

INTAMIN INC

Intamin
"Children's Parachute Tower"
Non Kiddie

MANUAL

for

CHILDREN'S PARACHUTE
TOWER

SCHWARCKOPF

for post

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MANUAL

for

CHILDREN'S PARACHUTE TOWER

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GENERAL REMARKS

For best performance and safety, and long life of the equipment, a reliable preventive maintenance program must be carried out based on the maintenance guidelines.

For damages caused by failure to follow these instructions or by changes in the systems (especially by-passing of contacts and the like) no claims can be made to the manufacturer and/or seller.

For all work which hereafter is mentioned to require a "responsible person", the management must designate a technically competent and qualified person who performs or supervises the required tasks, observing all guidelines and regulations as described.

Normal and conventional technical maintenance items are not listed in detail here, but must be carried out to keep the rides in proper working order and as contribution to the safety of the whole installation.

Before start-up of operation, the rides must be checked and inspected for proper and safe functioning of every part.

Deficiencies occurring during operation must be rectified immediately. The operation must be shut down for the duration of this repair work.

The necessary barriers are to be mounted completely and are to be secured against undesired removal.

Unless the whole ride area, with the exception of loading and unloading platforms, is fenced off against public entry, special protective barriers must be provided. These barriers must be installed in places where any moving parts would come within reach of visitors.

During any maintenance, repair or inspection work on any part of the installation, the power supply must be shut off and locked off reliably. Steps must be taken to prevent anyone from energizing any part of the equipment while work is carried out or personnel may be endangered.

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Whenever work is done with the parachutes in the up position, the weight must be secured by mechanical means to prevent unexpected movement of any part while work is being done and persons are close, in case the hydraulics should fail in some way or controls might be operated accidentally. For instance, the transition piece holding the parachutes may be tied down with chains to prevent moving. Care must be taken that all such mechanical, temporary restraints are removed and clear before operation is resumed.

Electric power may be reapplied only after the persons working on any ride have completed their task, are clear of moving parts, have reinstated the ride into a safe operating condition and have personally reported the ride clear and safe for energizing.

If testing with power is required involving moving parts, the following precautions must be observed:

- (a) The entire testing operation must be supervised and closely controlled by one qualified and responsible person being trained and familiar with the portion tested and its possible behavior, side effects or dangers.
- (b) During life and moving tests the responsible person must be sure that everyone is out of range of the moving parts and that no one can enter this area unexpectedly.
- (c) All persons involved with such testing of equipment must be warned that danger may exist and that parts may move or unexpectedly may start moving.

The safety keys of the key switches must be kept by a responsible person.

For installation of the main power supply service, utmost care must be taken that all local safety precautions are considered.

All work performed on any installation is to be ordered and supervised by the responsible person.

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I INTRODUCTION

1. The Children's Parachute Tower is designed to lift passengers to a predetermined height, pausing at a half way point as an added attraction, and then proceeding to full ascent.
2. The parachute drop is accomplished in two stages; it consists of falling half of the descent distance, followed by dropping to ground level.
3. These movements are accomplished under the influence of hydraulic power and are therefore uniform and smooth in speed, acceleration, and deceleration.
4. The design follows, and employs, the application of structural, mechanical and electrical engineering as applied to a building, or a machine of high quality and performance. The structural design conforms to building code requirements and the mechanical and electrical components are of the highest quality, being the same ones as employed in industry. The design factor of safety ranges from 8 to 1 to 5 to 1.

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II THE MACHINE

1. The entire system of motion and control is dual - this means there are two of every critically loaded and moving part, as well as two of every electrical and hydraulic component that controls the moving parts.
2. Therefore, each parachute, hung separately from every other parachute, is suspended by two cables on two sets of pulleys. All the parachutes are set in motion by a hydraulic system initiated by a source of power using the highest quality components available. Hydraulic power is applied to two hydraulic cylinders, which, in turn, operate two separate cable and pulley systems that direct all the parachute movements.
3. Basically, this machine consists of a structural steel tower firmly anchored to a heavy, strong concrete pad. Arms extending radially at the top of the tower suspend the parachute and seat frames by means of dual cables, which pass over a series of pulleys, directing these wire ropes down the interior of the tower tube, where, through a transition piece, they are connected to two separate hydraulic cylinder systems, which, in turn, operate in unison to raise and lower six (6) parachute and seat frame assemblies, simultaneously.
4. Actually, there are six (6) parachute stations arranged

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around the tower. Each parachute serves a seat frame and each seat frame mounts two seats for two passengers. The seats are of high strength, reinforced material, securely locked into the frame. Each seat is equipped with a tough seat belt locked with a tamper proof buckle. Suitable guide cables, for each parachute system, insure stability of movement, preventing sway and twisting regardless of the direction of movement of the parachute.

5. The operator's control console is close to the tower for convenience and ready assistance and attention to all passengers. The hydraulic power system is confined in a small room remote from the tower.
6. All electrical and hydraulic lines are installed under ground in conduits and in an accessible trench, respectively. (The room and the underground supplies are installed by the customer.)

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III FOUNDATIONS

1. The foundation is a reinforced concrete pad 8" thick by 19' 0" diameter with steel bar re-enforcements throughout. The pad contains a 3' 0" diameter pit by 10' 0" deep, at its center, with a 2" high by 1" wide projection, or lip, at the open end to deflect drainage. The concrete should be cast in monolithic form, with suitable water barriers to prevent seepage into the pit. A sump pump is required, by customer.
2. Suitable studs are preplaced, before pouring the pad and pit, for anchoring the base of the tower firmly to the concrete.
3. In addition, an electrical conduit line, and a trench suitably covered for containing the hydraulic lines, must also be preplaced before pouring the concrete.
4. Reference to Intamin, Inc. Dwg. No. D-1028 will reveal the geometry of the pad and its pit. Also the specific loadings, due to dead weight and windstorm.

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IV INSTALLATION

1. The Parachute Tower must be installed upon a substantial concrete base, the design of which is furnished by Intamin, Inc. Fasteners for bolting the feet of the base to the concrete are furnished with jacking screws and jacking plates for plumbing of the tower tube and positioning of the hydraulic cylinders.
2. Assembly drawings are furnished for proper combination of parts and fittings at the erection site. Care must be employed to assure proper positioning of the "basic leg" of the tower base to the trench on the concrete pad and the positioning of the hydraulic cylinder mounting frame.
3. To plumb the tower, the hydraulic cylinder mounting frame must be temporarily clamped in position. Two plumb bobs, suspended from the extreme top of the center of the tube, the other at the extreme of the inside radius of the tube at least 1/2 inch off the interior tube wall and precisely positioned halfway between the first two parachute stations measured counterclockwise from the "basic leg" of the tower base. Details of this arrangement are given in assembly

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drawings furnished by Intamin, Inc. Particular attention should be given in favor of locating the cylinder frame precisely - the tower plumb position is secondary.

4. Plumbing, with the bobs, is accomplished by adjusting the two jack screws in each base foot simultaneously. Once accomplished the lock nuts on the jack screws should be torqued down tight, followed by locking up the two (2) nuts on each foot on their studs. The feet of the base should be at least 3/4" off of the concrete pad when plumbing is accomplished, in order to allow ample space for a thick section of grouting which is finally applied. See Dwg. No. D-1124.
5. To install the seat frame guide wires, two plumb bob lines are dropped from the peripheral beams, which connect to the radial arm assemblies, at the top of the tower. Holes for receipt of eye bolts are to be used to anchor the plumb bob cord. The bobs will locate the points in the concrete pad for the studs that will retain the guide wires.
6. Caution: The pair of studs for each seat frame must be 48" apart and on a centerline through the two wire ropes

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that raise and lower the seat frame. This means that the holes in the aforementioned beams, from which the plumb bobs are suspended, must also be 48" apart and on a common centerline with the two wire ropes. Plus or minus 1/4" variation from 48" can be tolerated.

7. Installation of the guide wires should be such that when all seat frames are at the ground position, resting on their shock absorbing feet, the guiding caster at the bottom of the transition member, inside the tower tube, should be 3" above the bottom edge of the tube. This set up is with the cylinder pistons fully retracted.

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V ADJUSTMENT

1. The installation of the hydraulic cylinders to their support frame through the trunnion system is clearly shown in assembly Dwg. No. D-1127. The target and plate assembly also shown on this drawing require only two important adjustments. First, the guide wheels which track the plate are adjusted to firmly (but not tightly) hold the target plate.
2. This is done by slightly loosening the stop nuts on the ends of the long bolts that retain the wheels and with a wrench turn the eccentric bushings on which the wheels are mounted. By an eccentric action the clearance between the wheels and tracks can be changed.
3. The important aspect is to get a minimum running clearance, not binding, by moving the plate from one extreme position to the other. Second, the sensor mounting plate is positioned so that there .080" to .100 clearance between the targets and their respective sensors. This is checked out by also moving the plate from one extreme position to the other, manually; using the hydraulic power system to do this could result in damaging all the sensors, if they are set too close to the targets!

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4. Once the "target to sensor" clearance is established and manually checked, the sensor mounting plate is spot drilled (5/16 dia.) through the two holes provided for bolting, then spot through (3/16 dia.) the additional two holes provided for dowel pinning. The angle bracket that retains the sensor mounting plate is also spot drilled through (3/16" dia.) the two holes provided, for dowel pinning.
5. Installation of the passenger seats and their seat belts is done together. First the seat is positioned into the space provided by a seat bar and a back bar. Second, holes in the seat are spot drilled (5/16" dia.) through the seat into the bar. Carriage bolts with lock nuts are assembled thereto with the seat belt anchor plates between the seat and the seat bar. Third, holes are spot drilled (5/16" dia.) through the bar into the back of the seat. Fourth, carriage bolts and lock nuts are applied.

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VI HYDRAULIC SYSTEM

A. Installations

1. Refer to Dwg. No. C-1114. It is imperative that the materials and specifications listed be strictly adhered to.
2. It is of the utmost importance that all pipes, hoses and fittings be cleaned and inspected free of foreign material! The slightest laxity in this behalf can readily result in a failure of the system.
3. Make certain that the oil specified is used in the reservoir.
4. Check the motor voltage against the power supply for correspondence.
5. Before running the motor at full speed, "jog" the starter to make certain that the motor is rotating in same direction as the pointing arrow on the oil pump.

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B. Start Up

1. Refer to Dwg. No. C-1112 and figure 2.
2. Close valve #9; close the three valves #14; close valve #12.
3. DANGER: CLEAR THE AREA OF PERSONNEL!
4. Start the motor. If pressure does not come up immediately, shut the motor off and prime the pump with clean oil from the reservoir supply drum.
5. Relief valve #4 has been set to 1200 PSI and relief valve #10 has been set to 2000 PSI, at the factory.
6. With parachutes down (piston rods extended from their cylinders), depress start button. Parachutes will rise, piston will retract into cylinder. This action can be stopped immediately by pressing the "emergency stop" button.
7. If parachutes do not rise, check gauges #5 on valves #4 and #10. They should read 1200 PSI and 2000 PSI respectively. If they do not, set them to do so by setting both valves to 2000 PSI, followed by lowering pressure in valve #4 only to 1200 PSI.

(Note: 1200 PSI may vary from a requirement of 1100 to 1300 PSI, depending upon the frictional losses in the system.)

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8. Operate to lower the parachutes (pistons extend out of cylinder): slowly open flow control valves #10, one at a time, until the velocity of descent of the parachutes is of a slow, reasonable amount, not free falling at this point of start up. This requires repeated cycling of the parachute ascent and descent for observation and adjustment of the velocity. It may be necessary to remove all air trapped in the hydraulic system. A noisy pump will indicate air is in the system.
9. Once the proper adjustments are made on the relief valves #4 and #10, and on the flow control valves #14 they should be locked to prevent any movement of the final setting. Locking of valve #14 will be done later on as the start up and adjustment periods progress.
10. At the final descent to the ground area, flow control valve #12 is adjusted to allow an even slower descent during the remaining few inches to the shock absorbers. This latter action will always slowly direct the seat frames to the lowest point of descent, for passengers ease of exit from their seats.

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11. The deceleration of the parachutes, at the mid point of descent and at the ground area, is controlled by the time interval required to shift the spools in the main valves, #7 and #8, from their fully opened to their fully closed positions. This time interval is related to the pilot control valves, situated on the side of the main valves and is adjusted by a screw located at one end of the pilot choke, which in turn is situated between the pilot valve and the main valve.
12. A second adjusting screw in the pilot choke, directly opposite to the one mentioned in paragraph 11, is for adjusting the rate of shifting the main valve spools from their fully closed to their fully opened positions. Thus controlling the rate of aceleration.

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VII SENSOR SWITCHES AND TARGETS

A. Set Up

1. The sensor switch mount plate must be positioned so that all sensors are .080" to .100", from their respective targets.
2. All pulse targets are riveted to the target plate and therefore have a permanent position.
3. All other targets, after location in their proper positions, are screwed to the target plate, followed by wiring (with stainless steel wire) each pair of screw heads to each other, in order to secure the target.

B. Positioning of Movable Targets

1. Rows of screw clearance holes are provided on the target plates for setting a target for operation of its respective sensor switch.
2. Each row of target screw clearance holes is clearly stamped with a number that relates a target to its respective sensor switch.
3. Reference to Fig. 1 will show the positioning of each target. Note: There are two separate sets of sensor switches and a corresponding target plate for each set.

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One set of four (4) sensor switches and its target plate is identified by the suffix "A", the other set of five (5) sensor switches is identified by the suffix "B". A spacer is installed at the position marked "S4B" on plate "A".

Stampings on the target plate are for "A" only, and "B" only, or for "A" and "B", as the choice of which plate is to be "A" and which to be "B" is made.

4. There are two separate target plates, one mounted on each of the two cylinders and made to move with the piston rods. Thus, the position of a particular target, on its target plate, determines at what point in the piston stroke the corresponding sensor switch will be passed by the target and thus activated. An activation of the switches by the targets signals the hydraulic power package valves to direct the motions of the piston rods and therefore the movements of the parachutes.
5. Only those sensor switches and targets S2A, S2B and S3A, S3B are duplicated for "safety backup" to stop the chute drop at mid way and at ground levels. Sensor switches and targets S1A, S4B and S5B are for recycling, stopping the chute at mid point rise, and at full height, respectively.
6. Reference to Fig. 1 will serve as a guide to position

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the targets. And in conjunction with Dwg. No. C-1112, Hydraulic Power Package, adjustments of the target positions will allow the proper timing of the operation of their respective sensor switches; while adjustment of the pilot chokes in valves #7 and #8 will determine the rate of slowing down (deceleration) of the chutes from positions 3 to 4 and 5 to 6, on Fig. 1.

7. The rate of "free" drop from 2 to 3 and from 4 to 5 is controlled by the flow control valves #10 (see Dwg. No. C-1112). These valves, labeled A, B, and C are opened in alphabetical sequence until the desired rate of "free" drop, or fall, of the chute is obtained.
8. The approximate location of a particular target is at the center hole of the line of holes provided for that target - it is best to start here. Then, if the positions of the parachutes are not as outlined in figure 1, the targets can be moved one or more holes, in either direction, to obtain their proper location. Note: shifting the target one hole space is equivalent to changing the position of parachute reaction by 1 1/4".
9. All targets must have their holding screws tightened and secured with stainless steel wire, laced through each pair of screwheads.

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VIII OPERATION

1. Passengers are admitted to their seats, whereupon their safety belts are latched and adjusted. Note here that a safety belt cannot be released unless a pin type "key", held by the operator, is inserted into the keyway hole of the belt buckle.
2. A push button, on the operator's console, upon being depressed, initiates the ascent of the six (6) parachute stations, containing six (6) pairs or twelve (12) passengers. Halfway up there is an automatic pause for a predetermined interval followed by the remaining travel to the top of the tower. A pause here is preparatory to a fall of one half the distance to the ground accompanied by an intermediate hydraulic deceleration. A predetermined pause occurs at this point, followed by a second fall to ground level; also with deceleration, but followed by a gentle slow movement to shock prevention stops.
3. An emergency stop push button on the control console allows for immediate stopping of the ascent and descent phases. A special hand valve, at the power package, allows bleeding of the hydraulic oil caught and locked in the

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system, either by malfunction or emergency stops, so that all passengers may be slowly and safely brought to ground level from any position above the ground of their seats in the parachute frame.

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IX SAFETY PROVISIONS

1. The hydraulic system is controlled by two solenoid valves - they are in parallel electrically, but in series hydraulically; the reason for the latter is that in the event of a failure of one valve the remaining valve takes over. If the chutes are at ground level, there is no problem. If the chutes are off the ground, their motion will be stopped. It is only necessary then that the operator open a small bleed valve, which allows oil to drain out of the cylinders while the parachutes slowly descend.

The circuitry is such that any malfunction of the control valves will shut down the entire hydraulic system and prevent further operation until corrections are made.

2. All wire ropes, rope anchors, and rope fittings are of highest quality obtainable. They have been applied with a safety factor of 8 to 1.

OPERATING AND MAINTENANCE INSTRUCTIONS
AIRLINE ROTARY HYDRAULIC POWER UNITS

ALL AIRLINE Hydraulic Power Units are factory tested and adjusted and are ready for immediate operation when installed.

START UP PROCEDURE

The following precautions should be observed when installing and operating the system.

1. Clean the system thoroughly before connecting to power unit.
2. Connect the proper designated electrical power source, per motor nameplate.
3. Check motor for proper rotation as specified by directional arrow on pump.
4. Jog motor on first start-up to establish suction. Never operate pump for more than a few seconds unless it is full of oil.
5. Set relief valve adjustment at 100 PSI pressure setting on start-up. Run for five minutes and check for leaking system. Slowly increase pressure in 500 PSI increments and check for leaks as you go up to system pressure.
6. Bleed all air from system to insure quiet operation.
7. Clean suction strainer frequently during first period of operation. Noisy operation is a sign of clogged filters or air entering a loose suction line.
8. Check fluid level every 4-5 hours first day, twice a day first week, every day thereafter. Bring up to specified level with filtered oil of good quality. Reservoir should be checked for presence of water or emulsification of oil. If presence is noted, completely drain and flush system. Refill with new oil. Before restarting system check oil supply level in reservoir.
9. Four-way pilot operated control valves require 40-60 PSI back pressure to operate. A back pressure valve may be required to operate the 4-way valve.
10. Check filters after first 25 hours then after each 500 hours, or more frequently if dirt conditions of the particular installation make it desirable. If indicator type filter is used, change when indicator shows need.

TROUBLE SHOOTING HINTS

PUMP NOISY

1. Intake blocked
2. Air leaks in suction or shaft seal. Air drawn in through inlet due to low oil level.
3. Entrained air
4. Fluid viscosity too high
5. Pump running too fast
6. Suction filter too small
7. Loose parts in pump
8. Worn or damaged parts
9. Foreign matter drawn into pump

NO PRESSURE OR LACK OF PRESSURE

1. Relief valve not working properly (disassemble and clean)
2. Broken lines

PUMP DOES NOT DELIVER FLUID

1. Low fluid level in reservoir
2. Suction line blocked
3. Pump not priming
4. Pump not being driven properly or in wrong direction

FLUCTUATING FLUID PRESSURE

1. Air entrainment
2. Dirt passing through relief valve

EXCESSIVE HEATING OF FLUID

1. Relief valve set too high
2. Unloading valve improperly set
3. System may require heat exchanger
4. Restricted lines

MAINTENANCE HINTS

The following regular maintenance steps will usually insure long trouble-free service by these units:

1. Every 250 operating hours, clean suction strainer and air cleaner in solvent. Also, replace elements in micronic filter.
2. As required
 - a. Grease motor according to manufacturers recommendations.
 - b. Under good service conditions a good quality oil should last 5000 hours. Poor quality oil 1000 hours.

HYDRAULIC OIL

- a. Any mineral base hydraulic oil of turbine quality should be used. However, an oil high in anti-wear additives is suggested as it will contribute to long life.
- b. Recommendations (Anti-Wear)

American Rykon Series
Mobil DTE 24 or 26
Shell L. D. Hydrak
Texaco Rando A-HD or C-HD or equal

FIRE RESISTANT FLUIDS

Caution:

Unless pump unit is specifically designed for fire resistant fluids of a particular type check with the fluid manufacturer for conversion procedure.

The equipment has operation limitations which in some cases is not the same as for use with Petroleum base oils. Check with equipment manufacturer to assure satisfactory operation with the type of fire resistant fluid to be used.

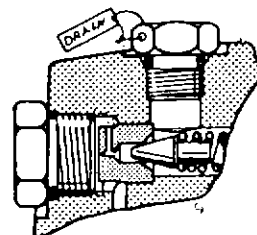
For pump units specifically designed for a particular fire resistant fluid the operating and service procedures outline above are applicable.

VICKERS

Service Parts Information

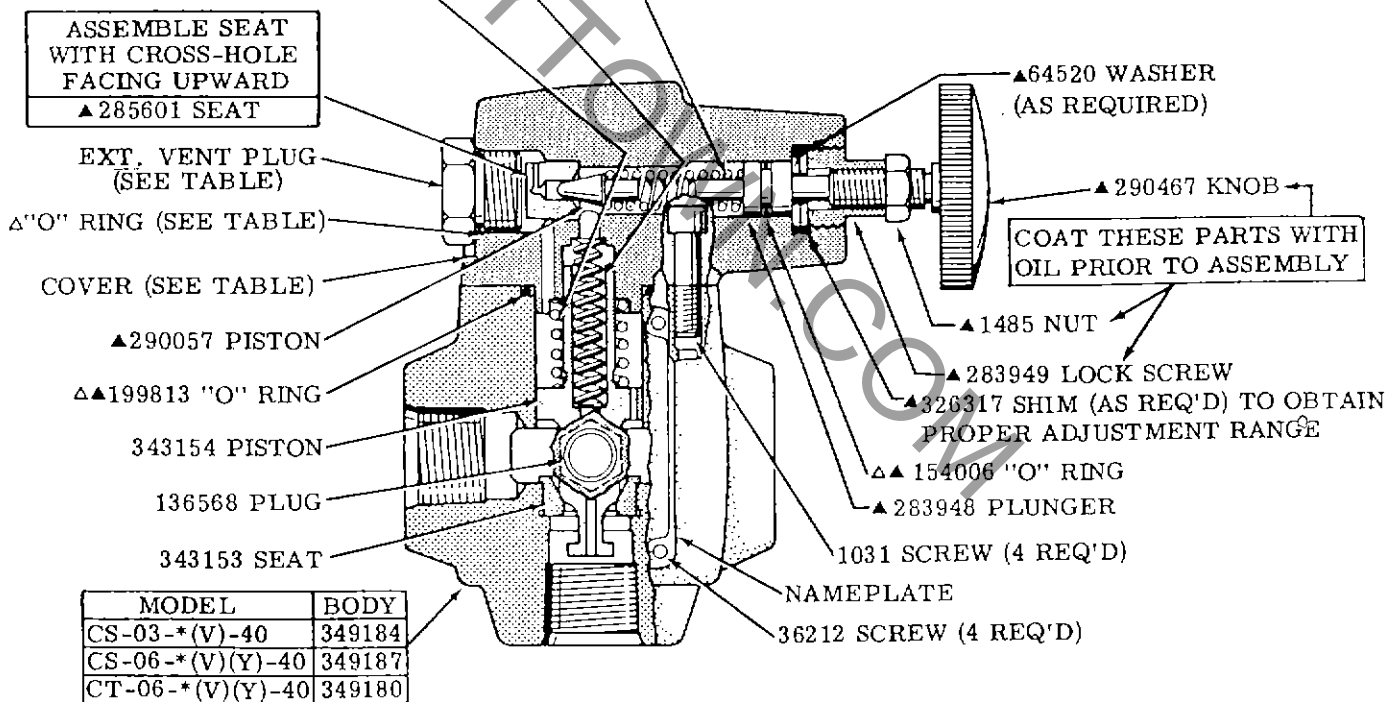
BALANCED PISTON TYPE RELIEF AND SEQUENCE VALVES

CS-03-*(V)-40
 CS-06-*(V)-40
 CS-06-*(V)(Y)-40
 CT-06-*(V)(Y)-40



Y COVER ASSEMBLY
 (SEE TABLE)

| MODEL | SPRING | SPRING | SPRING | PRESSURE RANGE |
|----------------|--------|--------|--------|----------------|
| C*-0*-B(Y)-40 | — | 2077 | ▲2280 | 125-1000 |
| C*-0*-BV(Y)-40 | 184458 | — | — | PSI |
| C*-0*-C(Y)-40 | — | 2077 | ▲2282 | 500-2000 |
| C*-0*-CV(Y)-40 | 184458 | — | — | PSI |
| C*-0*-F(Y)-40 | — | 2077 | ▲2281 | 1500-3000 |
| C*-0*-FV(Y)-40 | 184458 | — | — | PSI |



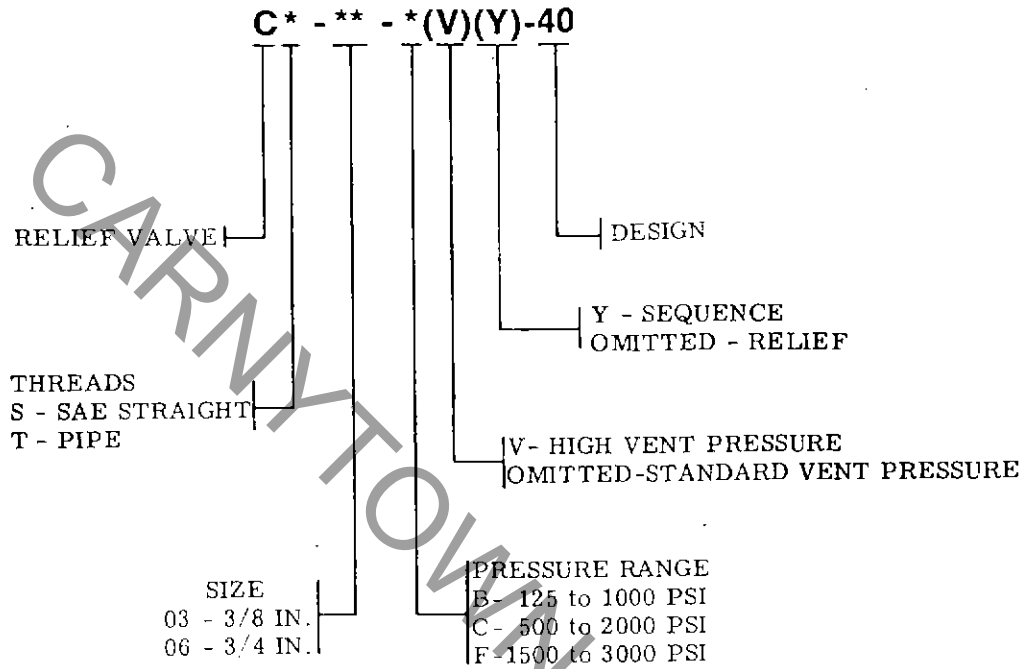
| MODEL | COVER S/A | COVER | PLUG (EXT. VENT) | |
|----------------|-----------|---------|------------------|----------|
| | | | PLUG | "O" RING |
| CS-0*-B(V)-40 | 942034 | — | — | — |
| CS-0*-C(V)-40 | 942035 | ▲349179 | ▲307354 | ▲▲154129 |
| CS-0*-F(V)-40 | 942036 | — | — | — |
| CT-06-B(V)-40 | 942037 | — | — | — |
| CT-06-C(V)-40 | 942038 | ▲349178 | ▲7076 | — |
| CT-06-F(V)-40 | 942039 | — | — | — |
| CS-06-*(V)Y-40 | — | 385648 | 307354 | ▲154129 |
| CT-06-*(V)Y-40 | — | 349181 | 7076 | — |

▲ INCLUDED IN SEAL KIT 919921

F3 EQUIVALENT SEAL KIT 919922

▲ INCLUDED IN COVER SUBASSY

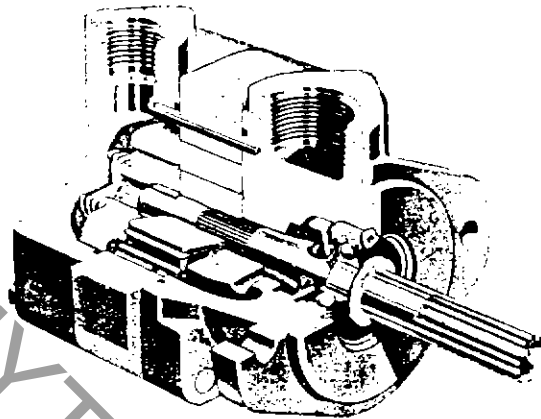
MODEL CODE BREAKDOWN



To insure sustained efficiency and maximum trouble-free life of this precision equipment, initial and continuous filtration of the fluid medium to 25 microns absolute or less is essential. (For information pertaining to Sperry Vickers economical 3 or 10 micron filters, see installation drawing 522140.)

SPERRY-VICKERS

**VANE
PUMPS**



**SERVICE
PARTS
INFORMATION**

V20, V20F -11 DESIGN

V20P -11/-12 DESIGN

SPERRY VICKERS
TROY, MI. 48064

Revised 8-1-78

M-2004-S

V20P - **** - **** - 11/12
PRIORITY VALVE COVER

| DESIGN | PLUG | SPRING | PISTON |
|--------|--------|--------|--------|
| -11 | 7077 | 256961 | 257063 |
| -12 | 433026 | 433025 | 433024 |

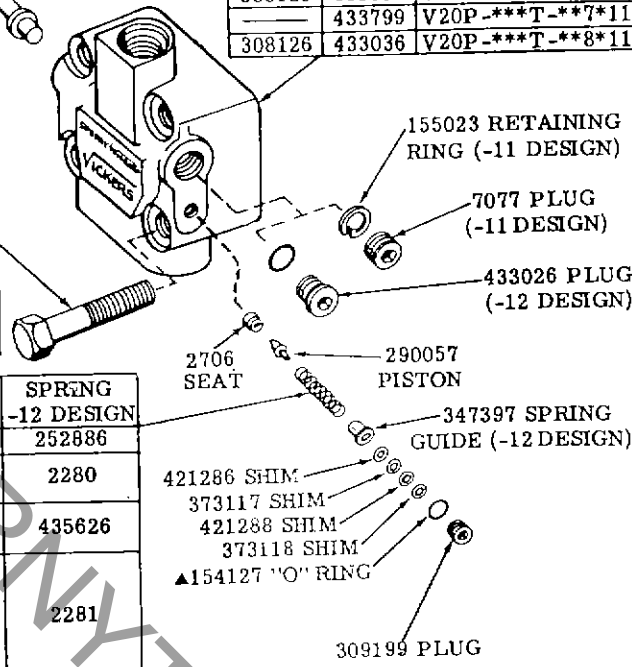
| -11 COVER | -12 COVER | MODEL |
|-----------|-----------|------------------------|
| 308121 | 433030 | V20P-***T-***2*11/12 |
| 308122 | 433031 | V20P-***T-***2.5*11/12 |
| 308123 | 433032 | V20P-***T-***3*11/12 |
| 308124 | 433033 | V20P-***T-***4*11/12 |
| 359314 | 433034 | V20P-***T-***5*11/12 |
| 308125 | 433035 | V20P-***T-***6*11/12 |
| | 433799 | V20P-***T-***7*11/12 |
| 308126 | 433036 | V20P-***T-***8*11/12 |

| MODEL DESIGN |
|--------------|
| V20*-****- |
| V20*-****- |
| V20*-****- |
| V20*-****- |
| V20*-****- |
| V20*-****- |

| MODEL | SCREW (4 REQ'D) TORQUE TO 80±5 lbf. ft. |
|----------------------|---|
| V20P-** 6*-****11/12 | 11165 |
| V20P-** 7*-****11/12 | |
| V20P-** 8*-****11/12 | 9431 |
| V20P-** 9*-****11/12 | |
| V20P-**10*-****11/12 | |
| V20P-**11*-****11/12 | 96168 |
| V20P-**12*-****11/12 | |
| V20P-**13*-****11/12 | |

| MODEL | PRESSURE SETTING | SPRING -11 DESIGN | SPRING -12 DESIGN |
|------------------|---------------------|----------------------|----------------------|
| V20P-****-***A1* | 250 | 252886 | 252886 |
| V20P-****-***B1* | 500 | 2280 | 2280 |
| V20P-****-***C1* | 750 | | |
| V20P-****-***D1* | 1000 | 2282 | 435626 |
| V20P-****-***E1* | 1250 | | |
| V20P-****-***F1* | 1500 | | |
| V20P-****-***G1* | 1750 | | |
| V20P-****-***H1* | 2000 | 2281 | 2281 |
| V20P-****-***J1* | 2250 | | |
| V20P-****-***K1* | 2500 | | |

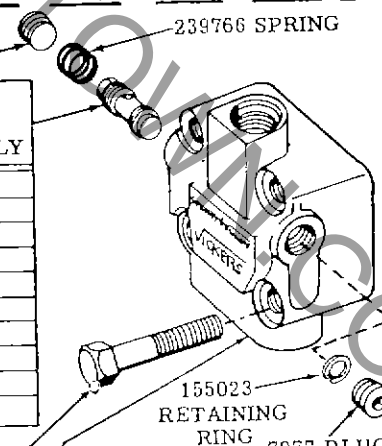
| COVER | MODEL |
|--------|----------------|
| 280690 | V20-***F-***11 |
| 313657 | V20-***P-***11 |
| 281145 | V20-***R-***11 |
| 293373 | V20-***S-***11 |
| 291045 | V20-***Y-***11 |



359287 PRESSURE P.
(INCLUDES 280267 I)

V20F - **** - **** - 11
FLOW CONTROL COVER

| MODEL DESIGNATION | PRESSURE SETTING (P. S. I.) | CONTROL VALVE SUB-ASSEMBLY |
|-------------------|-----------------------------------|----------------------------------|
| V20F-****-***A11 | 250 | 229613 |
| V20F-****-***B11 | 500 | 233018 |
| V20F-****-***C11 | 750 | 232794 |
| V20F-****-***D11 | 1000 | 232795 |
| V20F-****-***E11 | 1250 | 232796 |
| V20F-****-***F11 | 1500 | 232797 |
| V20F-****-***G11 | 1750 | 232798 |
| V20F-****-***H11 | 2000 | 232799 |
| V20F-****-***J11 | 2250 | 233019 |
| V20F-****-***K11 | 2500 | 233020 |



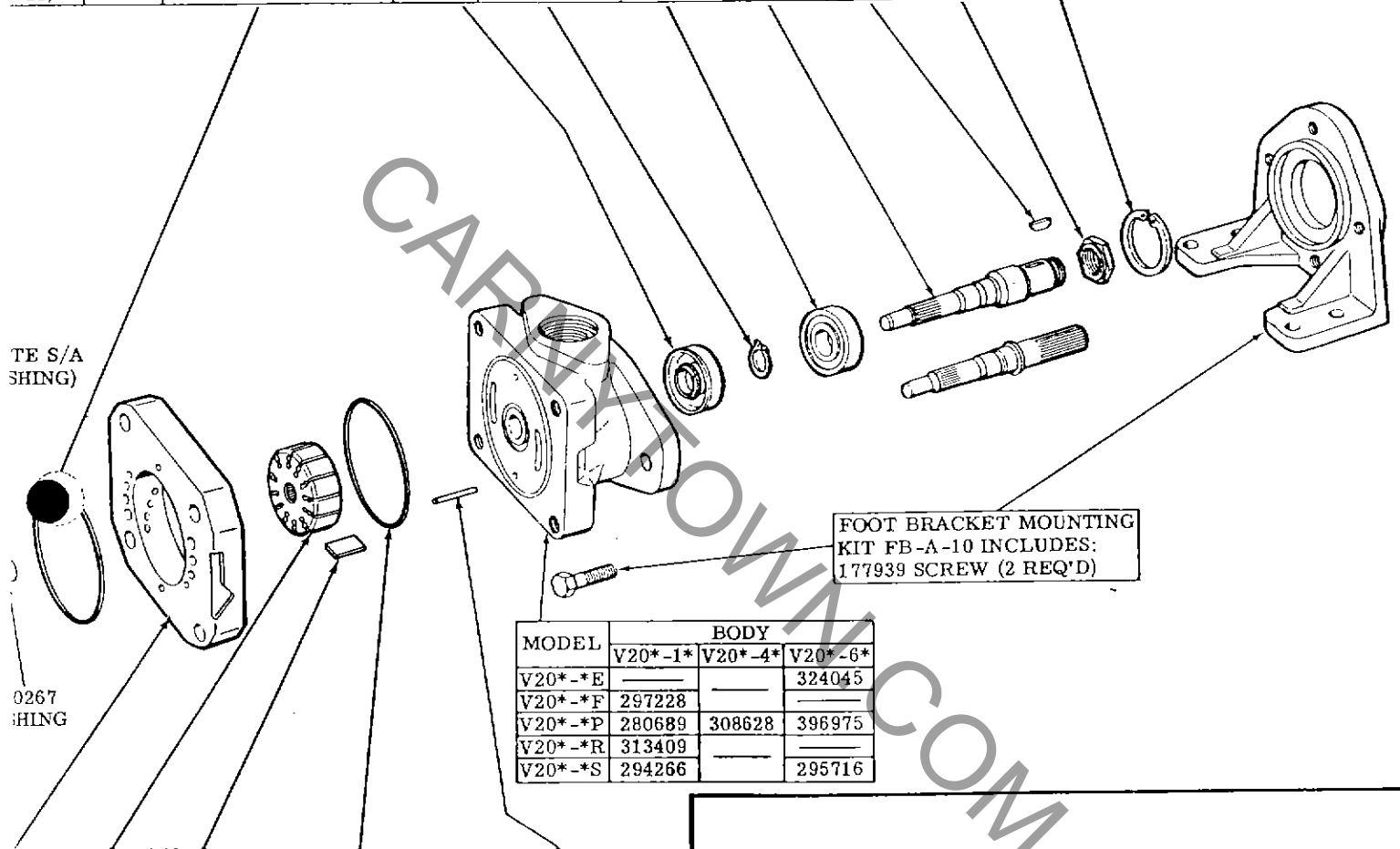
275672 SPRING

| MODEL | SCREW (4 REQ'D) TORQUE TO 80±5 lbf. ft. |
|-------------------|--|
| V20F-** 6*-****11 | 11165 |
| V20F-** 7*-****11 | |
| V20F-** 8*-****11 | 9431 |
| V20F-** 9*-****11 | |
| V20F-**10*-****11 | |
| V20F-**11*-****11 | 96168 |
| V20F-**12*-****11 | |
| V20F-**13*-****11 | |

| COVER | MODEL DESIGNATION |
|--------|--------------------|
| 316090 | V20F-***P-***2*11 |
| 385870 | V20F-***P-***3*11 |
| 316093 | V20F-***P-***4*11 |
| 309151 | V20F-***P-***5*11 |
| 310971 | V20F-***P-***6*11 |
| 316094 | V20F-***P-***8*11 |
| 316095 | V20F-***P-***10*11 |
| 306313 | V20F-***S-***2*11 |
| 306915 | V20F-***S-***4*11 |
| 363243 | V20F-***S-***5*11 |
| 306917 | V20F-***S-***6*11 |
| 306919 | V20F-***S-***8*11 |
| 306921 | V20F-***S-***10*11 |
| 306314 | V20F-***T-***2*11 |
| 306346 | V20F-***T-***4*11 |
| 306819 | V20F-***T-***6*11 |
| 306821 | V20F-***T-***8*11 |
| 306823 | V20F-***T-***10*11 |

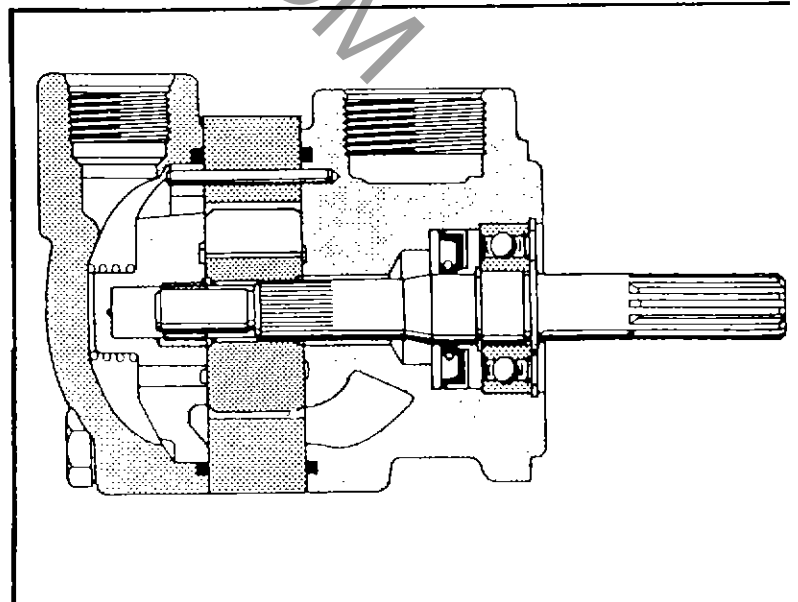
| MODEL | SCREW (4 REQ'D) TORQUE TO 80±5 lbf. ft. |
|----------------------|---|
| V20*-** 6*-****11/12 | 131485 |
| V20*-** 7*-****11/12 | |
| V20*-** 8*-****11/12 | |
| V20*-** 9*-****11/12 | 131486 |
| V20*-**10*-****11/12 | |
| V20*-**11*-****11/12 | |
| V20*-**12*-****11/12 | 1319 |
| V20*-**13*-****11/12 | |

| OPTION | ▲SEAL KIT | ▲"O" RING (2 REQ'D) | ▲SEAL | RETAINING RING | BEARING | SHAFT | KEY | NUT | RETAINING RING | SHAFT TYPE |
|--------|----------------------|---------------------|--------|----------------|---------|--------|------|--------|----------------|------------|
| | SERVICED IN SEAL KIT | | | | | | | | | |
| *11/12 | 922733 | 154090 | 229235 | 98653 | 98574 | 280372 | 5881 | 132260 | 109975 | STRAIGHT |
| *11/12 | | | | | | 280504 | 1615 | | | THREADED |
| *11/12 | | | | | | 297330 | 1609 | | | KEYED-STUB |
| *11/12 | | | | | | 280515 | — | | | SPLINED |
| *11/12 | | | | | | 294922 | — | | | SPLINED |
| *11/12 | | | | | | 328096 | — | | | SPLINED |



| MODEL | BODY | | |
|--------|---------|---------|---------|
| | V20*-1* | V20*-4* | V20*-6* |
| V20*-E | — | — | 324045 |
| V20*-F | 297228 | — | — |
| V20*-P | 280689 | 308628 | 396975 |
| V20*-R | 313409 | — | — |
| V20*-S | 294266 | — | 295716 |

| ANG | ROTOR | VANE KIT (12 VANES) | "O" RING (2 REQ'D) | CARTRIDGE KIT | PIN (2 REQ'D) |
|---------------------------|--------|---------------------|--------------------|---------------|---------------|
| SERVICED IN CARTRIDGE KIT | | | | | |
| 3150 | 358328 | 923485 | 154090 | 923480 | 2161 |
| 3152 | 358330 | 923493 | | 923481 | 2478 |
| 1791 | | | | 923483 | |
| 1789 | | | | 923484 | |
| 1309 | 358332 | 923478 | | 923620 | 16662 |
| 3156 | 358334 | 923479 | | 923482 | |
| 1806 | | | 923486 | 9603 | |
| 1807 | | | 923487 | | |



MODEL CODE BREAKDOWN

V 20 (P) * * * * - * * (*) (*) 11/12 - * * * L

VANE PUMP
(STRAIGHT VANE)

SERIES

F - FLOW CONTROL COVER
P - PRIORITY VALVE COVER
OMITTED-STANDARD COVER

MOUNTING

- 1 - 2 BOLT FLANGE (SAE "A" SIZE)
- 2 - FOOT BRACKET AT 12 O'CLOCK (VIEWED FROM SHAFT END)
- 3 - POWER TAKE-OFF
- 4 - FACE TYPE
- 6 - "B" MOUNTING FLANGE
- 23 - FOOT BRACKET AT 3 O'CLOCK
- 26 - FOOT BRACKET AT 6 O'CLOCK
- 29 - FOOT BRACKET AT 9 O'CLOCK

INLET PORT CONNECTIONS

- E - 1.5 INCH DIA.
2 BOLT FLANGE
- F - 1.156 INCH DIA.
2 BOLT FLANGE
- P - 1.25 N. P. T. F.
- R - 1.00 N. P. T. F.
- S - 1.625 - 12 UN 2B THD.

RING CAPACITY USGPM

- 1200 RPM-100 PSI
- 6 - 6 9 - 9 12 - 12
- 7 - 7 11 - 11 13 - 13
- 8 - 8

FOR LEFT HAND ROTATION
VIEWED FROM SHAFT END
(OMIT FOR RIGHT HAND
ROTATION)

SPECIAL FEATURE SUFFIX

V20, V20F - 11 DESIGN
V20P - 12 DESIGN

PRESSURE SETTING

- A - 250 PSI F - 1500 PSI
- B - 500 PSI G - 1750 PSI
- C - 750 PSI H - 2000 PSI
- D - 1000 PSI J - 2250 PSI
- E - 1250 PSI K - 2500 PSI

FLOW RATE THROUGH ORIFICE
IN COVER IN USGPM

- 2 - 2 3 - 3 6 - 6
- 2.5 - 2.5 4 - 4 7 - 7 8 - 8

PRESSURE PORT POSITIONS
VIEWED FROM COVER END

- A - OPPOSITE INLET CONNECTION
- B - 90° COUNTERCLOCKWISE FROM INLET CONNECTION.
- C - INLINE WITH INLET
- D - 90° CLOCKWISE FROM INLET CONNECTION

SHAFTS

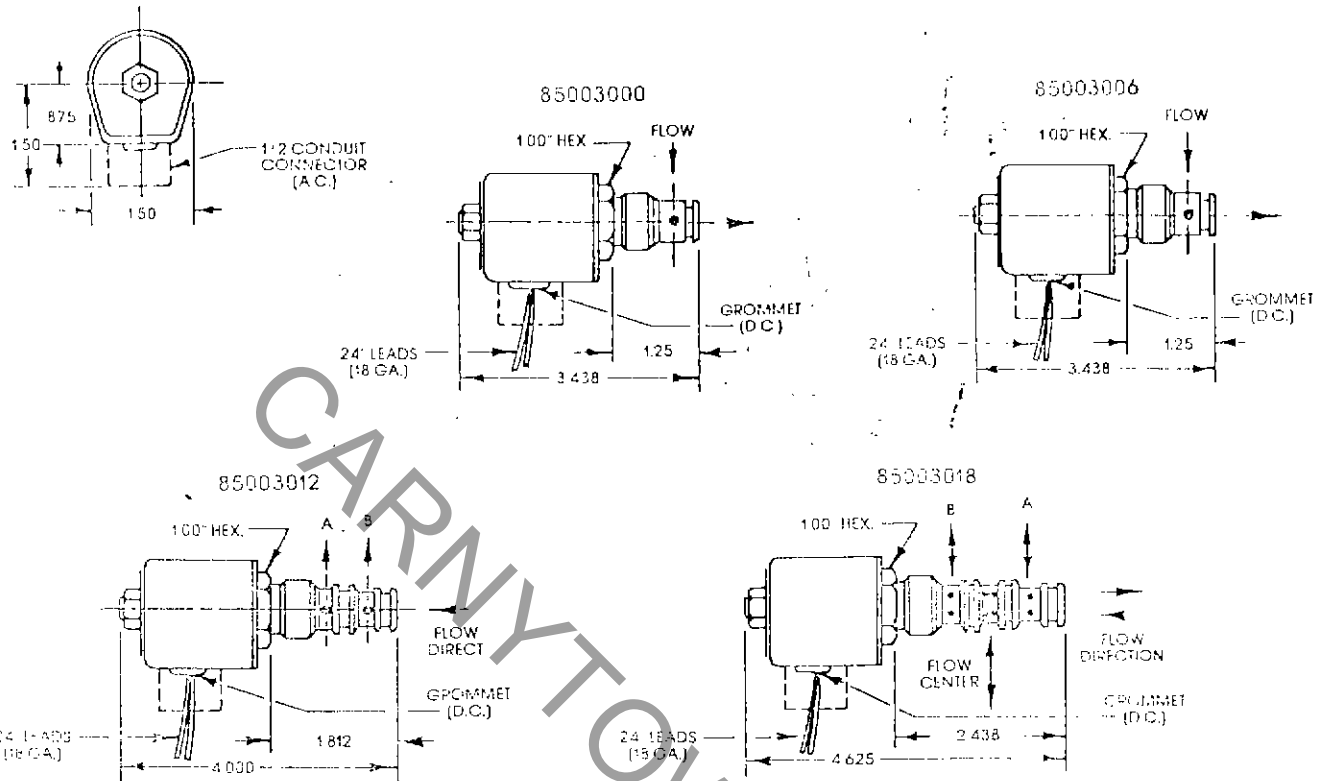
- 1 - STRAIGHT - KEYED
- 3 - THREADED
- 6 - STR. STUB-KEYED
- 11 - SPLINE
- 15 - SPLINE
- 38 - SPLINE

OUTLET PORT CONNECTIONS

| CODE | STANDARD COVER | FLOW CONTROL COVER | | PRIORITY VALVE COVER | | |
|------|-------------------|--------------------|-------------------|----------------------|------------------|------------------|
| | | PRESSURE | TANK | PRIMARY OUTLET | SECONDARY OUTLET | TANK |
| F | .687 DIA. | — | — | | | |
| P | .750 NPT THD. | .750-16 ST. THD. | .500 NPT THD. | — | — | — |
| S | 1.062-12 ST. THD. | .750-16 ST. THD. | 1.062-12 ST. THD. | | | |
| T | — | .750-16 ST. THD. | .750-16 ST. THD. | .750-16 ST. THD. | .875-14 ST. THD. | .750-16 ST. THD. |

To insure sustained efficiency and maximum trouble-free life of this precision equipment, initial and continuous filtration of the fluid medium to 25 microns absolute or less is essential. (For information pertaining to Sperry Vickers economical 3 or 10 micron filters, see installation drawing 522140.)

3000 SERIES

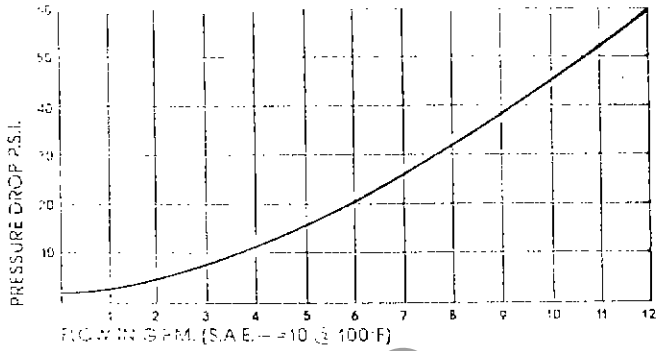


3000 SERIES SOLENOID OPERATED* CARTRIDGE VALVES

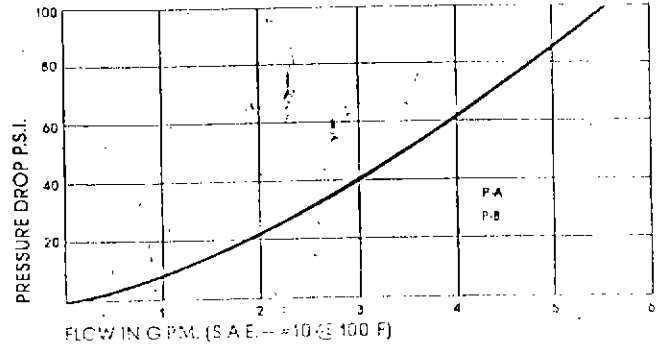
| Description | Symbol | Coil Rating Number | | | | | | | | Coil Voltage | | Weight (g) |
|--------------------------------|--------|--------------------|----------|----------|----------|----------|----------|----------|---------|--------------|---|------------|
| | | 12 VDC | 24 VDC | 36 VDC | 24 VAC | 118 VAC | 240 VAC | 440 VAC | 120 VAC | 240 VAC | | |
| N.C. 2-Way Poppet In Body | | 85003000 | 85003001 | 85003002 | 85003021 | 85003003 | 85003004 | 85003005 | 12 | 3000 | A | |
| | | 85005008 | 85005010 | 85005011 | 85005115 | 85005017 | 85005018 | 85005014 | | | | |
| N.O. 2-Way Poppet In Body | | 85003006 | 85003007 | 85003008 | 85003026 | 85003009 | 85003010 | 85003011 | 12 | 3000 | A | |
| | | 85005018 | 85005019 | 85005020 | 85005116 | 85005021 | 85005022 | 85005023 | | | | |
| 3-Way 2-Position Spool In Body | | 85003012 | 85003013 | 85003014 | 85003027 | 85003015 | 85003016 | 85003017 | 5 | 3000 | B | |
| | | 85005012 | 85005013 | 85005014 | 85005117 | 85005018 | 85005019 | 85005035 | | | | |
| 3-Way 2-Position Spool In Body | | 85003018 | 85003019 | 85003020 | 85003028 | 85003019 | 85003020 | 85003021 | 5 | 3000 | C | |
| | | 85005018 | 85005019 | 85005020 | 85005118 | 85005021 | 85005022 | 85005023 | | | | |

PERFORMANCE*

85003012-3015
85003018-3011

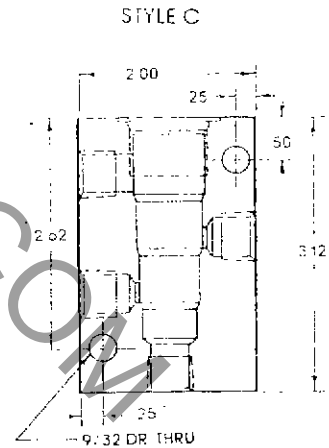
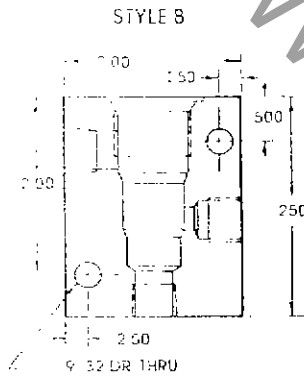
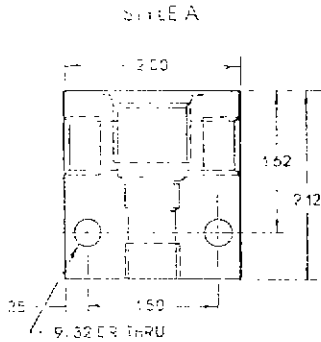


85003012-3017
85003018-3023

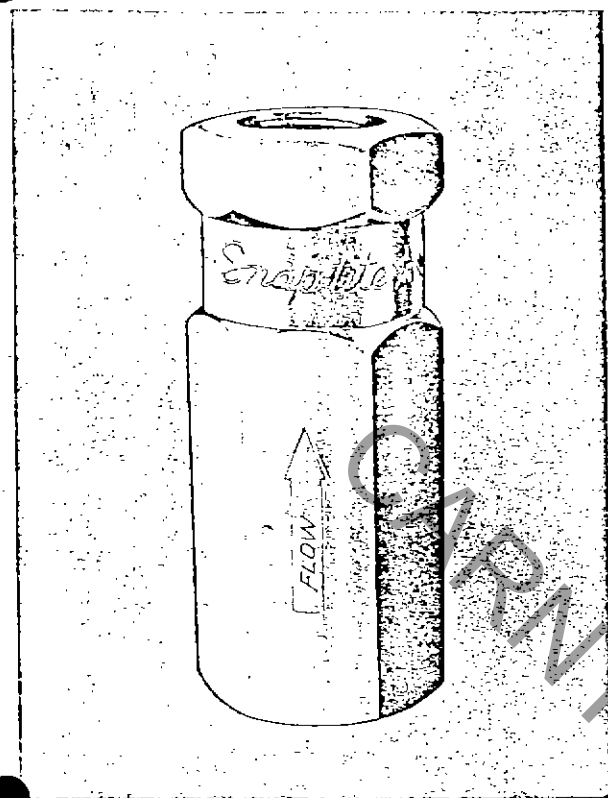


CARNYTOWN.COM

FIVE BODY STYLE OPTIONS



| Style | Use With | Body Catalog Number | Filter Tool Catalog Number |
|-------|--------------|---------------------|----------------------------|
| A | 2-Way Valves | 8-100-000 | 9-001000 |
| B | 3-Way Valves | 8-100-000 | 9-001000 |
| C | 3-Way Valves | 8-100-000 | 9-001000 |



Inline Check Valve

POPPET STYLE—SOFT SEAT

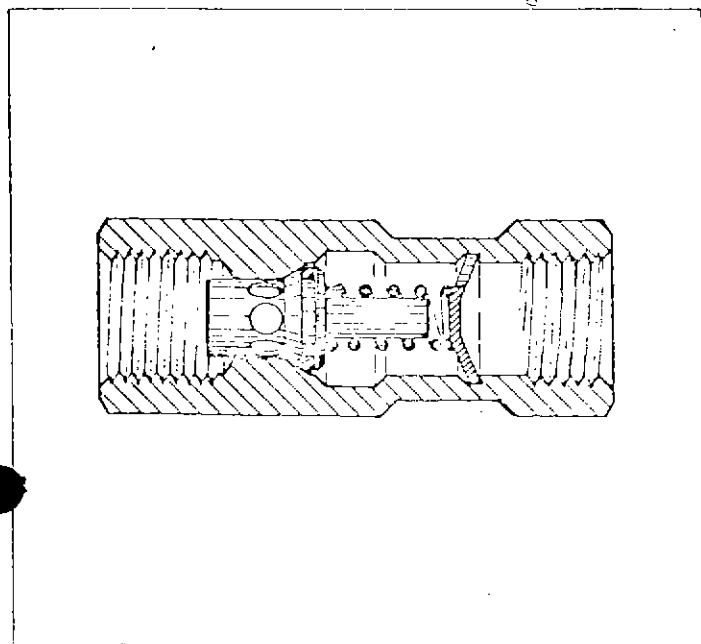
- For use with hydraulic fluids
- Flow rates to 130 GPM
- Working pressures to 5000 PSI
- Compact — easily installed
- Fast operating action
- Four standard cracking pressures
- Seven sizes — $\frac{1}{4}$ " , $\frac{3}{8}$ " , $\frac{1}{2}$ " , $\frac{3}{4}$ " , 1" , $1\frac{1}{4}$ " and $1\frac{1}{2}$ "

Features

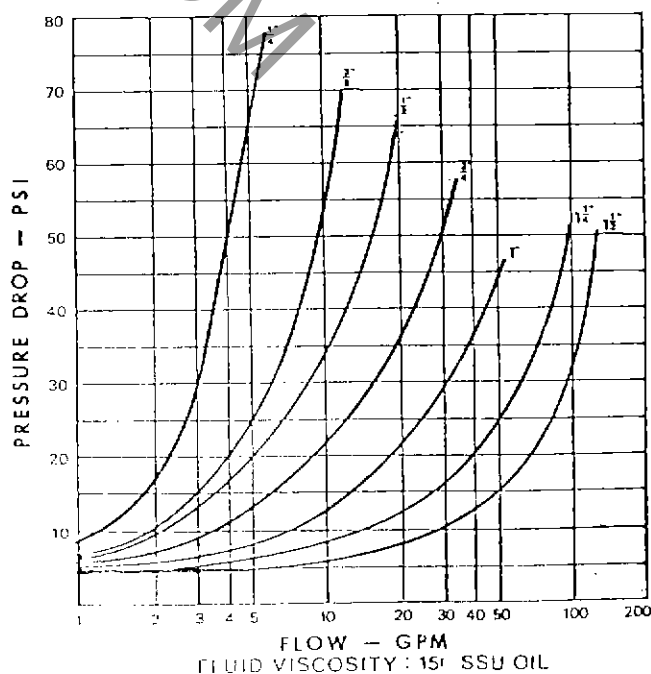
Snap-Tite Soft Seat (virtual zero leak) and guided piston design Inline Check Valves are excellent for a wide variety of hydraulic applications where free flow in one direction and blocked flow in the reverse direction is required. The streamlined poppet with full

ports and soft seat offers minimum restriction to flow and positive shutoff and can be provided with seals for most types of hydraulic fluids and a selection of cracking pressures.

Construction



Flow and Pressure Drop



Specifications and Dimensions

Inline Check Valve



Specifications

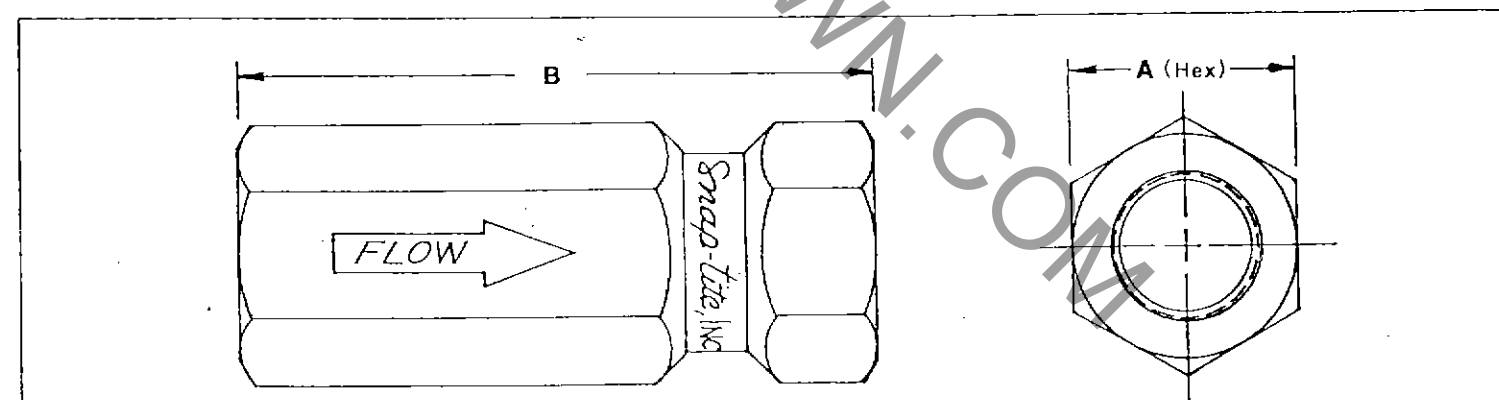
| Materials: | Rated Flow: | Working Pressure: | Weight: |
|---|---|-------------------|---|
| Cartridge Housing — Steel Internal Parts — Steel | ¼" — 6 GPM ⅜" — 12 GPM ½" — 19 GPM ¾" — 35 GPM 1" — 55 GPM 1¼" — 95 GPM 1½" — 130 GPM | To 5000 PSI | ¼" — 3 oz ⅜" — 4 oz ½" — 14 oz ¾" — 1 lb 4 oz 1" — 2 lbs 4 oz 1¼" — 3 lbs 14 oz 1½" — 7 lbs 10 oz |

Ordering Information

Select and specify the proper Inline Check Valve from the following tables:

| Part Number: | End Fitting: | Thread Type: | Port Size: |
|---------------------|--------------------|--------------------------------------|------------|
| CPIFF-4P-15A | FF — Female/Female | P — NPSF (Std.) | 2 — ¼" |
| | | | 3 — ⅜" |
| | | | 4 — ½" |
| | | | 6 — ¾" |
| | | | 8 — 1" |
| | | | 10 — 1¼" |
| | | | 12 — 1½" |
| | Cracking Pressure: | Seals: | |
| | 05 — 5 PSI | A — Buna N (Std.) | |
| | 15 — 15 PSI | V — Viton | |
| | 25 — 25 PSI | X — Other seal types consult factory | |
| | 60 — 60 PSI | | |

Dimensions



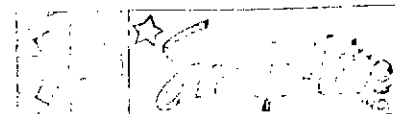
NOTES:

Decimal dimensions are ±.015.
Ratings, specifications and dimensions are subject to change without notice.

Part configurations are typical and do not necessarily represent actual appearance.
Consult factory for Certified Drawing.

| | | 6.4 mm/¼" | 9.8 mm/⅜" | 12.7 mm/½" | 19.1 mm/¾" | 25.4 mm/1" | 31.8 mm/1¼" | 38.1 mm/1½" |
|---------|------|-----------|-----------|------------|------------|------------|-------------|-------------|
| A (Hex) | M/M | 19.05 | 22.2 | 31.8 | 34.9 | 44.5 | 54.0 | 60.0 |
| | INCH | ¾" | ⅞" | 1¼" | 1⅜" | 1¾" | 2⅛" | 2¾" |
| B | M/M | 49.02 | 52.23 | 82.55 | 109.98 | 116.08 | 144.53 | 157.73 |
| | INCH | 1.93" | 2.45" | 3.25" | 4.33" | 4.57" | 5.69" | 6.21" |

m/m = m/m inch
Inch



Description

Operation of the main spool is by means of a pilot valve, available with either DC or AC air gap or oil immersed solenoids. Manual override on the pilot valve solenoids allows operation of the main spool without energisation of the solenoids, provided pilot pressure is available. The main valve spool is held in the center or end positions by springs or hydraulic pressure.

The pilot oil supply and drain can be provided internally or externally. Details of possible conversions are shown on page 11.

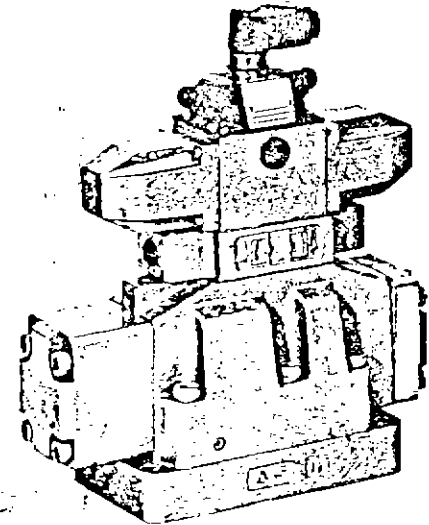
The directional control valves size 25 are available for an operating pressure up to 5000 PSI.

Design Features:

- subplate mounting
- cast oil passages
- spring or hydraulic centering of main spool
- Interchangeability of spools

Depending on the application, the valves can be supplied with the following additional features:

- pilot choke adjustment (p. 11)
- stroke limiter on main spool (p. 12)
- main spool position indicator (p. 12)
- limit switch on main spool (p. 5)
- pilot pressure insert in P-passage of main valve (p. 11)
- throttle orifices to reduce pilot oil supply (p. 11)
- pressure reducing valve (fixed pressure reduction) for reducing pilot pressure in excess of 3500 PSI (page 11)
- electrical connections (page 5)



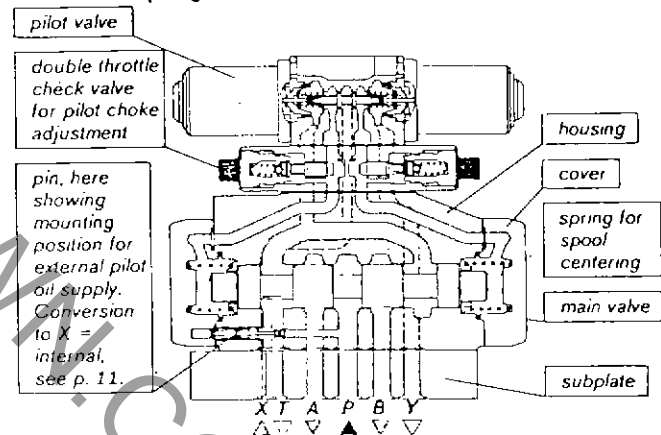
Description

4/3-Way Valves Spring Centering of Main Spool

The main spool is held in the zero position by 2 springs. Both spring chambers are connected to the tank via the pilot valve. Pressurization of one spool area causes the spool to move into one of the end positions. On unloading of the pressurized spool area the opposing spring returns the spool to the zero position.

The maximum flow details for the spring centered valves are given in the table 'Maximum Performance Data' (p. 4).

4 WEH 22 spring centered



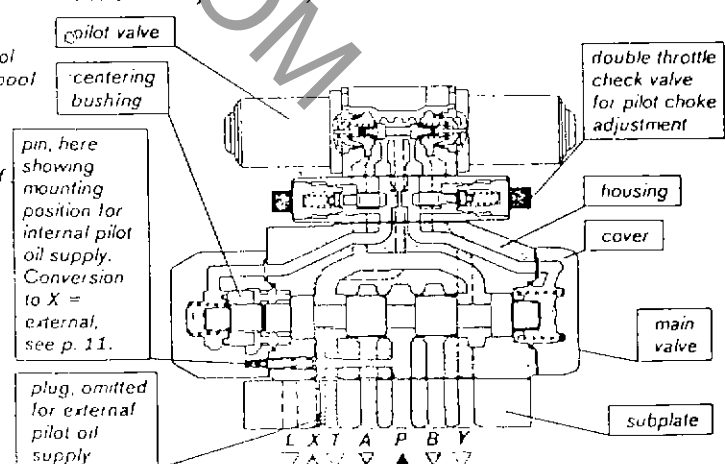
4/3-Way Valves with Hydraulic Centering of Main Spool

The main spool is held in the zero position by pressurization of both spool areas via the pilot valve. A centering bushing in the housing fixes the spool position.

Unloading one spool area causes the spool to move into one of the end positions. For all spool types of this model the maximum performance data at minimum pilot pressure of 120 PSI are shown in line 1 of the table 'Max. Performance Data', p. 4. For applications in excess of these values a higher pilot pressure is required. For example, at operating pressure $p = 5000$ PSI and a flow of $Q = 120$ GPM a pilot pressure of 210 PSI is required.

The maximum flow for this valve model is therefore entirely dependent on the Δp value in the system.

4 WEH 22 hydraulically centered



4/2-Way Valve (see p. 8)

4 different types are available:

- 1) Pilot valve and main valve each have one spring for fixing of spool end position (guaranteed shifting even with power failure)
- 2) Pilot valve has one spring to hold the spool in the end position. The main valve spool has no springs and is fixed in the end position hydraulically.
- 3) Pilot valve has two solenoids. No springs in pilot or main valve. The spool positions are fixed by means of solenoid energization. 1 solenoid must therefore always remain energized.
- 4) Pilot valve has two solenoids, the spool has detents in the end position (impulse valve). The main valve spool has no detents and moves into position when pressurized.

With types 2, 3 and 4 the shifting positions are guaranteed only when pilot pressure is available.

Model Number

4WEH22

30/

Hydraulic centering = H
Spring centering = no designation

spool return to zero position (main valve)

| Symbols with spool crossover positions | Valve Symbols (spool type) |
|--|----------------------------|
| | = C |
| | = D |
| | = K |
| | = Z |
| | = E |
| | = F |
| | = G |
| | = H |
| | = J |
| | = L |
| | = M |
| | = Q |
| | = R |
| | = S |
| | = T |
| | = U |
| | = V |
| | = W |

(see pages 6 and 7) spool type

Series 30 = 30
30 to 39 ^Δ installation and connection dimensions remain the same.

(specified by factory)

Series no.

without spring return = O
without spring return, with detent = OF
(in both cases the 'H' for hydraulic centering is still required. The detent is in the pilot valve only).

spool positioning (pilot valve)
2-position valves and 2 solenoids only

pilot valve size 8 (3/8") = 8
pilot valve size 10 (1/2") = 10

(Valve details, see page 5) pilot valve size

Oil immersed solenoid (size 10 only) = A
Air gap solenoid = L

solenoid type

120 V Ac, 60 Cyc. = IV 120-60

24 V DC = G 24

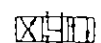

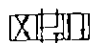
see technical data for further voltages)

solenoid voltage

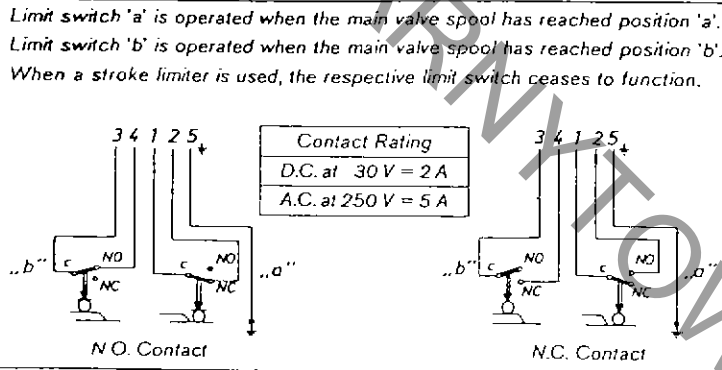
Pilot Valve (details in parenthesis refer to size 10)

| | | | | |
|--|---|-----------------|---|-----------------|
| A 4 way directional control valve size 8 (size 10 optional) is used as pilot valve. The valve spool is held in zero position by springs, and in shifting position by solenoids or detents. Operation of the spool is by means of air gap or oil immersed DC or AC solenoids. | The air gap solenoid is of simple construction and fully encapsulated. The oil immersed solenoid has a long working life, and is fully encapsulated. The solenoid runs in oil thus resulting in low wear, good heat dissipation and cushioned stop. | | | |
| | The DC solenoid is extremely reliable, provides smooth operation and is suitable for high shifting frequencies. It is not affected by voltage fluctuations in either direction. | | The AC solenoid has short response times. Single operation and no special contact protection are its main features. | |
| Solenoid type | DC solenoid dry | DC solenoid wet | AC solenoid dry | AC solenoid wet |
| Catalogue sheet size 8 (3/8") | RA 23 286 | | RA 23 287 | |
| Catalogue sheet size 10 (1/2") | RA 23 299 | RA 23 196 | RA 23 300 | RA 23 197 |
| Power requirement | 25 W (43 W) | 25 W (35 W) | | |
| Holding current | - | - | 46 VA (64 VA) | 84 VA (130 VA) |
| In-rush current | - | - | 230 VA (430 VA) | 310 VA (530 VA) |
| Duty cycle | 100 % | | | |
| Voltage Rating | 12; 24; 42; 60; 110; 180; 195 & 220 V | | 42; 110; 127; 220V, 50Cyc.; 120&220V, 60Cyc. | |
| Insulation | IP 65 | | | |
| Terminal connections for central connection | with 1 solenoid | | with 2 solenoids | |
| | solenoid always to terminals 1 and 2 ground to terminal 5 | | solenoid a to terminals 1 and 2, solenoid b to terminals 3 and 4, ground to terminals 5 | |


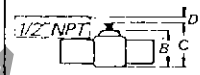
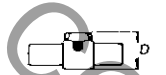

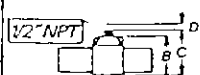

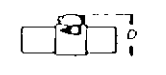
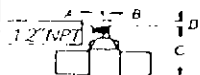
For the various models of the main valve the following models and spool types of the pilot valve are used:

| | | | |
|-------------|---|---|--|
| Main valve | 3-position valve, spring centered | 2-position valve | 3-position valve, hydr. centered |
| Pilot valve | 3-position valve, spring centered spool type J =  | 2-position valve, spring offset, without spring return or without spring return with detent spool type D =  | 3-position valve spring centered spool type M =  |

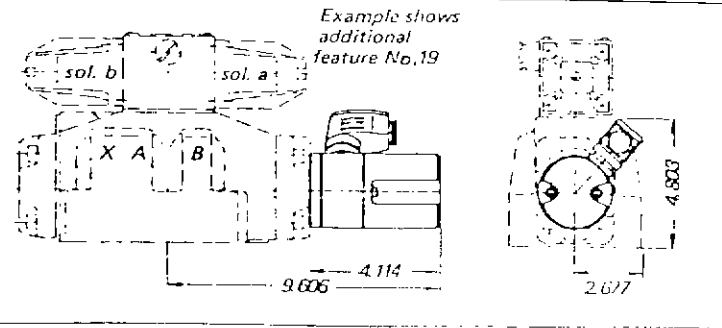
Limit Switch on Main Valve (Dimensions in inches)



Electrical Connections (details in parenthesis refer to size 10)

| Code | Illustration | A | B | C | D | |
|--------------|--|--------------------|------------------|------------------|------------------|------------------|
| no desig. |  | 1/2"NPT 1/2"NPT | 0.788 (0.709) | 0.276 (0.276) | 2.776 (3.445) | |
| D |  | - (-) | 3.780 (4.449) | 4.646 (5.158) | 0.276 (0.197) | |
| L |  | 1/2"NPT 1/2"NPT | 0.788 (0.709) | 0.276 (0.276) | 3.780 (4.449) | |
| Z |  | 1/2"NPT | 2.481 (2.481) | 0.551 (0.551) | 2.225 (1.890) | 0.630 (0.630) |
| DL |  | 1/2"NPT | - (-) | 3.780 (4.449) | 4.646 (5.158) | 0.276 (0.197) |
| DZ |  | 1/2"NPT | 1.929 (1.929) | 0.551 (0.551) | 5.512 (6.339) | 0.630 (0.630) |
| ZL |  | - (-) | 2.225 (1.890) | 0.630 (0.630) | 3.780 (4.449) | |
| DZL |  | 1/2"NPT | 1.929 (1.929) | 0.551 (0.551) | 5.512 (6.339) | 0.630 (0.630) |

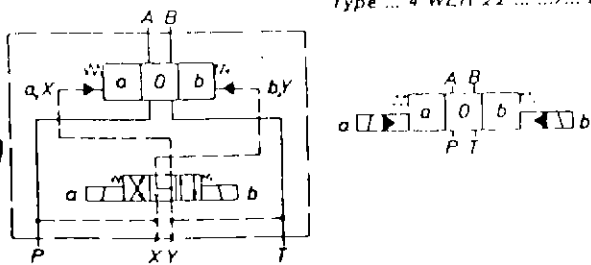
| Mounting of Limit Switch on Main Valve | | Feature code | |
|--|---|---|----|
| N.O. contact | 2-position valves, 3-position valves, spring centered | limit switch (N.O. contact) on side of A port | 18 |
| | 2-position valves, hydr. return, 3-position valves | limit switch (N.O. contact) on side of B port | 19 |
| | 2-position valves, hydr. return, 3-position valves, spring centered | stroke limiter on side of A port limit switch (N.O. contact) on side of B port | 20 |
| | | stroke limiter on side of B port limit switch (N.O. contact) on side of A port | 21 |
| N.C. contact | 2-position valves, 3-position valves, spring centered | limit switch (N.C. contact) on side of A port | 22 |
| | 2-position valves, hydr. return, 3-position valves | limit switch (N.C. contact) on side of B port | 23 |
| | 2-position valves, hydr. return, 3-position valves, spring centered | stroke limiter on side of A port limit switch (N.C. contact) on side of B port | 24 |
| | | stroke limiter on side of B port limit switch (N.C. contact) on side of A port | 25 |



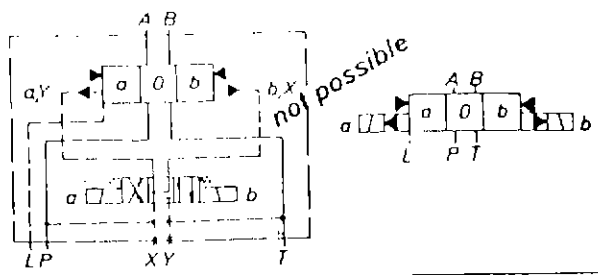
Spring centered valves

Hydraulically centered valves

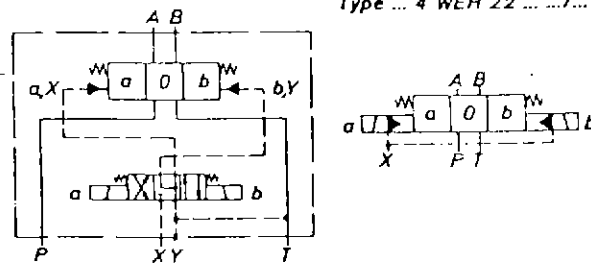
Type ... 4 WEH 22 ... /... ET



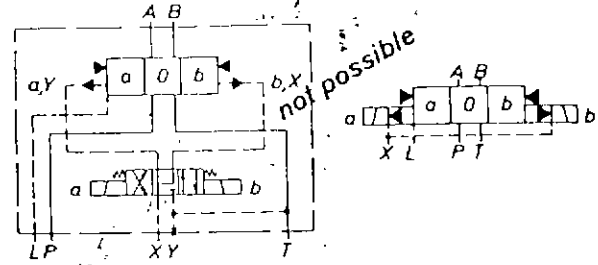
not possible



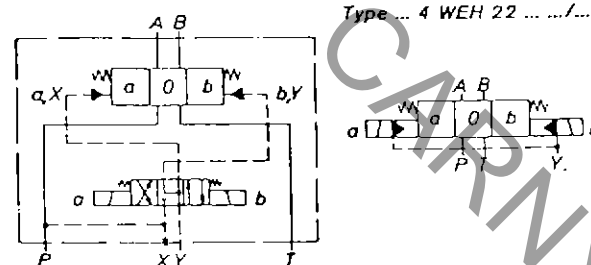
Type ... 4 WEH 22 ... /... T



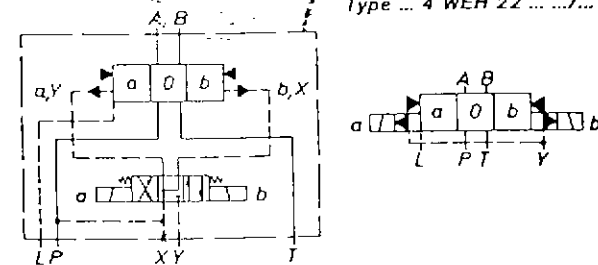
not possible



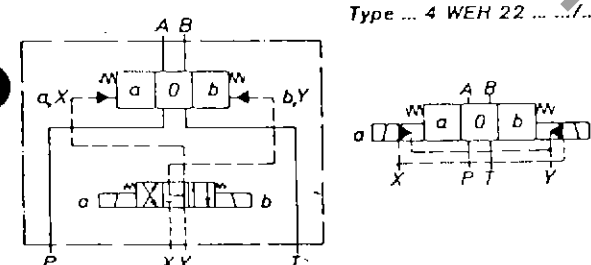
Type ... 4 WEH 22 ... /... E



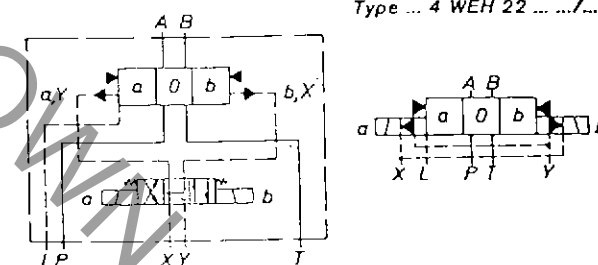
Type ... 4 WEH 22 ... /... E



Type ... 4 WEH 22 ... /...

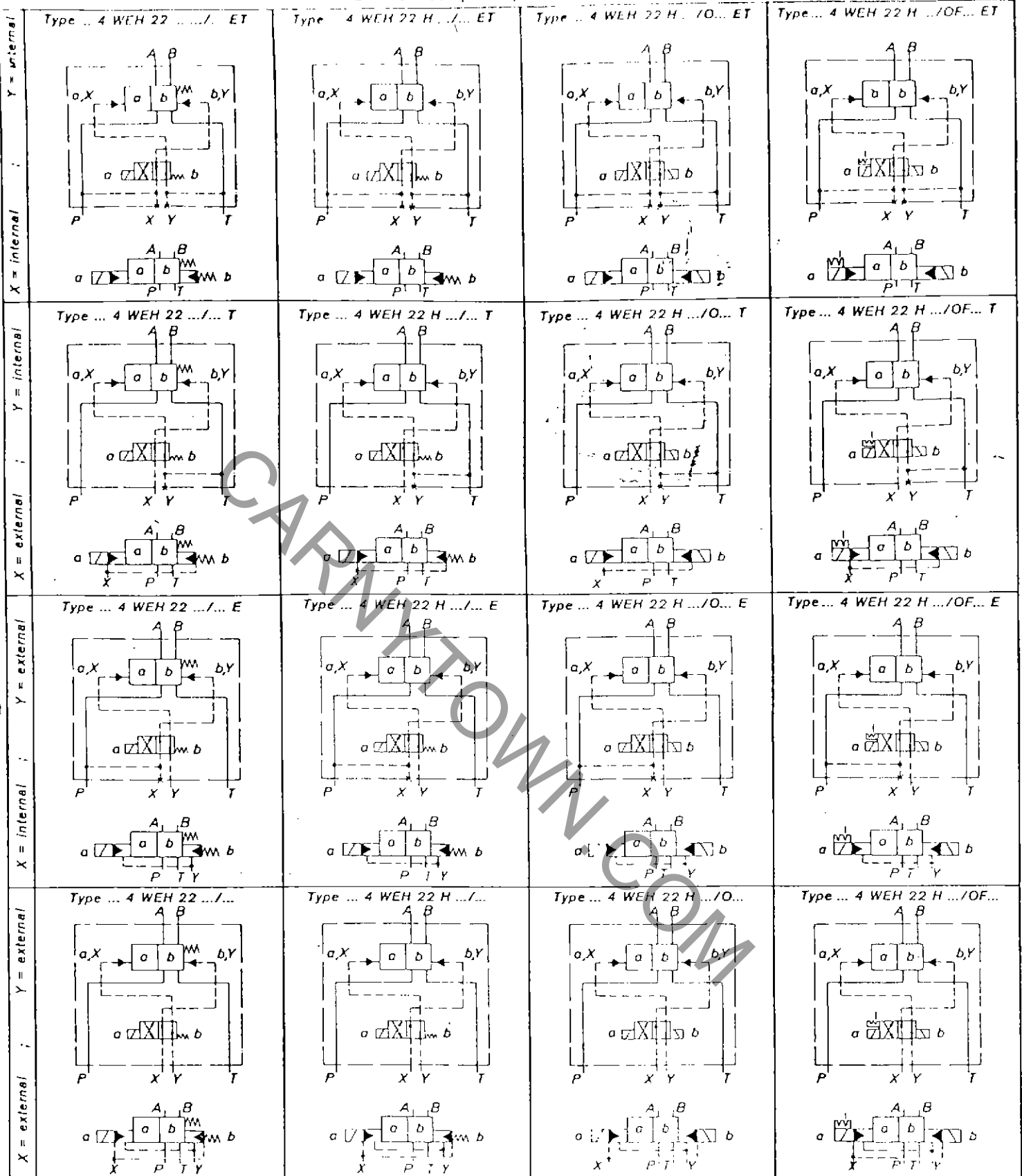


Type ... 4 WEH 22 ... /...



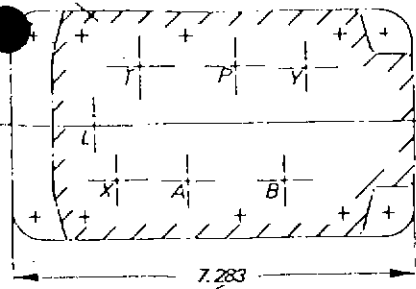
| Model Code spring centered | Model Code hydr. centered | Spool Type | Valve Symbol (spool type) | Symbols with Spool Crossover Positions |
|-------------------------------|------------------------------|------------|---------------------------|---|
| ... 4 WEH 22 ... E .../... | ... 4 WEH 22 H E .../... | E | | |
| ... 4 WEH 22 ... F .../... | ... 4 WEH 22 H F .../... | F | | |
| ... 4 WEH 22 ... G .../... | ... 4 WEH 22 H G .../... | G | | |
| ... 4 WEH 22 ... H .../... | ... 4 WEH 22 H H .../... | H | | |
| ... 4 WEH 22 ... J .../... | ... 4 WEH 22 H J .../... | J | | |
| ... 4 WEH 22 ... L .../... | ... 4 WEH 22 H L .../... | L | | |
| ... 4 WEH 22 ... M .../... | ... 4 WEH 22 H M .../... | M | | |
| ... 4 WEH 22 ... Q .../... | ... 4 WEH 22 H Q .../... | Q * | | |
| ... 4 WEH 22 ... R .../... | ... 4 WEH 22 H R .../... | R | | |
| ... 4 WEH 22 ... S .../... | ... 4 WEH 22 H S .../... | S | | |
| ... 4 WEH 22 ... T .../... | ... 4 WEH 22 H T .../... | T | | |
| ... 4 WEH 22 ... U .../... | ... 4 WEH 22 H U .../... | U | | |
| ... 4 WEH 22 ... V .../... | ... 4 WEH 22 H V .../... | V * | | |
| ... 4 WEH 22 ... W .../... | ... 4 WEH 22 H W .../... | W * | | |

*With spool types Q and V the center position is throttled to 16% and with spool type W to 3% of the nominal section.



| Spool Type | Valve Symbol (spool type) | Symbol with Spool Crossover Positions |
|------------|---------------------------|---------------------------------------|
| C | | |
| D | | |
| K | | |
| Z | | |

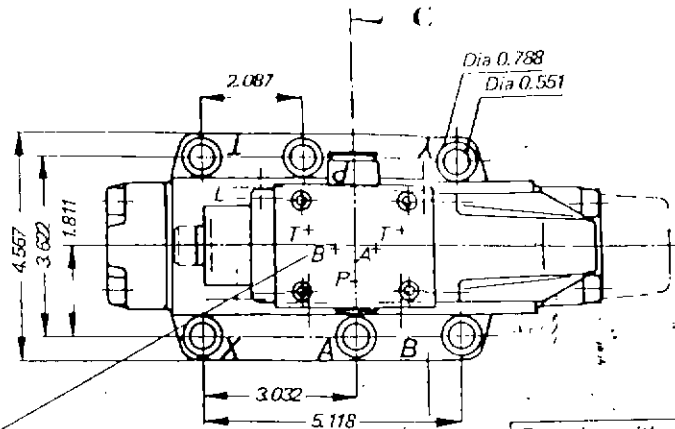
Porting pattern of main valve



machined valve mounting surface

subplate details, see p. 10

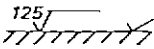
Porting pattern of pilot valve



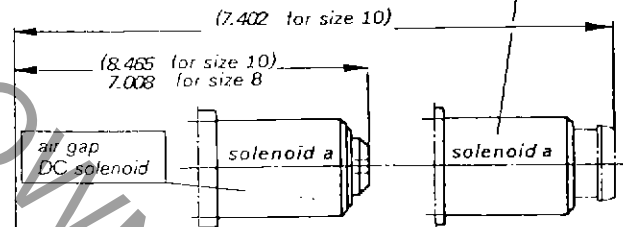
Section C-C shows the throttle orifice (see page 11)

For valves without subplates the mounting screws have to be ordered separately. Mounting screws: (6) 1/2"-13NC x 2 1/2" tightening torque 118ft-lb

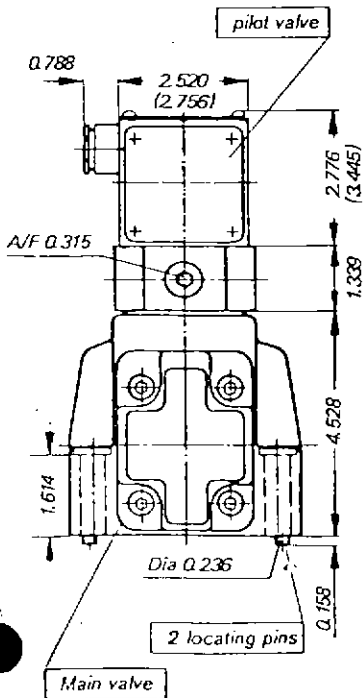
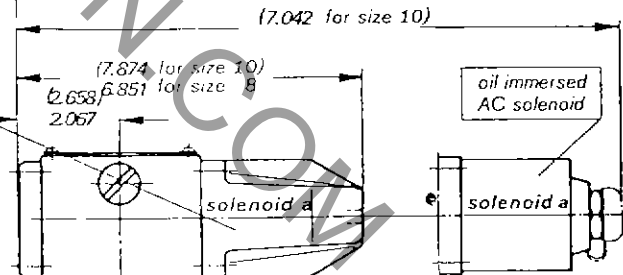
Flatness Tolerance: When mounting valve without subplate the max. irregularity of the mating surface to be ≤ 0.0001 in. per 1,000 in length



oil immersed DC solenoid



oil immersed AC solenoid



air gap AC solenoid

Throttle screw of pilot choke adjustment fully closed

Throttle screw of pilot choke adjustment fully open

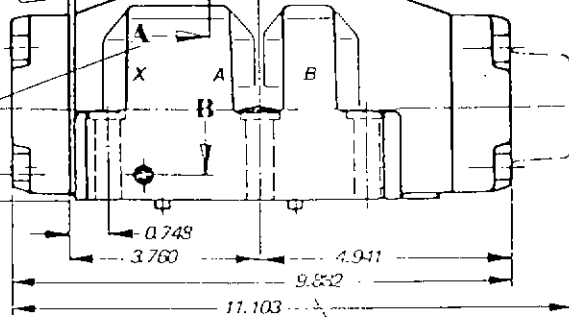
plate to take O-rings

Section A-A shows the pilot drain (see page 11)

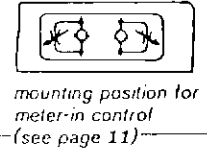
Section B-B shows the pilot oil supply (see page 11)

2-position valve, spring offset

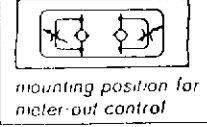
2-position valve with hydraulic return



pilot choke adjustment



pilot choke adjustment

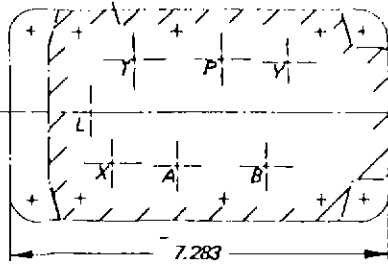


mounting position for meter-out control

mounting position for meter-in control (see page 11)

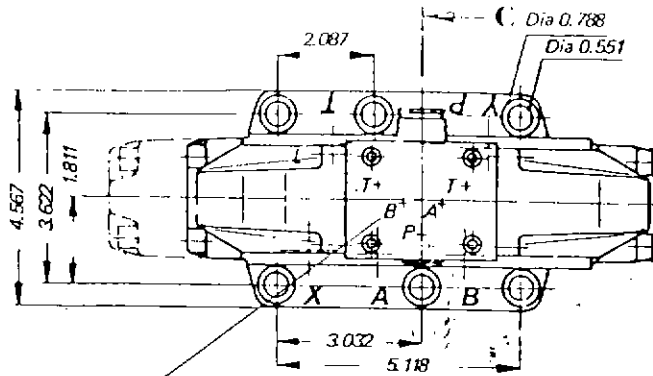
mounting position for meter-out control

Porting pattern of main valve



Machined valve mounting surface
subplate details, see p. 10

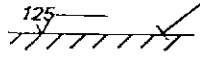
Porting pattern of pilot valve



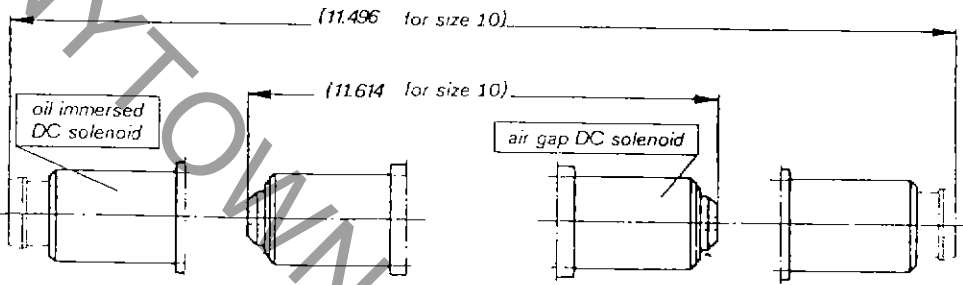
Section C-C shows the pilot drain (see p. 11)

For valves without subplates the mounting screws have to be ordered separately.
Mounting screws:
(6) 1/2"-13NC x 2 1/2"
tightening torque 118ft-lb

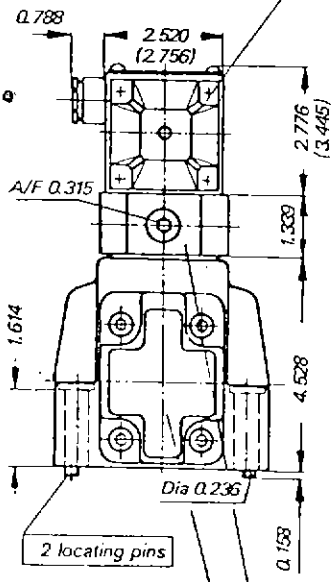
Flatness Tolerance: When mounting valve without subplate the max. irregularity of the mating surface to be ± 0.0001 in. per 1.000 in length.



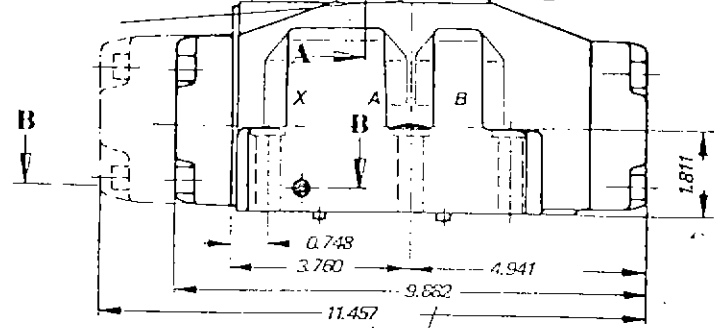
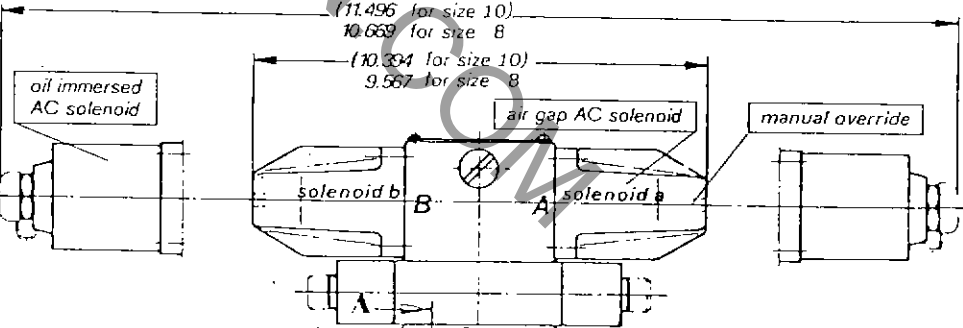
Manual override



pilot valve

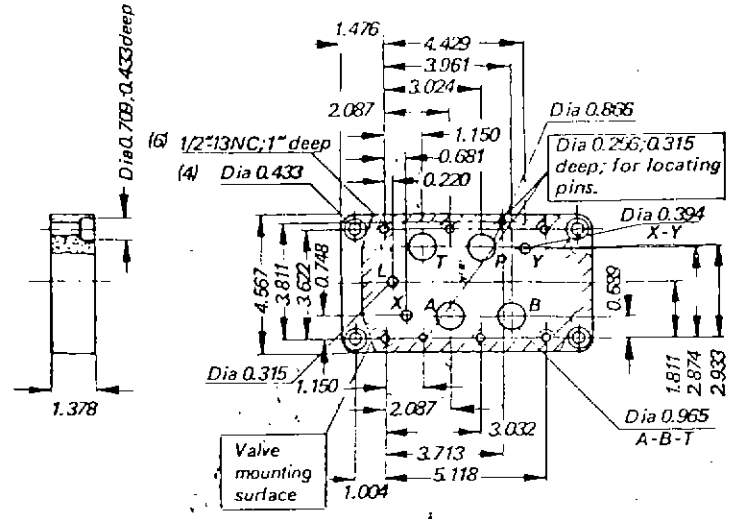
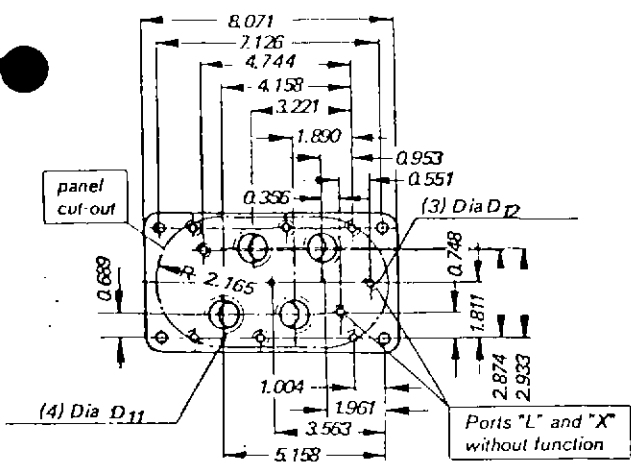


2 locating pins
main valve
pilot choke adjustment see pages 8 and 11

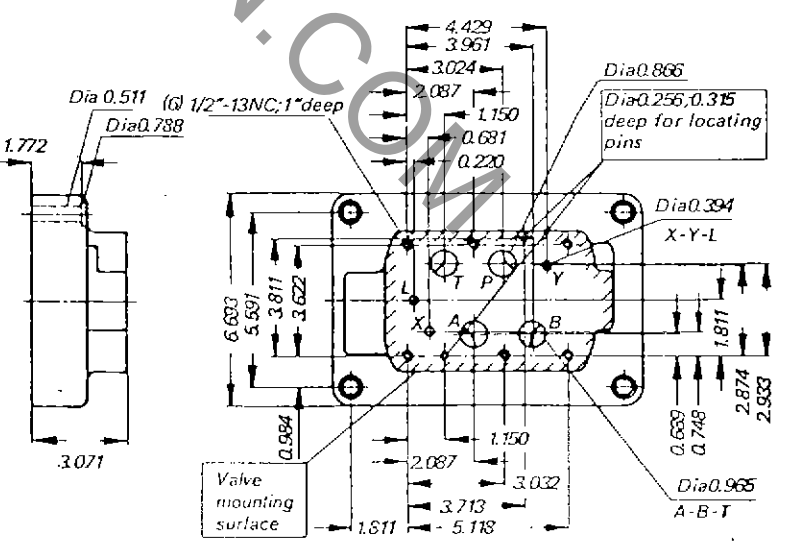
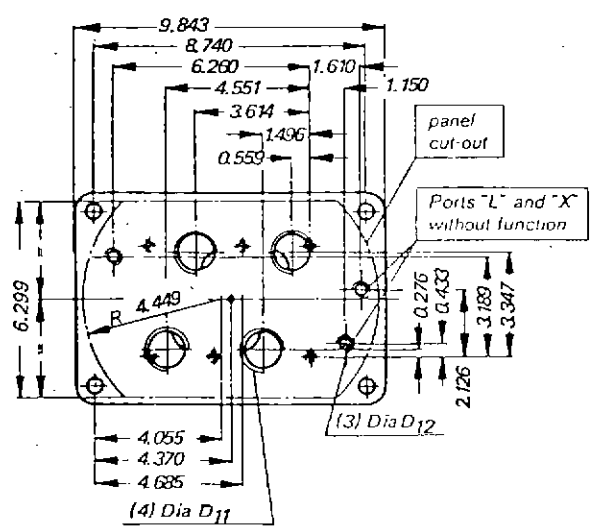


3-position valve, hydraulically centred

3-position valve, spring centred
2-position valve, hydraulic return

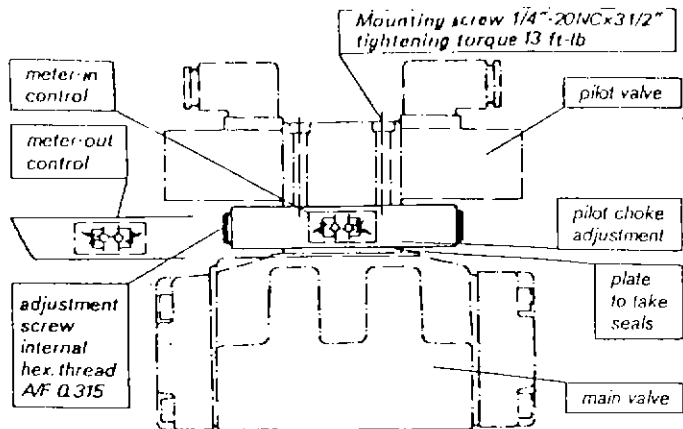


| Subplate types | Dia D ₁₁ | Dia D ₁₂ |
|----------------|---------------------|---------------------|
| G 151/5 | 1" NPT | 1/4" NPT |



| Subplate type | Dia D ₁₁ | Dia D ₁₂ | Subplate type | Dia D ₁₁ | Dia D ₁₂ |
|---------------|---------------------|---------------------|---------------|---------------------|---------------------|
| G 154/5 | 1 1/4" NPT | 1/4" NPT | G 155/5 | 1 1/2" NPT | 1/4" NPT |

Pilot choke adjustment: clock wise rotation of adjustment screw increases the response time of the main valve, counter clock wise rotation reduces the response time.

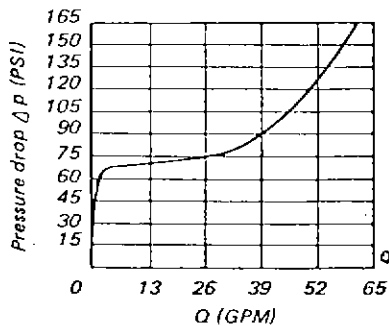
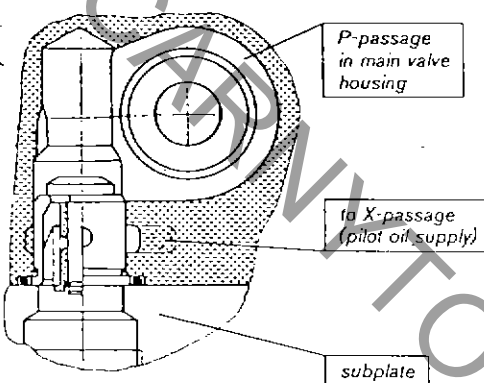


Conversion from meter-in to meter-out control: Remove pilot valve; seal plate remains in position; turn pilot choke adjustment through 180° and refit; remount pilot valve.

Pilot Pressure Insert (Type 303 717)

For valves with bypass and internal pilot drain it is necessary to fit a pilot pressure insert in the P-passage of the main valve to obtain the min. pilot pressure required.

The cracking pressure is approx. 63PSI.

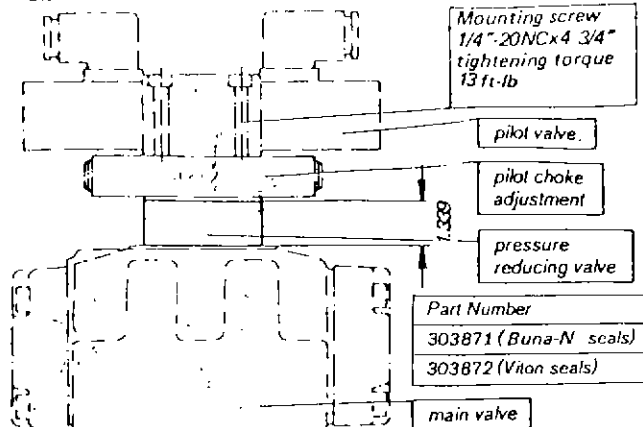


The flow resistance should be added to that of the main valve (page 4) to give a total value.

The pressure reducing valve must be used with pilot pressures in excess of 3500PSI. It affects a pressure reduction of the pilot pressure in the ratio 1 : 0.66.

Note:

The minimum pilot pressures given on page 4 must be increased by the factor $k_{pr} = 1.515$ if a pressure reducing valve is fitted. The pressure reducing valve cannot be fitted simultaneously with internal drain and pilot pressure insert (P 4.5), as the pilot pressure is then reduced to 45 PSI.



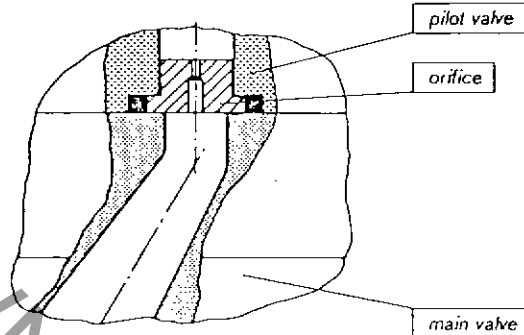
Part Number

| |
|-----------------------|
| 303871 (Buna-N seals) |
| 303872 (Viton seals) |

Throttle Orifice

Section C — C (position of section, see p. 8 and 9)

The throttle orifice serves to reduce the pilot oil supply to the P-port of the pilot valve. The orifice can be fitted to all valve types.



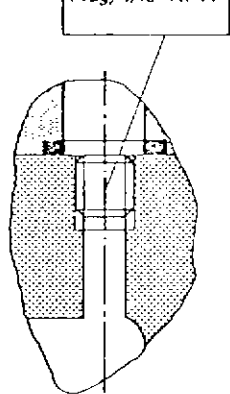
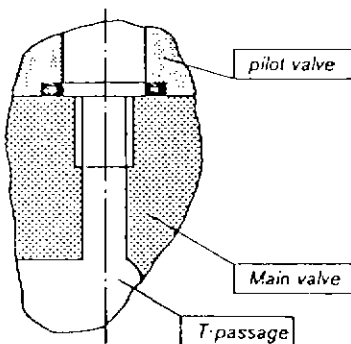
| Available Orifices | | |
|--------------------|----------|----------|
| Dia | Type No. | Part No. |
| 0.031 in. | B 08 | 121741 |
| 0.040 in. | B 10 | 121747 |
| 0.043 in. | B 11 | 121810 |
| 0.047 in. | B 12 | 121746 |
| 0.059 in. | B 15 | 129186 |

Pilot Drain, conversion internal/external

Section A — A (position of section, see p. 8 and 9)

Internal pilot drain (not for hydr. centered valves)

External pilot drain

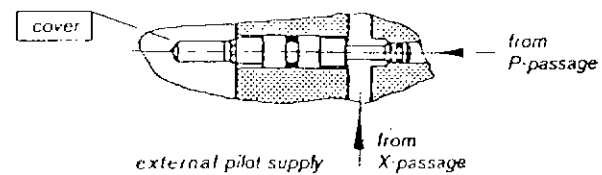
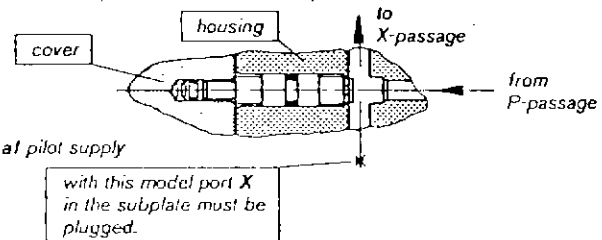


For internal pilot drain, plug 1/2" NPTF to be removed and port Y in the subplate plugged.

Pilot Supply, conversion internal/external

Section B — B (position of section, see p. 1, 8 and 9)

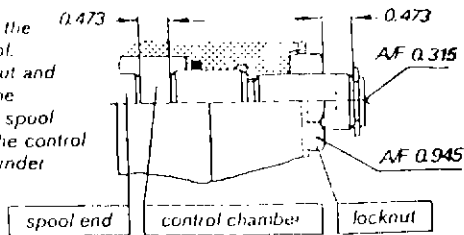
internal pilot supply



Conversion: Remove cover, remove pin and refit the opposite way. Cover screw 3/8" 16NCx1 1/2", tightening torque 50ft-lb (AF 0.315)

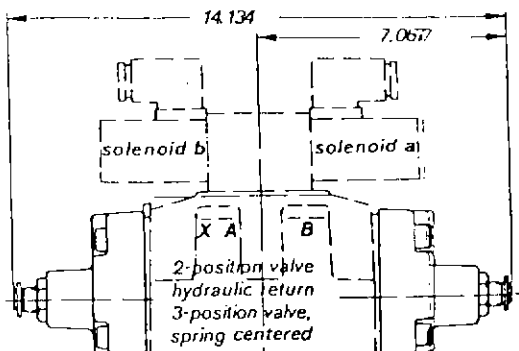
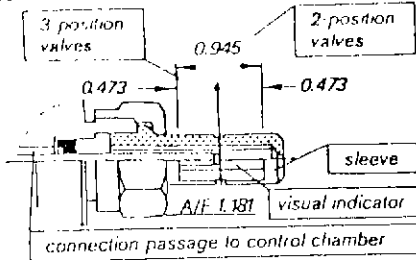
Stroke Limiter, mounting possibilities (Dim. in inches)
 Adjustment range 0.473, 1 turn = 0.090 adjustment stroke

The stroke limiter limits the stroke of the main spool. By loosening the locknut and clockwise rotation of the adjustment spindle the spool stroke is decreased. The control chamber must not be under pressure.

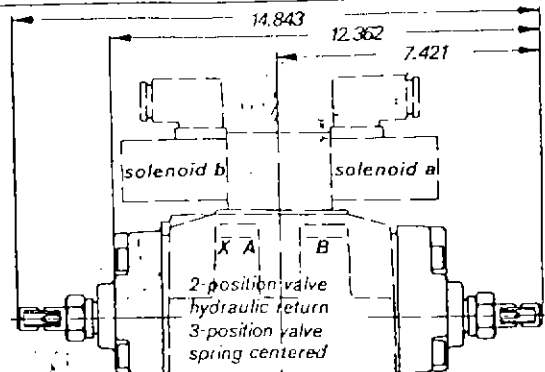


Spool Position indicator, mounting possibilities (Dim. in inches)

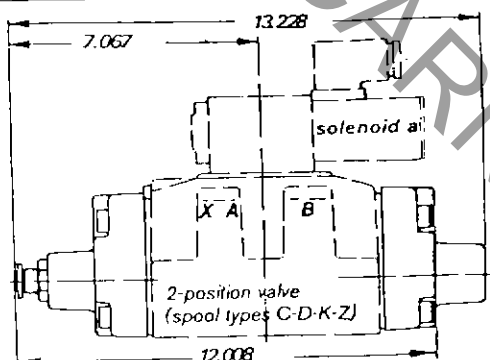
By loosening the cap nut the sleeve with visual indicator can be adjusted through 360°. The control chamber must not be under pressure.



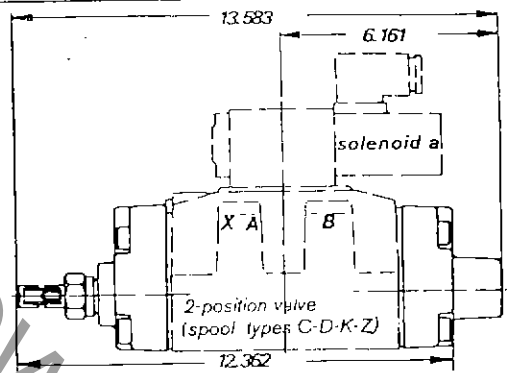
stroke limiter on A and B sides of main valve = additional feature 10
 stroke limiter on A side = 11
 stroke limiter on B side = 12



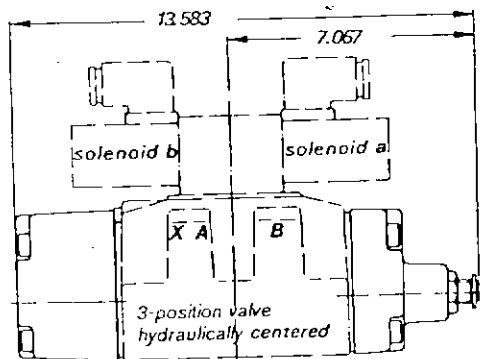
spool position indicator on A and B side of main valve = additional feature 13
 spool position indicator on A side = 14
 spool position indicator on B side = 15



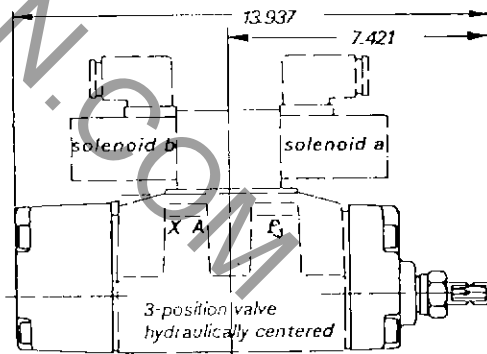
stroke limiter on A side of main valve = additional feature 11



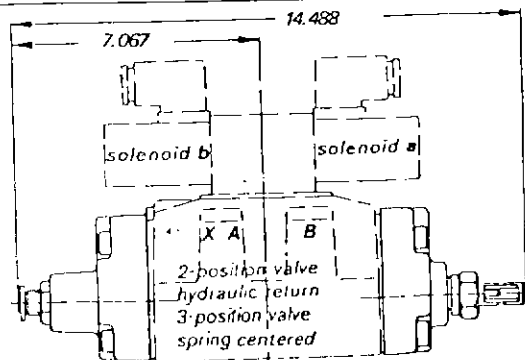
spool position indicator on A side of main valve, additional feature 14



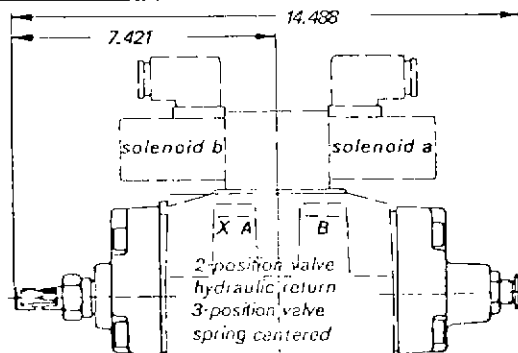
stroke limiter on B side of main valve = additional feature 12



spool position indicator on B side of main valve, additional feature 15



stroke limiter on A side of main valve and spool position indicator on B side } additional feature 16



spool position indicator on A side of main valve and stroke limiter on B side } additional feature 17

THE REXROTH CORPORATION/BETHLEHEM, PA. 18018
 2315 City Line Road, L. V. I. P.

Telex: 84-7498

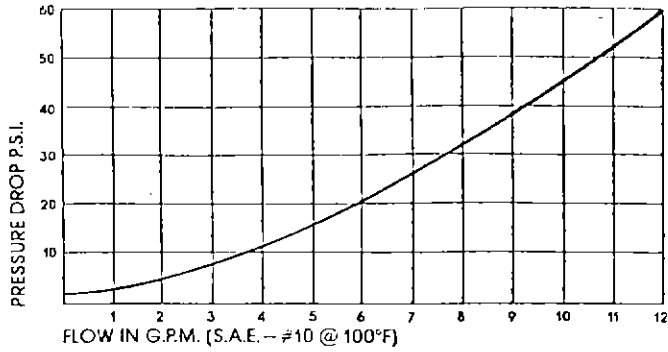
Phone: 215/865-6110

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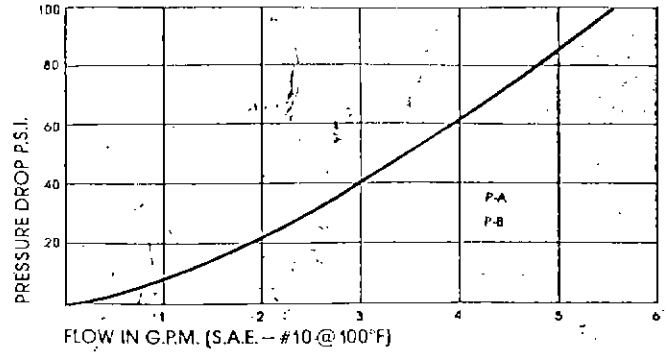
RA 24 770/4, 75 C₁ Replaces: RA 24 770/6, 74

PERFORMANCE*

85003000-3005
85003006-3011



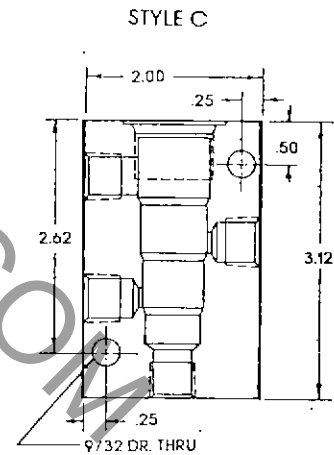
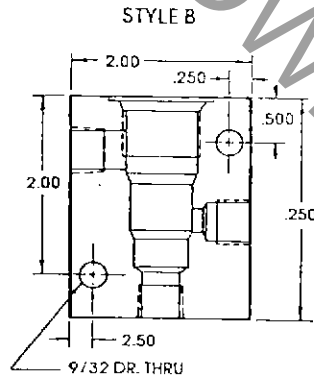
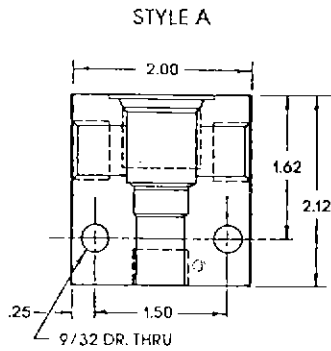
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*AVERAGE VALUES

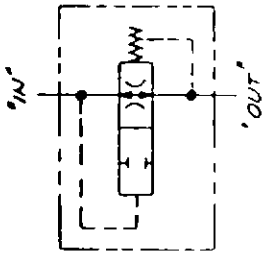
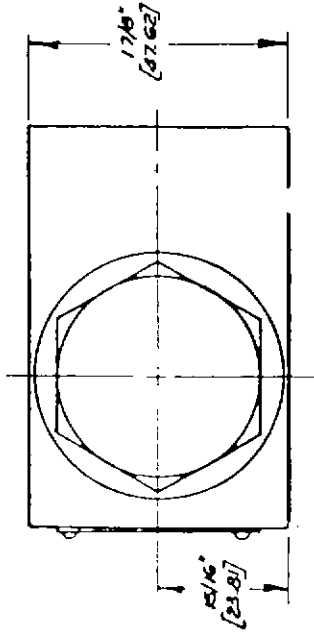
CARNY TOWN.COM

VALVE BODY STYLE OPTIONS

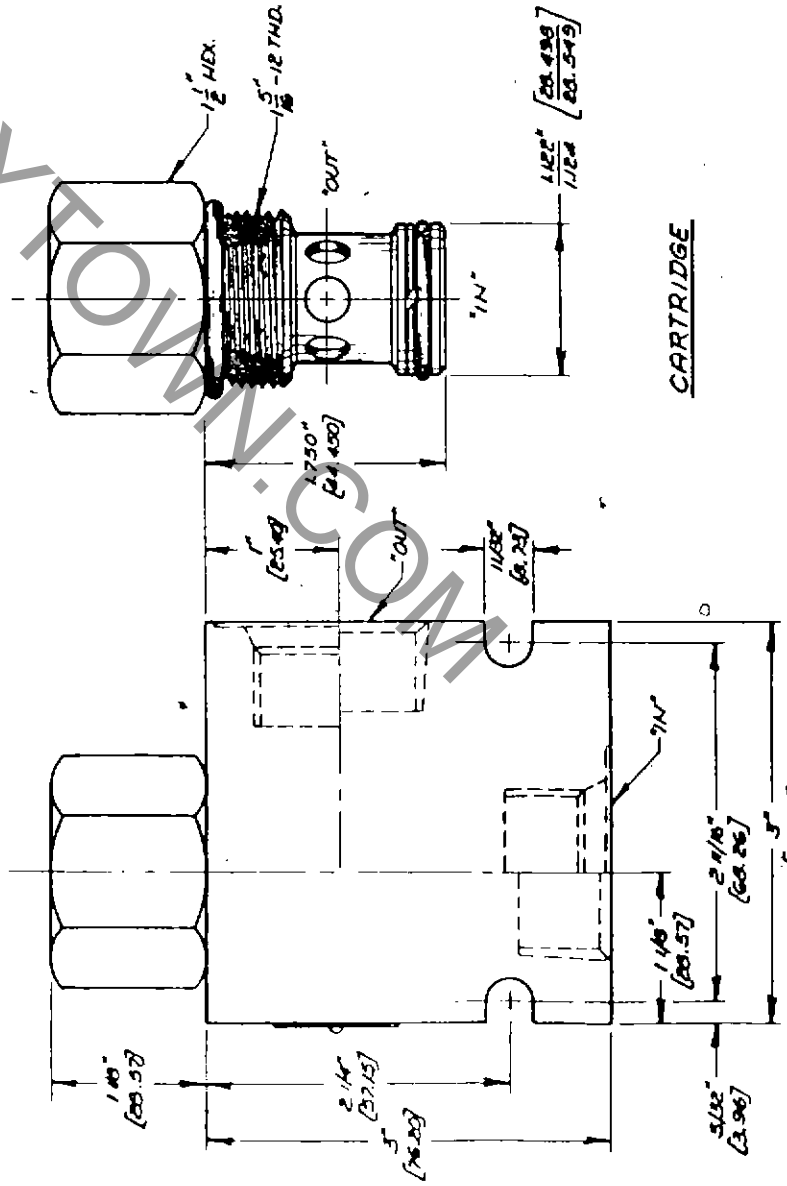


| Body Style | Use With: | Body Catalog Number | Form Tool Catalog Number |
|------------|--------------|---------------------|--|
| A | 2-Way Valves | 30102006 | 85001000  |
| B | 3-Way Valves | 30102015 | 85001001  |
| C | 4-Way Valves | 30102014 | 85001002  |

VFI-16X-F-X-X.X

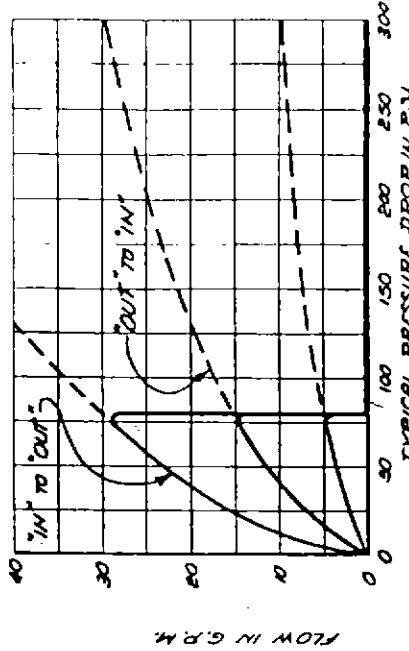


USASI SYMBOL



VALVE SPECIFICATION

1. THIS UNIT IS A FIXED FLOW (FACTORY SET) VELOCITY FUSE ALSO KNOWN AS AUTOMATIC STOP VALVE, SAFETY VALVE, EXCESS FLOW CHECK VALVE AND HYDRAULIC OR FLUID CIRCUIT BREAKER VALVE.
2. THIS VALVE PROVIDES A PREDETERMINED MAXIMUM FLOW RATE, IF THE FLOW EXCEEDS THE PRESET RATE THE FUSE WILL SNAP CLOSED AND REMAIN CLOSED UNTIL THE PRESSURE TO THE FUSE IS REDUCED TO OR BELOW 80 P.S.I.
3. FACTORY SET FLOW RATES FROM 0.5 TO 30.0 G.P.M.
4. FREE FLOW PRESSURE DROP AS DETERMINED BY ORIFICE SIZE.
5. OPERATING PRESSURE TO 3000 P.S.I.
6. OPERATING MEDIA: ALL GENERAL PURPOSE HYDRAULIC FLUIDS SUCH AS MIL-H-5608, SAE#10, SAE#20, ETC.
7. MATERIAL: HARDENED STEEL CASE WITH ANODIZED ALUMINUM ALLOY SPOOL, ALL OTHER PARTS ARE STEEL BUNA N PACKINGS STRAIGHT TEFLOON BACK-UP WASHERS AND ANODIZED ALUMINUM ALLOY BODY.
8. FUSE MODULAR CONTROLS VALVE CAVITY=C-8-2 (FOR CARTRIDGE).



ORDERING INFORMATION

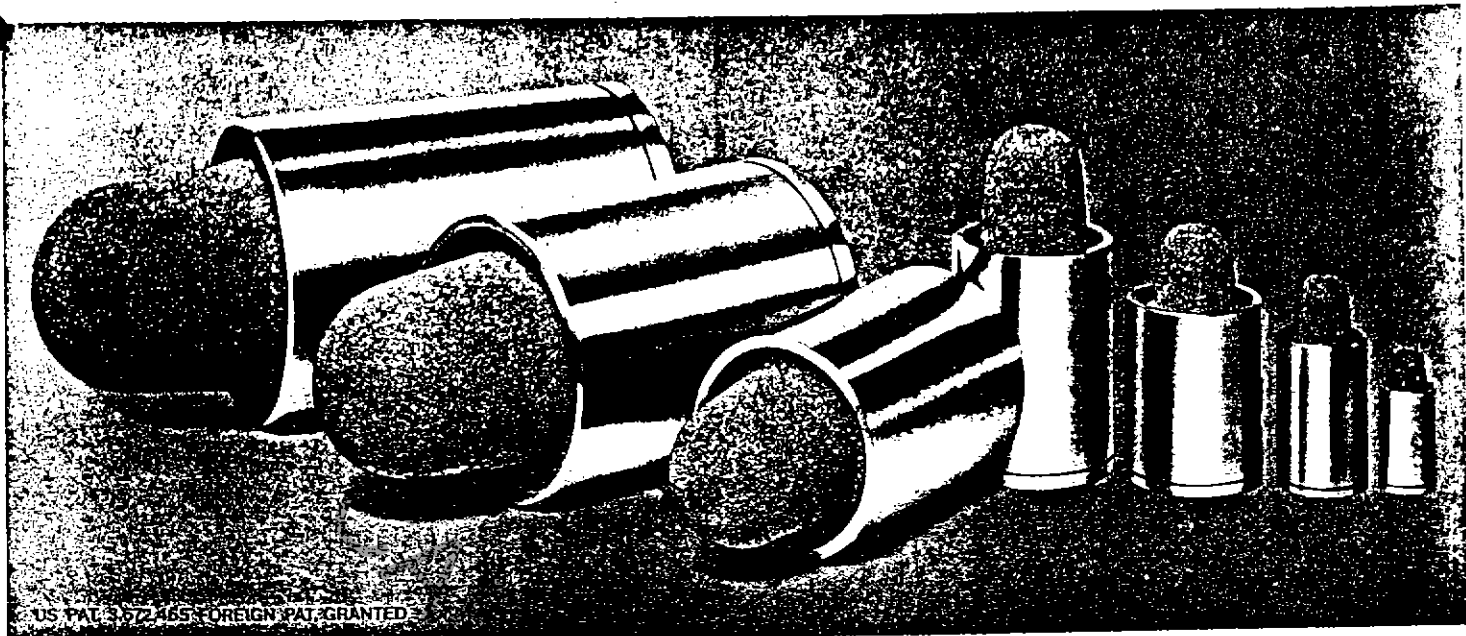
MODEL NUMBER: VFI-16-F-0-X-X

- BASIC
- STEEL AND SEALS
- 16 - BUNA N
- 16V - VITON
- ADJUSTMENT
- F - FACTORY SET
- MAXIMUM FLOW RATE
- 0.5 TO 30.0 G.P.M.
- PARTS
- 0 - CARTRIDGE
- 6 - 3/4" N.P.T.F.
- 8 - 1" N.P.T.F.
- 12T - SAE-12
- 16T - SAE-16

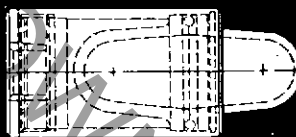
| | | |
|----------------------|------|---|
| | | Modular Controls 1000 W. 10th St. / Dallas, TX 75201 |
| DATE | 1/11 | BY |
| DESIGNED BY | | CHECKED BY |
| DRAWN BY | | APPROVED BY |
| VELOCITY FUSE | | VFI-16X-F-X-X |

"NADIR" SILENCERS

Industrial Air Exhaust

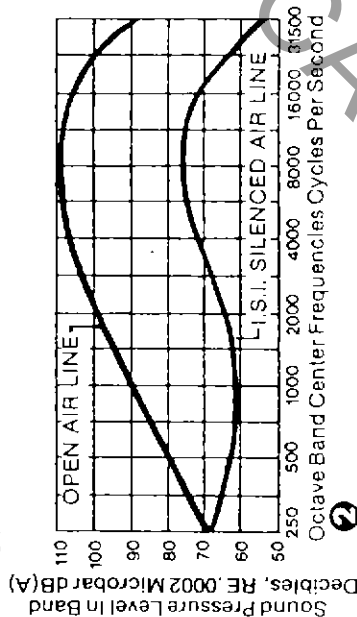
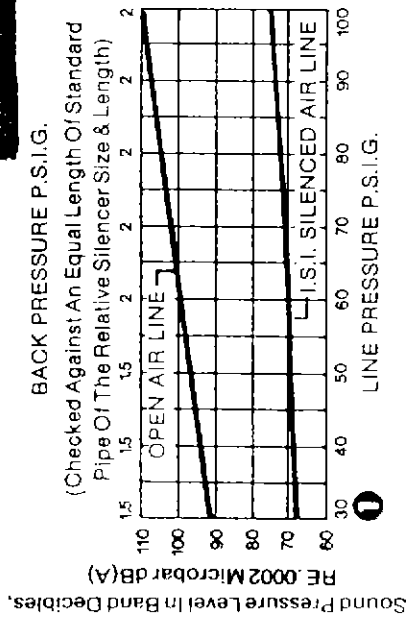


U.S. PAT. 3,157,165 FOREIGN PAT. GRANTED



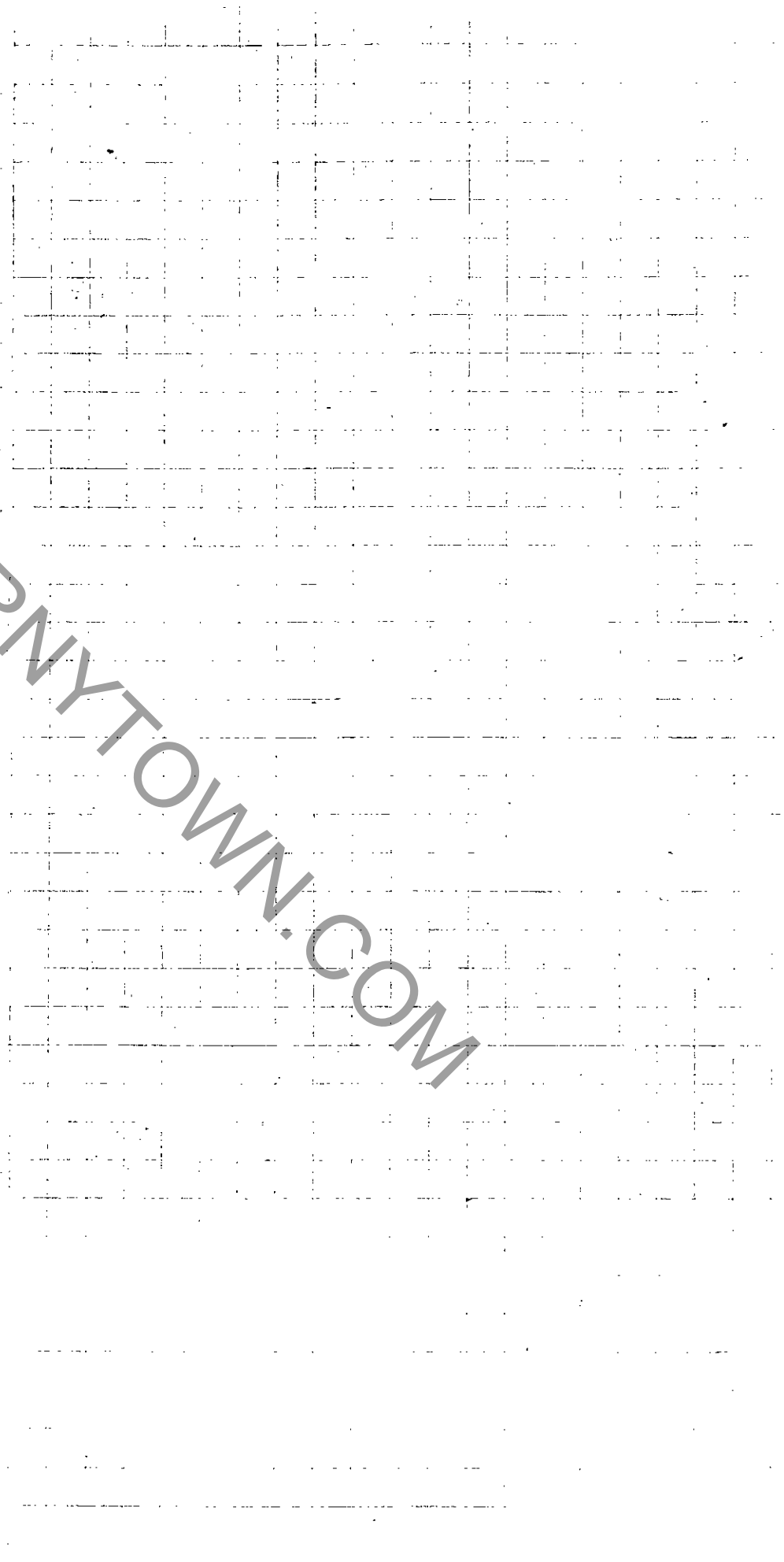
| SILENCER NO. | A BARREL LENGTH | B OVERALL LENGTH | C DIA. | D THREAD |
|--------------|-----------------------|------------------------|-----------|--------------|
| MF18 | 1-1/2 | 1-31/32 | 7/8 | 1/8 N.P.T. |
| MF18-T14 | 1-1/2 | 1-31/32 | 7/8 | 1/4 N.P.T. |
| MF14 | 2-1/8 | 2-15/16 | 1-5/16 | 1/4 N.P.T. |
| MF38 | 2-9/16 | 3-5/8 | 2" | 3/8 N.P.T. |
| MF12 | 2-9/16 | 3-5/8 | 2" | 1/2 N.P.T. |
| MF34 | 3-5/16 | 4-7/8 | 2-3/8 | 3/4 N.P.T. |
| MF34-T1 | 3-5/16 | 4-7/8 | 2-3/8 | 1" N.P.T. |
| MF100 | 4-3/8 | 6-1/2 | 3" | 1" N.P.T. |
| MF100-T114 | 4-3/8 | 6-1/2 | 3" | 1 1/4 N.P.T. |
| MF114 | 5-9/16 | 8-11/32 | 4" | 1 1/4 N.P.T. |
| MF114-T112 | 5-9/16 | 8-11/32 | 4" | 1 1/2 N.P.T. |
| MF112 | 6-1/2 | 9-7/8 | 4 1/2 | 1 1/2 N.P.T. |
| MF112-T200 | 6-1/2 | 9-7/8 | 4-1/2 | 2" N.P.T. |
| MF38V | 1-1/2 | 1-31/32 | 7/8 | 3/8 N.P.T. |

MF38V-APPLICATION, VENTURI ONLY, at 35 p.s.i.g.
DISTANCE 24" RATING 74 dBA with ZERO BACK PRESSURE



Test comparison showing I.S.I. sound level in dB(A) slow response as compared to an open air line of respective size and length. Graph 1: broad band spectrum noise analysis at 100 P.S.I.G. Graph 2: MF18, MF14 and MF38 sizes at 3 feet from source. MF12 size 6 feet from source. I.S.I. test comparisons checked with B&K No. 2204/S precision sound meter, B&K No. UA0055 random incidence corrector, attached B&K No. 4145 microphone to a flexible extension rod and B&K No. 1613 octave filter.

AMBIENT NOISE LEVEL = 64dB(A)



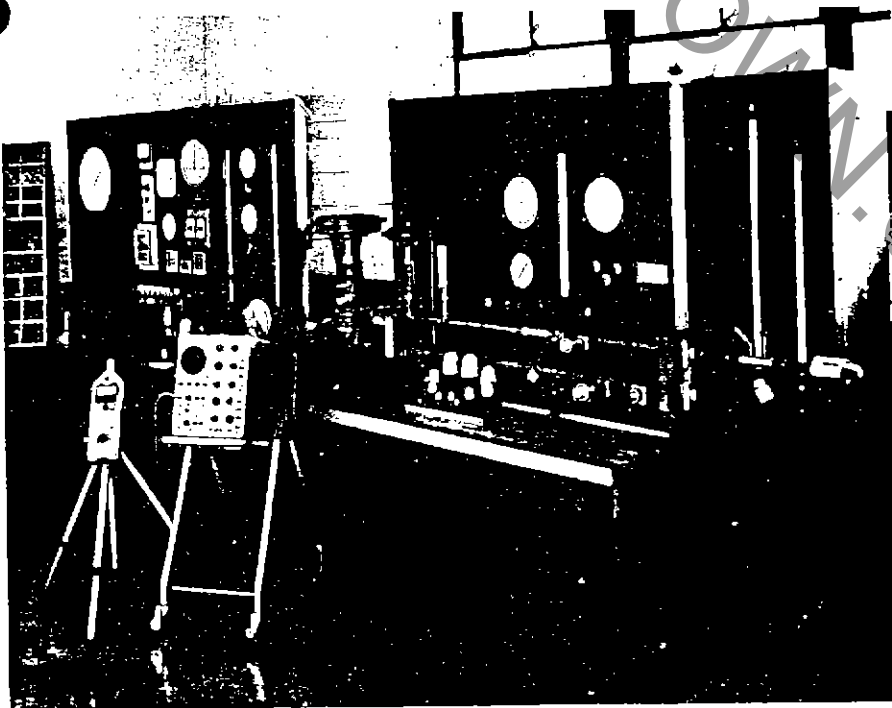
VALUES OF MAXIMUM AIR FLOW through I.S.I. AIR SILENCERS

| | OPERATING PRESSURE (PSI) | | | | | | | | | | | OPEN LINE FLOW AT 80 PSI | | | | |
|------------|--------------------------|------|------|------|------|------|------|------|------|------|------|--------------------------|------|------|------|--|
| | 35 | 40 | 45 | 50 | 55 | 60 | 65 | 70 | 75 | 80 | 85 | 90 | 95 | 100 | | |
| MF18 | 33 | 38 | 43 | 49 | 54 | 59 | 64 | 66 | 72 | 74 | 90 | 79 | 81 | 87 | 89 | |
| MF18-T114 | 41 | 48 | 55 | 59 | 64 | 69 | 72 | 77 | 79 | 87 | 90 | 92 | 98 | 100 | 102 | |
| MF14 | 65 | 74 | 81 | 89 | 96 | 104 | 111 | 121 | 129 | 136 | 152 | 143 | 149 | 158 | 165 | |
| MF38 | 126 | 138 | 154 | 170 | 185 | 196 | 211 | 225 | 240 | 255 | 256 | 271 | 284 | 300 | 316 | |
| MF12 | 173 | 193 | 209 | 231 | 251 | 272 | 289 | 310 | 327 | 348 | 407 | 369 | 383 | 407 | 477 | |
| MF34 | 237 | 266 | 295 | 324 | 352 | 379 | 407 | 432 | 462 | 499 | 679 | 540 | 569 | 601 | 628 | |
| MF100 | 419 | 475 | 532 | 584 | 636 | 692 | 744 | 801 | 857 | 905 | 1139 | 956 | 1017 | 1069 | 1126 | |
| MF100-T114 | 473 | 534 | 588 | 645 | 702 | 763 | 828 | 889 | 946 | 1003 | 1139 | 1068 | 1138 | 1182 | 1255 | |
| MF114 | 663 | 756 | 842 | 926 | 1021 | 1108 | 1189 | 1275 | 1356 | 1433 | 1910 | 1523 | 1609 | 1686 | 1788 | |
| MF112 | 962 | 1077 | 1260 | 1398 | 1558 | 1650 | 1765 | 1867 | 2016 | 2130 | 2611 | 2244 | 2382 | 2520 | 2681 | |
| MF112-T200 | 1029 | 1178 | 1347 | 1485 | 1623 | 1750 | 1899 | 2004 | 2130 | 2234 | 2611 | 2361 | 2521 | 2658 | 2796 | |

I.S.I. AIR SILENCERS

CHART READS AIR FLOW (SCFM)
 EXAMPLE:
 MF38 with 80 PSI OPERATING PRESSURE
 FLOWS 255 SCFM

44R BLOW GUN



I.S.I. SOUND & AIR FLOW TEST LAB
 Sound to 140 dBA
 Air Flow To 5000 SCFM

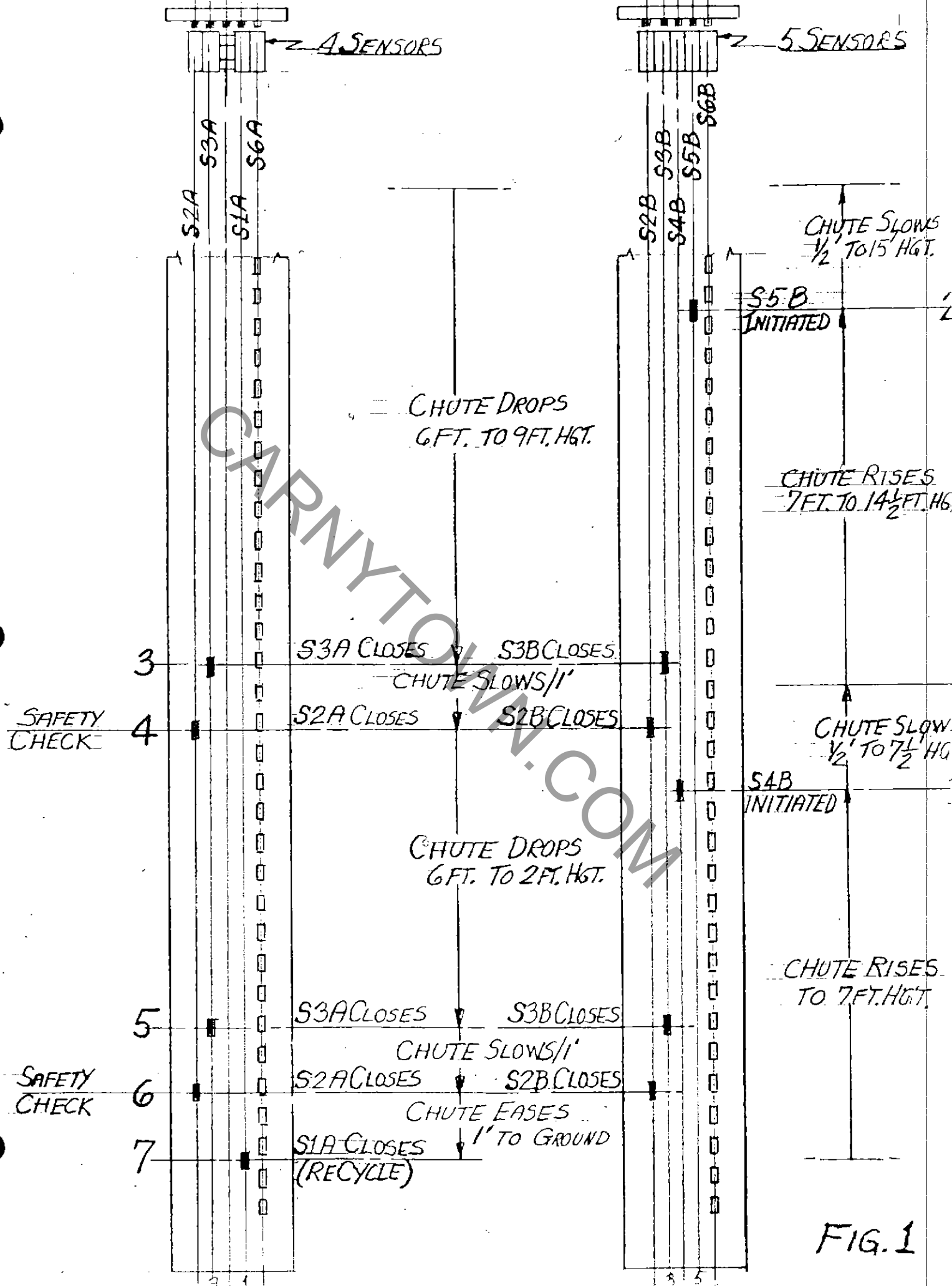


FIG. 1

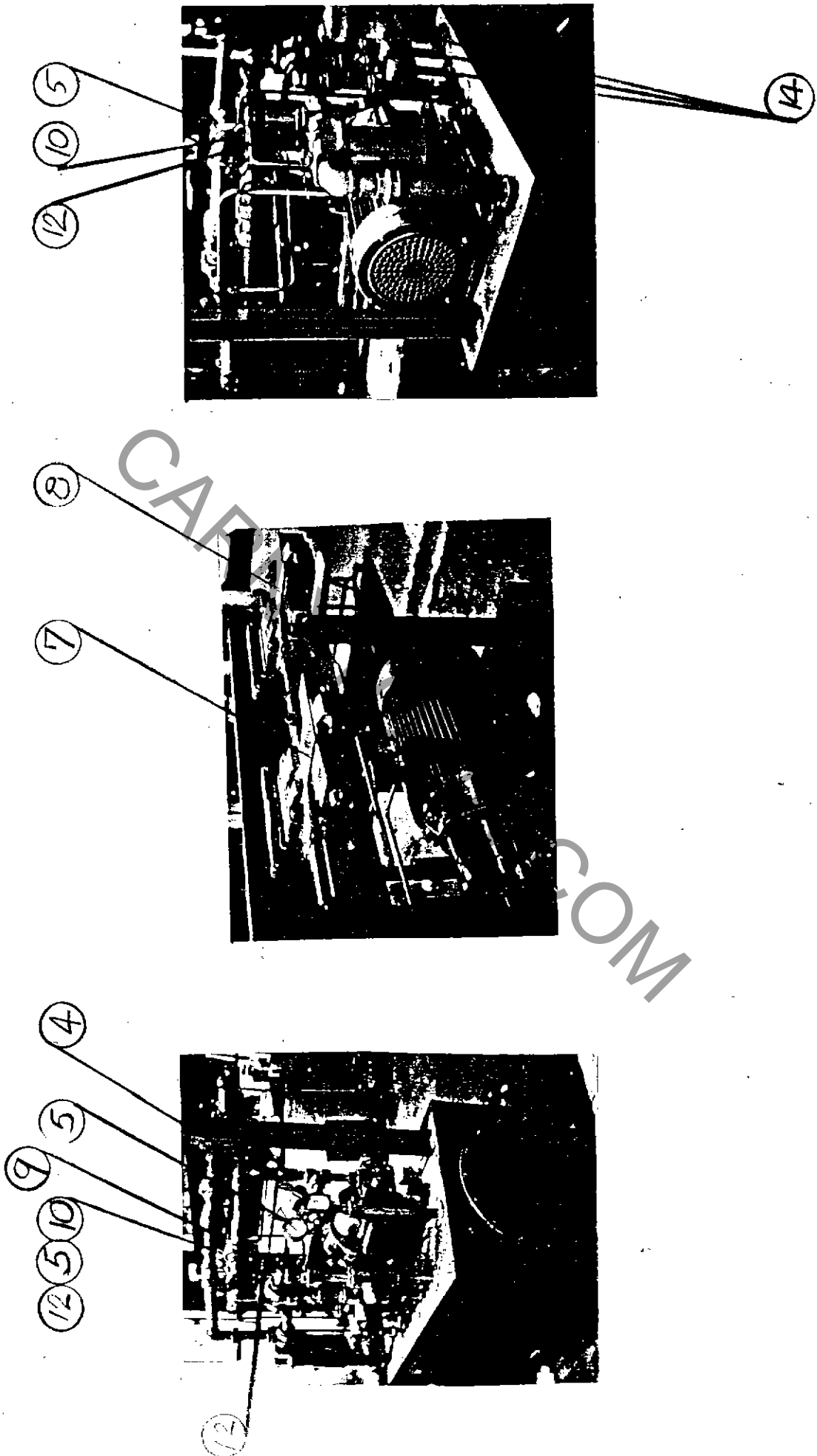


FIG.2