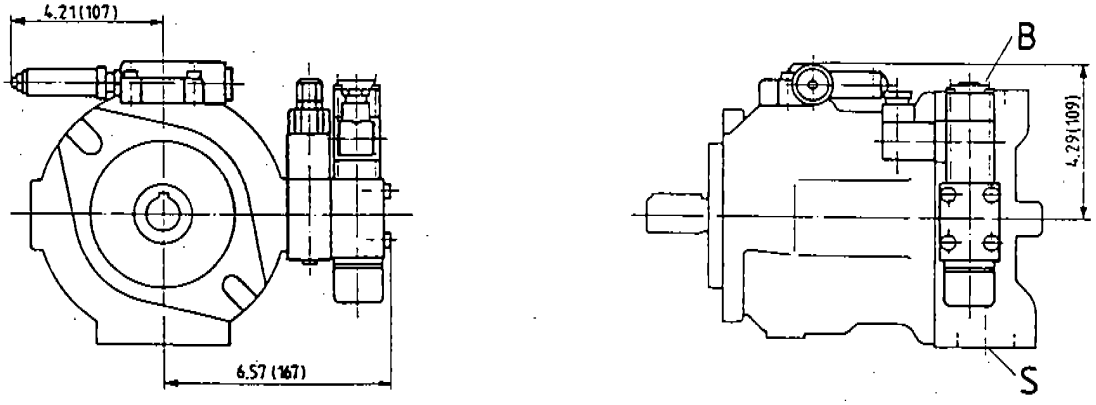
Constant pressure/flow/power control DFLR



Electrical flow control FE



Electrical flow control with pressure compensation FED



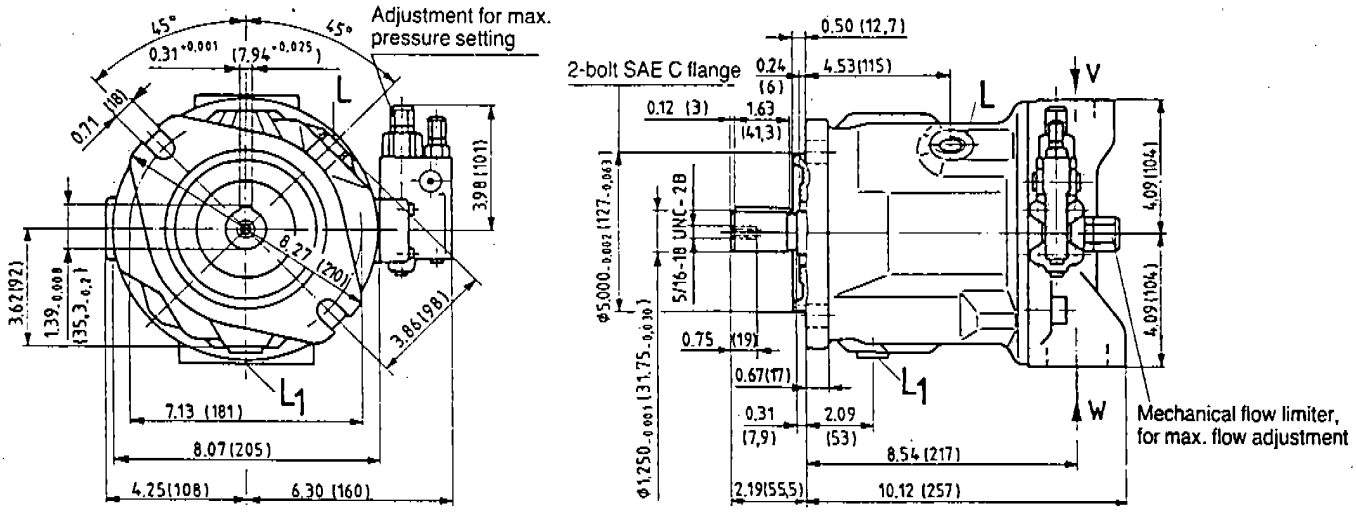
Port connections

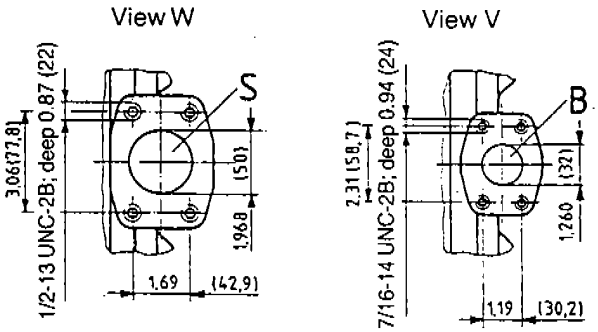
B	pressure port:	1" SAE flange (standard pressure range)
S	suction port:	1 1/2" SAE flange (standard pressure range)
X	pilot pressure port:	(for DFR and DFLR) 7/16-20 UNF-2B; deep 0.39(10)
L, L_1	case draining ports:	7/8-14 UNF-2B

Unit dimensions, Size 71

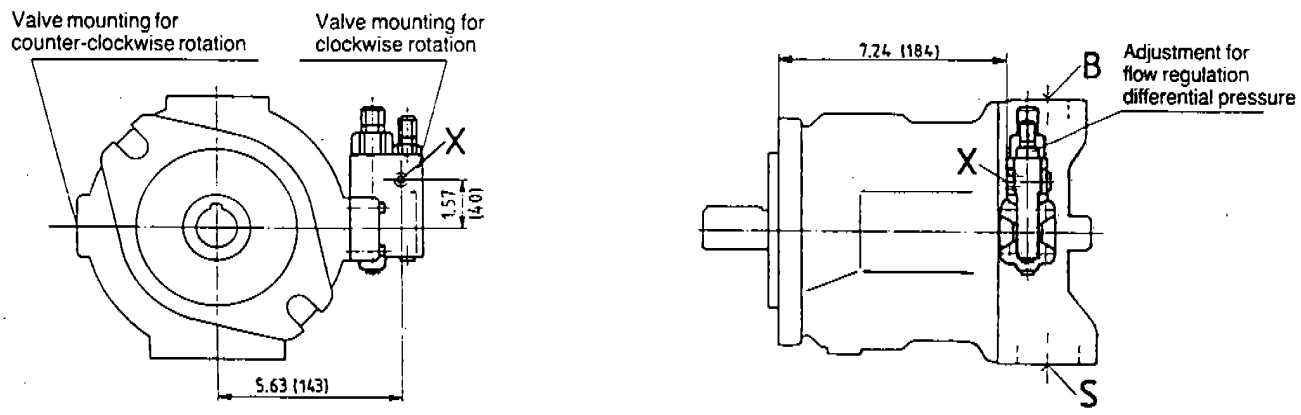
Model **N00** (without through drive)

Constant pressure compensator DR

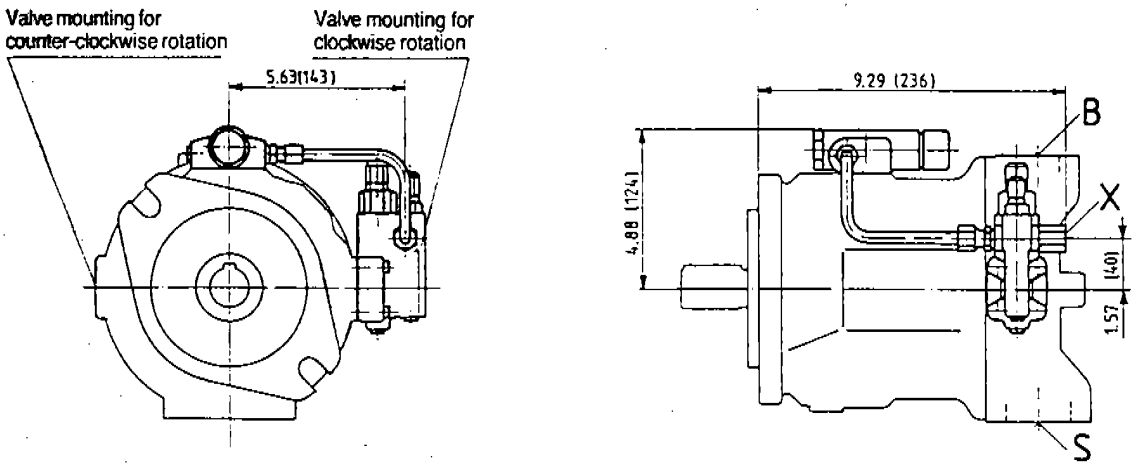




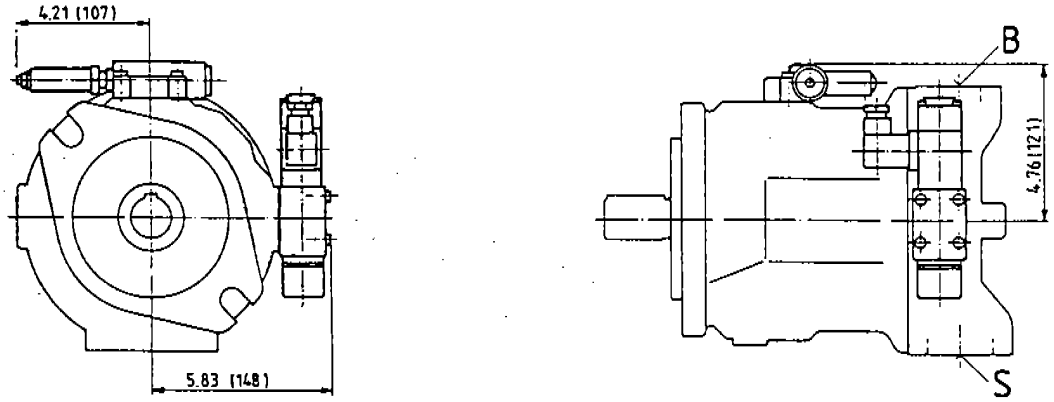
Constant pressure/flow compensator DFR



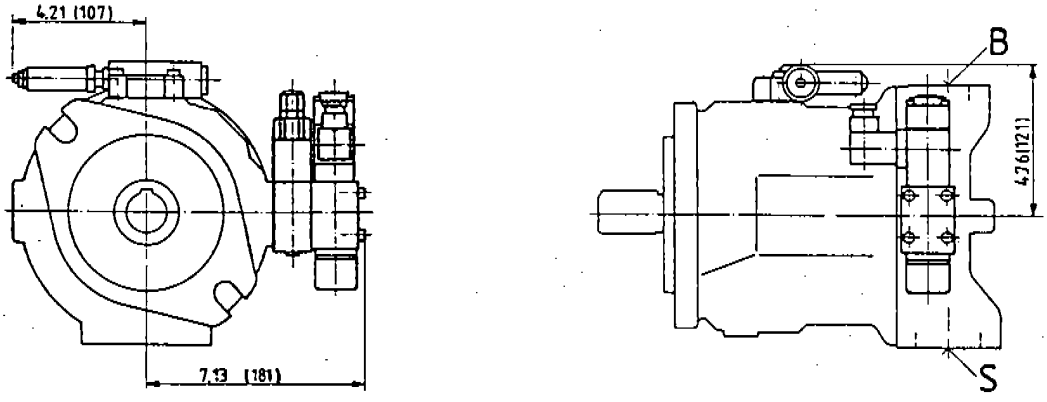
Constant pressure/flow/power control DFLR



Electrical flow control FE



Electrical flow control with pressure compensation FED



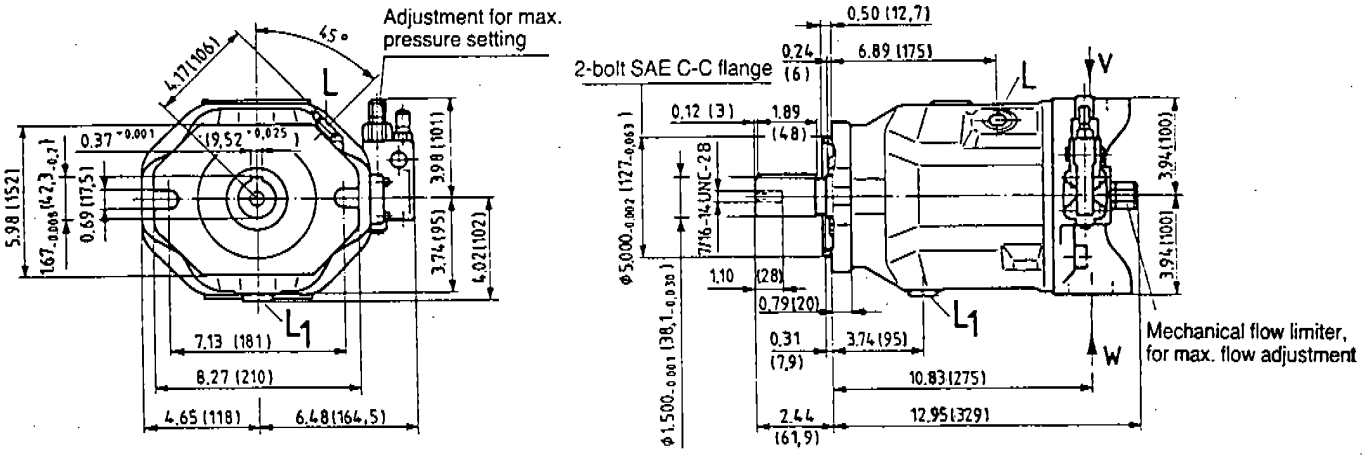
Port connections

B	pressure port:	1 1/4" SAE flange (standard pressure range)
S	suction port:	2" SAE flange (standard pressure range)
X	pilot pressure port:	(for DFR and DFLR) 7/16-20 UNF-2B; deep 0.39(10)
L, L_1	case draining ports:	7/8-14 UNF-2B

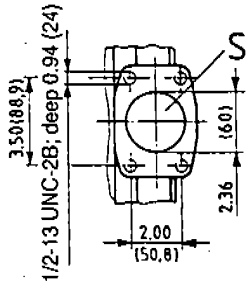
Unit dimensions, Size 100

Model **N00** (without through drive)

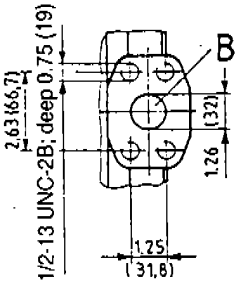
Constant pressure compensator DR



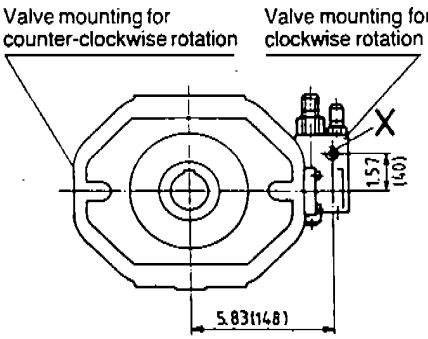
View W

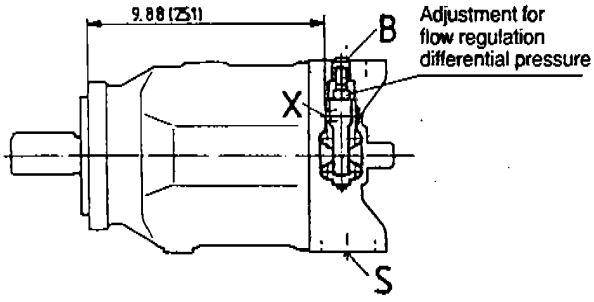


View V

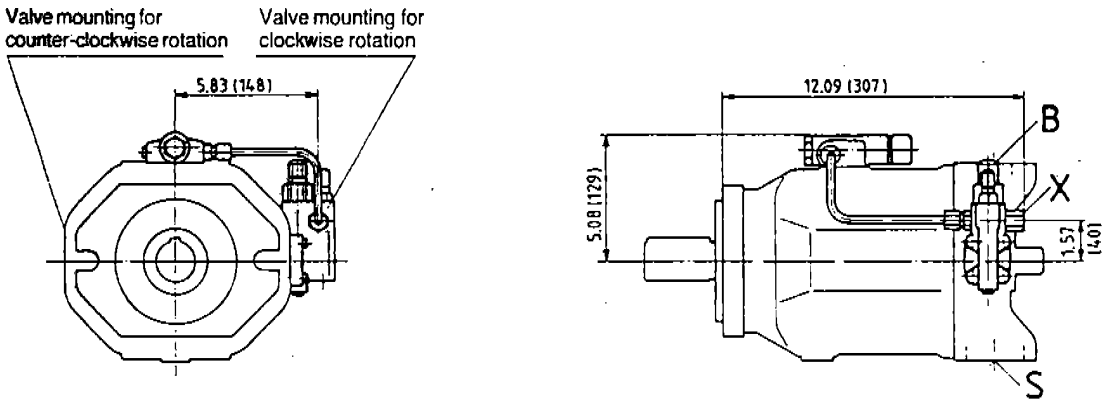


Constant pressure/flow compensator DFR

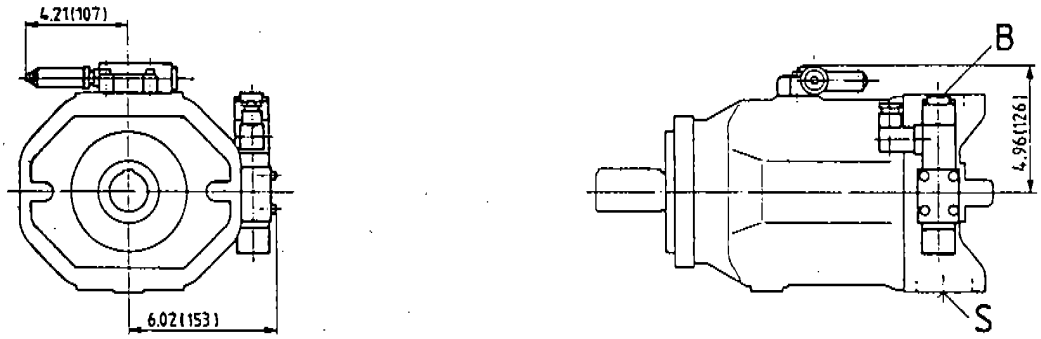




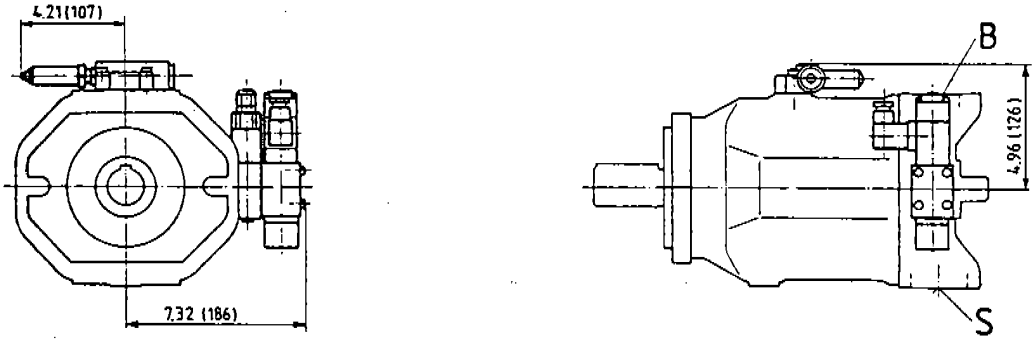
Constant pressure/flow/power control DFLR



Electrical flow control FE



Electrical flow control with pressure compensation FED



Port connections

B	pressure port:	1 1/4" SAE flange (6000 PSI, flange)
S	suction port:	2 1/2" SAE flange (standard pressure range)
X	pilot pressure port:	(for DFR and DFLR) 7/16-20 UNF-2B; deep 0.39(10)
L, L_1	case draining ports:	7/8-14 UNF-2B

Through Drive

Axial piston unit AA10VSO may be supplied with a through drive, as indicated in the ordering code page 2.

The Through Drive is determined by index (K01 – K08).

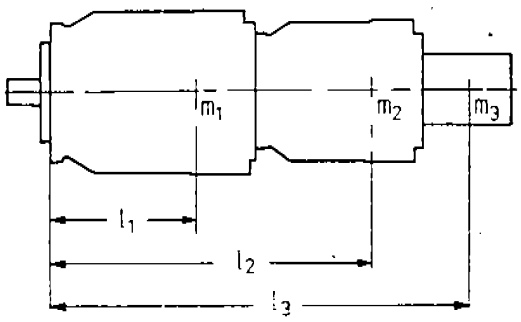
If the combination pumps are assembled in the factory, the ordering code consists of the individual pump codes connected by »+« signs.

Ordering Example:
AA10VSO 71 DR/30 R – PPA12K25 +
AA10VSO 28 DR/30 R – PPA12N00

If the second pump has not to be delivered resp. mounted, the simple type code is sufficient. The coupling, the seal and the fixing screws are a part of the delivery.

We recommend that no more than three individual pumps are coupled in series.

Permissible bending moment at mounting flange



$M_m = m_1 \times l_1 + m_2 \times l_2 + m_3 \times l_3$

Size			28	45	71
Bending Moment	M_m	lb-ft (Nm)	101 (137)	159 (216)	253 (343)
Weight (approx.)	M_1	lbs (kg)	33 (15)	46 (21)	73 (33)
Distance to center of gravity	l_1	in (mm)	4.33 (110)	5.12 (130)	5.91 (150)

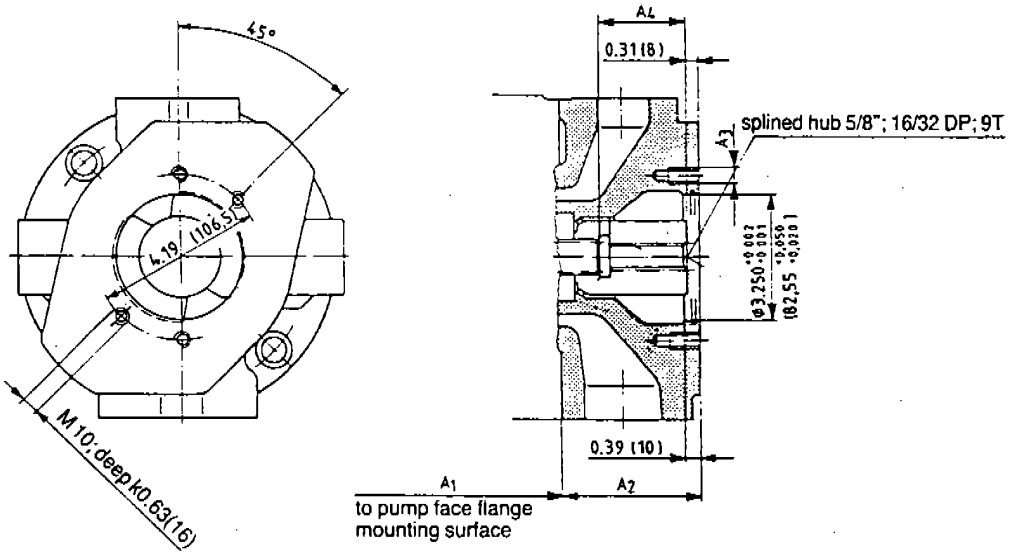
Permissible through drive torque

Size			28	45	71
Through drive torque*	M_D	lb-ft (Nm)	33 (45)	52 (70)	81 (110)

* assuming max. torque through the primary pump

Unit dimensions

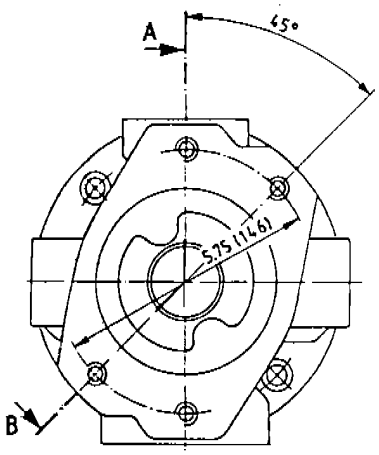
SAE A for mounting of secondary pump,
order code **K01**



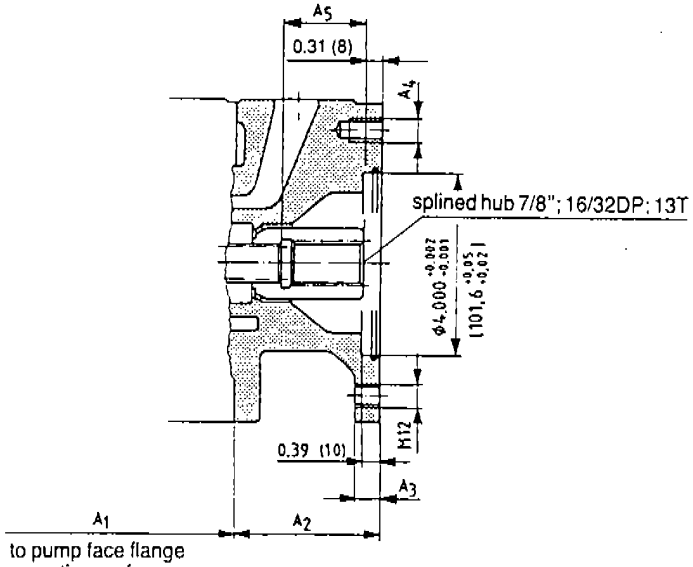
Size	A_1	A_2	A_3	A_4
28	5.268 (133.8)	2.76 (70)	M10; deep 0.63 (16)	1.49 (38)
45	5.858 (148.8)	3.15 (80)	M10; deep 0.63 (16)	1.73 (44)
71	6.960 (176.8)	3.54 (90)	M10; deep 0.79 (20)	2.05 (52)

SAE B for mounting of secondary pump,
order code **K02**

Primary pump sizes 45 and 71



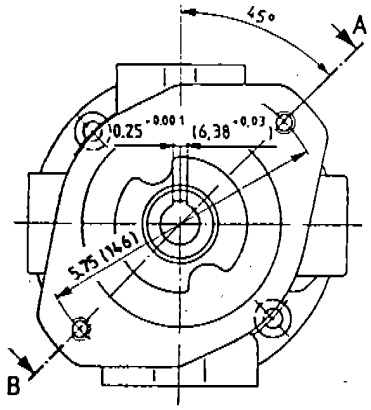
cutaway A – B

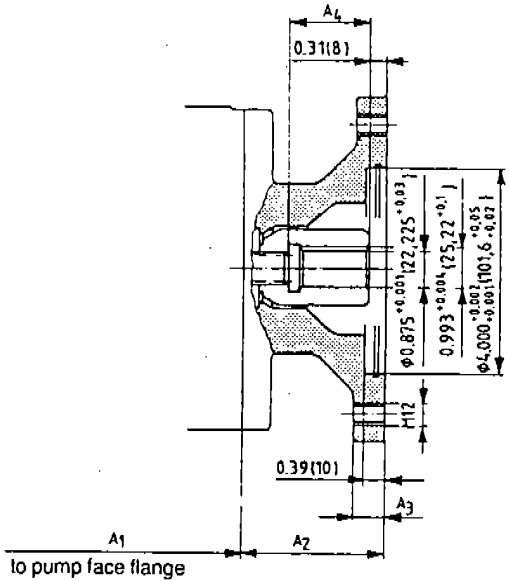


Size	A_1	A_2	A_3	A_4	A_5
45	5.858 (148.8)	3.15 (80)	0.55 (14)	M12; deep 0.71 (18)	1.73 (44)
71	6.960 (176.8)	3.54 (90)	0.71 (18)	M12; deep 0.79 (20)	2.05 (52)

Mounting of an AA10VSO 28;
order code **K03**

cutaway A – B

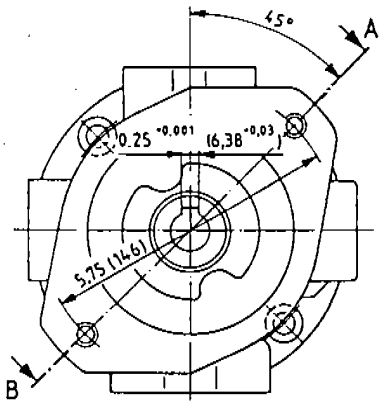




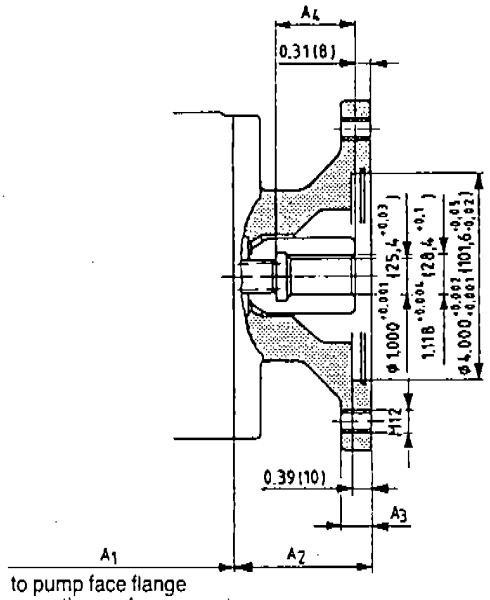
Size	A_1	A_2	A_3	A_4
28	5.268 (133.8)	2.76 (70)	0.59 (15)	1.49 (38)
45	5.858 (148.8)	3.15 (80)	0.55 (14)	1.73 (44)
71	6.960 (176.8)	3.54 (90)	0.71 (18)	2.05 (52)

Mounting of an AA10VSO 45;
order code **K 05**

primary pump sizes 45 and 71



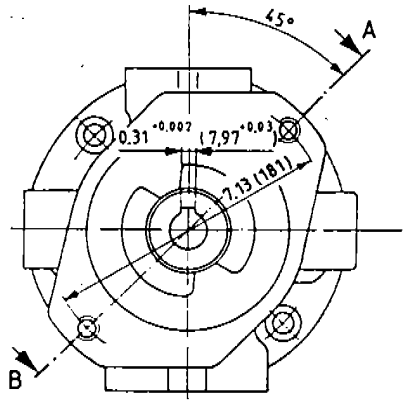
cutaway A – B

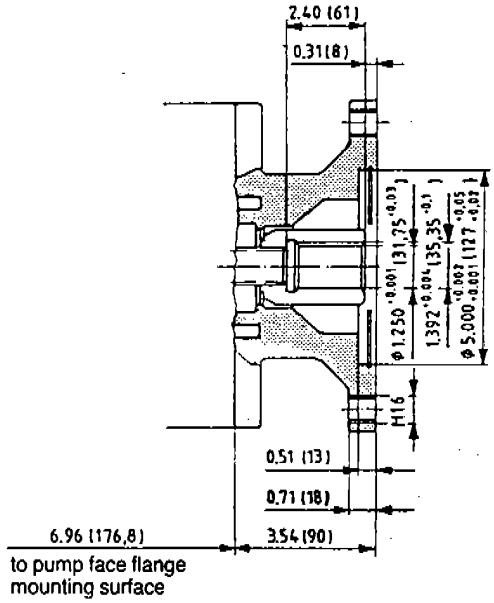


Size	A_1	A_2	A_3	A_4
45	5.858 (148.8)	3.15 (80)	0.55 (14)	1.73 (44)
71	6.960 (176.8)	3.54 (90)	0.71 (18)	2.05 (52)

Mounting of an AA10VSO 71;
order code **K 08**
primary pump size 71

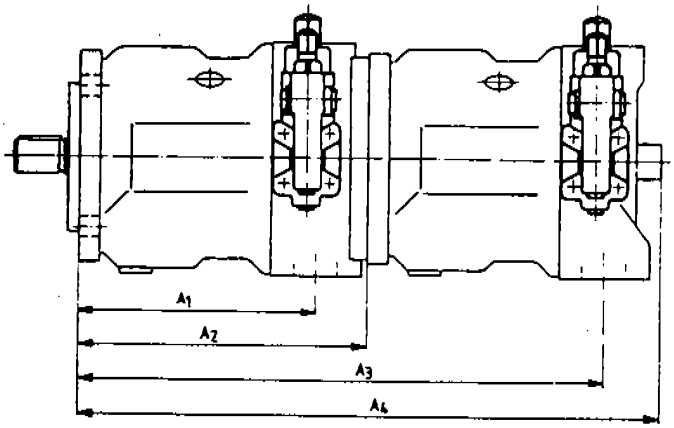
cutaway A – B





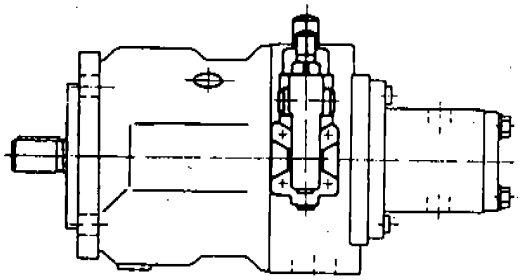
Unit dimensions, combination pumps

AA10VSO + AA10VSO



Primary pump / secondary p.	AA10VSO 28				AA10VSO 45				AA10VSO 71			
	A_1	A_2	A_3	A_4	A_1	A_2	A_3	A_4	A_1	A_2	A_3	A_4
AA10VSO 28	6.46 (164)	8.03 (204)	14.49 (368)	16.14 (410)	7.24 (184)	9.02 (229)	15.47 (393)	17.13 (435)	8.54 (217)	10.51 (267)	16.97 (431)	18.62 (473)
AA10VSO 45	–	–	–	–	7.24 (184)	9.02 (229)	16.26 (413)	17.83 (453)	8.54 (217)	10.51 (267)	17.76 (451)	19.13 (491)
AA10VSO 71	–	–	–	–	–	–	–	–	8.54 (217)	10.51 (267)	19.06 (484)	20.63 (524)

AA10VSO + Gearpump*



*Specify complete pump code see page 2