BELT DEWATERING PRESS
MANUFACTURING, INC

P.O. Box 118 • GREENWICH, N.Y. 12834 • (518) 695-6851

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60" BELT DEWATERING PRESS

WEST POINT, NEW YORK

TAB

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Browning Sprockets/Bushings and Chain

B PRELIMINARY DRAINAGE DRUM DRIVE (PDD)

Wer Motor
Hub City Gear Box
Browning Sprockets/Bushings and Chain

C DISTRIBUTION BOX DRIVE

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Hub City Gear Box

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Industrial Fabric
DuPont Paint
Spraying Systems, Inc., Nozzles

☑ APPROVED DATE: 12/10/84
☐ DISAPPROVED CHECKED BY: DGertz
☐ REVISE AND RESUBMIT
☐ APPROVED NOT AS NOTED
SUBJECT TO CONFORMITY TO PLANS AND SPECIFICATIONS FOR THIS WORK EXCEPT AS TO FIGURED DIMENSIONS.
JACQUES H. GERSTENFELD
Architect

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P.O. Box 118 ⊕ GREENWICH, N.Y. 12834 ⊕ (518) 695-6851

LIST OF SPARE PARTS

1 - 60" Belt Dewatering Press - (1.5 Meter)

WEST POINT, NEW YORK

One set of belts (mesh size to be selected after two months of operation)

Two Sets of doctor blades

One main press drive chain (60 pitch)

One primary drum drive chain (40 pitch)

Two drive roll bearings

Two table roll bearings

Two tracking roll bearings

Two "S" roll bearings

BELT DEWATERING PRESS MANUFACTURING, INC.

BELT FILTER PRESS

EQUIPMENT, OPERATION & MAINTENANCE MANUAL

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Forward

The design concepts of the BDP belt dewatering press machine are based on the premise of producing a dependable unit with the best possible throughput, dryness and filtrate quality. However, in addition to this, the machine has been designed for the operator and the maintenance personnel.

As the operator becomes more and more familiar with the numerous practical components and operating systems, maintenance, cleaning and mechanical ability of the equipment, the operator should become at ease and confident with the machine.

This manual will introduce and familiarize personnel from an operating, mechanical and maintenance standpoint. The manual was compiled through informational input solicited from those directly operating, building and maintaining these machines.

INTRODUCTION

A. General

The key to the success of any dewatering equipment is the proper operation maintenance of the equipment. The key to the results when properly operating maintaining a machine is in the feed sludge characteristics and proper conditio of sludge with polymer.

There are many sludge characteristics which affect the sizing, through cake dryness, and filtrate quality of a belt filter press. All belt filter pre are rated by the effective meter width of the machine and the solids throughpu lbs. of dry solids/hr/meter width.

B. Sludge Sources and Characteristics

1. General - Sludge sources and characteristics can vary from communit community depending on the types of sewers, industrial and commercial sources other contributing factors. However, the fact that most treatment plants gener use the same processes for removal of BOD_5, Suspended Solids and NOD, allows ge al classifications of sludges and sludge characteristics to be made.

2. Sludge Sources - The two most general classifications of sludge are mary and Biological and can be characterized as listed below:

Primary	Biological
Fibrous (porous)	Fine (non- porous)
Large Particle Size	Colloidal
Non-Compressible	Compressible

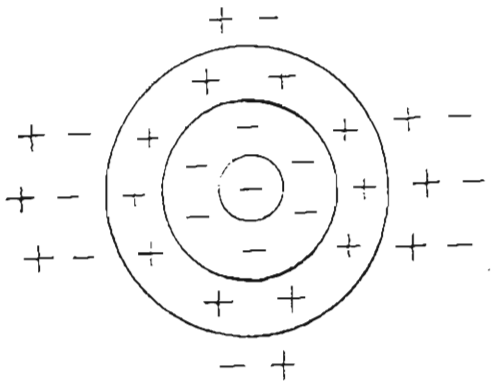
These characteristics reveal why fresh primary sludges are so relatively to dewater from a standpoint of cake dryness, throughput and filtrate quality why fresh biological sludges are more difficult.

Expanding these characteristics further:

a. Fibrous (porous) vs. Fine (non-porous) - Solids that are fibrous in na have a tremendous quantity of pores and generally release water quite rap whereas fine solids are less porous and tend to fill the voids in the belts sludge or be lost in the filtrate during sludge dewatering processes.

b. Large Particle Size vs. Colloidal Particles - Heavier large particles settle and agglomerate naturally to form flocs which are readily dewatered for lease of the free or carrier water and some bound or capillary water. Collo particles (whose behavior and characteristics are generally duplicated by biol cal sludges and septic sludges, although the particles are generally larger colloidal size) do not settle at all and may be either hydrophobic (water hat or hydrophylic (water loving in nature).

1. Hydrophobic colloids - These particles do not agglomerate easily due to the fact that their surface charges (Zeta Potential) predominate their activity and overcome natural attractive forces (Brownian Motion and Van Der Wal's forces). The reason that the surface charge predominates the particles behavior is that the surface area of the particle is much greater than the mass. Most colloidal particles are negatively charged and have a double electric layer around them as depicted below:



Therefore, for hydrophobic colloidal solids to coagulate, the polyelectrolyte or polymer is usually cationic and must neutralize the natural repulsive charges of the particles.

2. Hydrophylic colloids - These particles exhibit their behavior of infinite suspension strictly due to their affinity to water. This bond is extremely difficult to break and often extremely large dosages of coagulants are required or other forms of treatment such as heat are needed to break this bond. A sludge with many particles that exhibit hydophylic colloidal behavior can, therefore, only be dewatered to a certain degree and no further without additional processes and expenses.

C. Non-Compressible vs. Compressible - In any dewatering process, the solids that are non-compressible will exhibit more backbone when put under pressure and will retain shape and openness, whereas compressible solids will collapse and fill all voids available, virtually locking out the removal of filtrate through the cake and belts.

3. Sludge Characteristics - Some of the numerous sludge characteristics affecting the dewaterability of sludges are:

1. Particles size distributrion and source of sludge (solids character)
2. Volatile solids content
3. pH of sludge
4. Whether or not the sludge is anaerobic, and the length of time it has been anaerobic.
5. Proportions of primary and biological sludges
6. Solids content of % solids

The effects of these characteristics can be summarized in the following ments:

1. The nature of the sludge (by settling, chemical or biological so will, with a review of the discussion under Sludge Sources, give an understanding of the degree of difficulty to expect in dewate the sludge.
2. As the volatile solids content of a sludge increases, the hydrop content of the sludge normally increases resulting in higher coa dosages.
3. The pH of the sludge may affect the surface charges of suspended ticles and may also affect the configuration and charge on polym Normally, a pH as low as 5.5 does not significantly affect polym dosages.
4. Septic or anaerobic sludges, even totally digested sludges, have their nature created more fines which exhibit colloidal behavior these sludges also have entrained gases.
5. The sludge that is 70% primary and 30% waste activated, for exam will dewater significantly drier and easier than a sludge that i primary and 70% waste activated.
6. Sludge solids content or % solids greatly affect the volume that sludge occupies and the amount of water that must be removed to achieve a desired dryness.

This is shown by the following:

1. Sludge Volume and Sludge Concentration Relationship where:

$V1 \quad S_2$

$V_2 \quad S_1$

V1 = initial volume of sludge
V_2 = final volume of sludge
S_1 = initial solids concentration
S_2 = final solids concentration

This approximate relationship shows that if 100 gallons of 1% sl solids content is concentrated to 2% sludge solids content, then volume will be only 50 gallons. Doubling the solids content of sludge results in halving the volume. (see Table 1)

1. Performing a Mass Balance on a Belt Press

The useful formulas listed below were used to calculate Table No which follows and dramatically represent the importances of feed highest % solids possible to a dewatering unit.

a) Dry lbs. of sludge dewatered per hour =

$$\frac{\text{Sludge solids feed (mg/l)} \times \text{gpm}}{2{,}000} \quad (1)$$

b) Dry lbs. of filtrate discharge per hour =

$$\frac{\text{filtrate suspended solids (mg/l} \times \text{gpm)}}{2{,}000} \quad (2)$$

c) % Solids Capture = $\frac{(1) - (2)}{(1)}$

d) Dry lbs. of sludge cake discharge per hour =

$$(1) - (2) \quad (3)$$

e) lbs. of water fed to press per hour =

$$\text{gpm} \times 8.34 \times 60 - (1) \quad (4)$$

f) lbs. of water in cake per hour =

$$\frac{(3)}{\text{\% cake solids}} - (3) \quad (5)$$

g) % water removed = $\frac{(4) - (5) \times 100}{(4)}$

Example:

Feed Solids = 4% T.S.S. (40,000 mg/l)
Filtrate Solids* = 2,000 mg/l
gpm (feed sludge) = 100 gpm
Cake Solids = 25%
gpm (filtrate) = 45 gpm

a) $\frac{40{,}000 \times 100}{2{,}000}$ = 2,000 dry lbs. (1)

b) $\frac{2{,}000 \times 85}{2{,}000}$ = 85 dry lbs. (2)

c) $\frac{2{,}000 - 85}{2{,}000}$ = 95.75%

d) 2,000 - 100 = 1,915 dry pounds (3)

TABLE NO. 1

DEWATERING COMPARISON

EFFECT OF FEED SOLIDS CONCENTRATION ON SOLIDS THROUGHPUT

FEED SOLIDS CONCENTRATION (% T.S.S.)	THROUGHPUT (DRY LB/HR)	WATER REMOVED (%)
2	1000	91.9
2.5	1250	89.8
3	1500	87.7
3.5	1750	85.6
4	2000	83.4
4.5	2250	81.2
5	2500	79.0

** ALL GO TO 20% SOLIDS AND FILTRATE QUANTITY AND QUALITY STAYS THE SAME

e) $100 \times 8.34 \times 60 - 2{,}000$ lbs. $= 48{,}040$ lbs. (4)

f) $\frac{1{,}915}{0.25} - 1{,}915 = 5{,}745$ lbs. (5)

g) $\frac{48{,}040 - 5{,}745}{48{,}040} \times 100 = 88.04\%$ (6)

* Filtrate does not include shower water or polymer mixure.

C. Belt Filter Press Anticipated Throughput and Dryness

Sludge Dryness	Feed Sludge % Solids *	Throughput lb/hr/meter	Cake Dryness % Solids
Aerobically Digested	1.5 - 2.5	500	13 - 16
Fresh Water Activated	2 - 4	750	17 - 20
Anaerobically Digested	3 - 5	1,000	18 - 22
Combined Primary & Waste Activated	2.5 6.5	1,500	18 - 40

* If this value is greater than listed value, higher % solids in the cake can be expected.

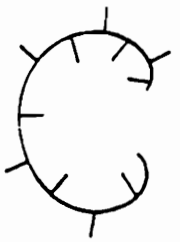
D. Polymer Conditioning of Sludge

1. General - Polymers are linear chains of high molecular weight (in the millions) organic synthetic flocculating agents which have many sites available for the colloidal particles in sludge. Since most sludge solids are negatively charged, cationic or positively (+) charged polymers are used since the polymers can then coagulate or gather particles by electrical charge neutralization or chemically. Although cationic polymers are the most common used, anionic or negatively (-) charged polymers and non-ionic or neutrally charged polymers are also marketed. This is due to the fact that some sludges are extremely difficult to coagulate and flocculate and rquire a combination of two different types of polymer. The most

commonly used polymers are characterized by high molecular weight, high posit charge.

Polymers normally coagulate by particle absorption and then interparti bridging with other polymer chains causing a cross linking effect. Polymers available in dry, liquid, and gel or emulsion form. The most commonly used are liquid and dry polymers. The dry forms are approximately 100% pure, the liq forms vary between 4-8% for a water solution polymer up to 50% for an emulsion p ymer.

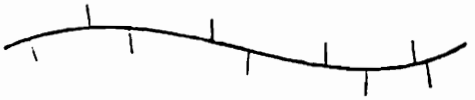
2. Polymer Dilution (Day TAnk) and Secondary Dilution - When mixing a tank solution of polymer, there are general guides for the desired concentration polymer to avoid overdosing. This is due to the fact that the high molecu weight synthetics look like this in the concentrated state:



— POLYMER MOLECULE WITH AVAILABLE SITES

Many of the polymer's sites available for particle capture are lost in center of the closed shape. Dilution with water in a day tank will serve to h the following effect:

This has made the polymer open up to a certain degree and allowed more si to be available. Finally, the use of secondary dilution water in the polymer so tion feed line results in the following polymer shape:



This readily reveals that more sites are now available and the least poly dosage will be applied.

The day tank dilution of the polymer depends on the type of polymer.

Generally:

1. For a liquid water solution polymer, a 10% solution should be the maximum concentration made. This should be made assuming the polymer is 100% pure. For example: A 10% solution is made by mixing a 0.4 foot of polymer in a total solution mixture of water and polymer of 4 feet.
2. An emulsion liquid polymer would be mixed in the same way as 1), however, if the emulsion were 40% (most water solution polymers are only 4-8%), this fact must be taken into consideration along with the pumping abilities of the chemical feed pump.
3. Dry polymers are normally mixed in a day tank with a maximum concentration of 1%. By this is meant, 1 lbs. of polymer for every 100 lbs. of water. In all cases, the mixer should be left on until the polymer is thoroughly dissolved into solution. Secondary dilution water should be added via the method depicted in Figure 1. This set up should be located within 50 feet of the belt filter press. The metering of the water rate in gpm is important since the secondary dilution water necessary will vary depending on feed sludge characteristics.

3. Anticipated Polymer Dosages - Polymer dosages are generally calculated in lbs. of polymer/dry ton of solids processed. In these calculations, whatever polymer amount is used is considered to be pure polymer. This is the way all dosage data is calculated:

Example No. 1

A day tank solution using 96 gallons of a liquid (water solution) polymer is 960 gallons of total solution is made. This day tank lasts 8 hours. In this 8 hour period, 10 dry tons of sludge are processed on a 2 meter machine.

The polymer dosage is lb/dry ton is calculated as follows:

$$\text{Lbs. of polymer used} = 96 \text{ gallons} \times \frac{8.37^{*} \text{ lbs.}}{\text{gal.}} = 803.53 \text{ lbs.}$$

$$\frac{\text{Lbs. of polymer}}{\text{dry ton solids}} = \frac{803.50}{10} = 80.4 \text{ lbs/dry ton}$$

* unit weight of polymer per gallon

Example No. 2

A day tank is made up of a 5% solution of polymer. The polymer feed pump is delivering the solution at 1.6 gpm. A belt filter press discharge is 2 tons per

hour at a solids content of 25%. What is polymer dosage?

$$\text{lbs/hr of polymer} = \frac{50{,}000 \text{ mg/l}^* \times 1.6 \text{ gpm}}{2{,}000} = 40 \text{ lbs.}$$

Tons dry solids/hr = 2 x .25 = .5

* Equivalent to 5%

$$\text{Therefore: lbs/dry ton} = \frac{40 \text{ lbs.}}{0.5 \text{ tons}} = 80 \text{ lb/dry ton}$$

The actual dosage fed for any belt press opeation depends on 1) the type sludge being dewatered and 2) the proper operation of the polymer system. Typi values of polymer dosages are: (all values lbs/dry tons)

Sludge Type	Liquid Polymer	Dry Polymer
Aerobically Digested	100 - 200	8 - 15
Fresh Waste Activated	100 - 200	7 - 12
Anaerobically Digested	80 - 200	5 - 12
Combined Sludge	60 - 150	3 - 10

While polymer can be categorized generally, their reactions with sludge c vary significantly. An optimum application with one polymer may depend upon a ve narrow spectrum of variables, while another may give similar results over a wi range of operating parameters. It is important to work closely with the polyr supplier to achieve the lowest chemical costs. He should be consulted specifical in the following areas:

1. Proper product
2. Method of mixing
3. Solution strengths
4. Use of dilution water
5. Point or points of application

See Figure No. 1 for recommended polymer introduction.

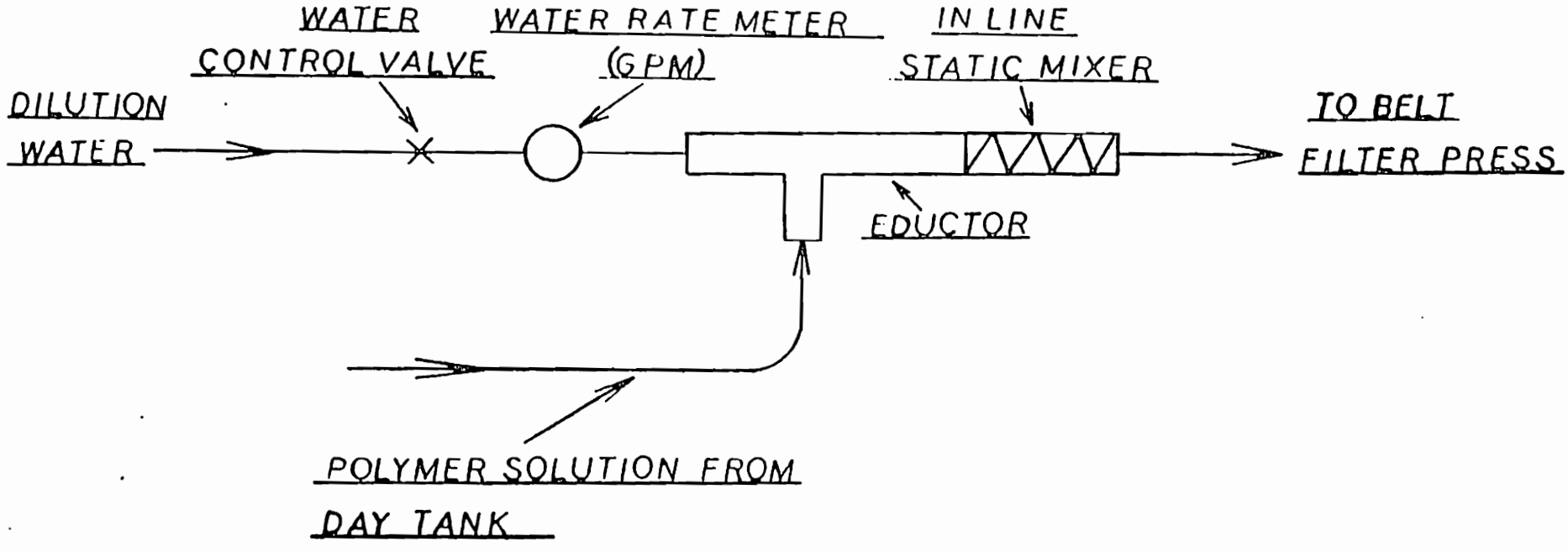

WATER
CONTROL VALVE
WATER RATE METER
(GPM)
IN LINE
STATIC MIXER
DILUTION
WATER
TO BELT
FILTER PRESS
EDUCTOR
POLYMER SOLUTION FROM
DAY TANK

FIGURE NO. 1

I. PRESS COMPONENT SYSTEMS

General

The belt press is comprised of several component systems which provide one more functions and complement and/or support one another. A description of component systems is present herein.

A. Structural

The frame of the press is made up of welded 4" x 6" 1/4" heavy duty rectangular steel tubing conforming to ASTM A-500 specifications. Structural steel supports for the press that are non-tubular conform to ASTM A-36. The pressure gravity sections of the machine have rigid welded side frames with bolted cross members. All bearing pads are welded on the structural tubing frame, are a minimum of 3/4" thick and have machined bearing surfaces.

All rollers are constructed of schedule 40 carbon steel pipe with carbon steel journals and double flanges. The table rollers or gravity dewatering section rollers are constructed of 3" diamater carbon steel stock shrunk fit into each end. The other rollers have double flanged journals which are welded to the tubing. The Appendix contains information on roller locations, roller sizes, shaft diameter sizes and bearing numbers for your size machine. All of the rollers are coated with a minimum of 1/4" of fiberglass or 1/8" of neoprene over 1/4" of fiberglass, depending on the location and stress loading of the rollers.

All rollers are supported with bolted in place, heavy duty, double sealed pillow block ball bearings. The bearings are self aligning and are fitted with Alemite grease fitting. Each bearing is mounted on an individual bearing plate allowing easy access to rollers for removal and replacement. Rollers can be removed and replaced without removing adjacent rollers or sections of frames.

All exposed non-stainless steel components receive a protecting coating of polyurethane 7 step corrosion protection system. This system has excellent corrosion resistant and cleaning properties.

The combination of the heavy duty frame, pillow block bearings and machined mounting bearing surfaces ensures both stress loading distribution and structural integrity for the press.

B. Belt Tension (pressure) and Belt Tracking

The pneumatic system which: a) allows control of the operating pressure on

sludge being dewatered; b) provides the required high pressure for added dewatering and; c) provides the tracking of the top and bottom belts, is simple and dependable and will maintain constant pressure even if cake thickness varies.

The operating pressure is provided by four (4) pneumatic cylinders (whose diameters are dependent on machine size) which are capable of providing pressure through their entire arm extension. These cylinder pressures are easily controlled by simply setting an air pressure controller at the press control panel. Two of the cylinders are provided for the top belt and two for the bottom. The cylinders are bolted to the frame on steel support pads and threaded into a structural support on the return rollers.

The high pressure sections (not found on some machines) of the press are provided by cylinders which actuate a set of press rollers. The diameter of these cylinders are equal to the operating pressure cylinders but have much shorter extension lengths (3"). These cylinders are also controlled by just setting an air pressure controller on the control panel and result in added pressure exerted on the sludge being dewatered by the resulting surface contact of two adjacent rollers. The high pressure rollers are located near the discharge end of the machine. The cylinders are bolted to the frame on steel support pads and pin connected to the press rolls.

The belt tracking devices are simple, time proven and extremely dependable. Paddle shaped limit switches are used to actuate a reciprocating air valve that in turn operates a cylinder connected to a tracking roller. The tracking roller is moved either one direction or the other depending on the direction the belt is to be moved. The tracking roller is connected to the cylinder by a yoke clamp and the cylinder is guided by a high density polyethylene wear plate. One tracking cylinder provides tracking for the top belt and one cylinder provides tracking for the bottom belt, supplemented by over travel shutdown switches.

All cylinders are constructed of brass and the cylinder rods of stainless steel. The air supply for the press may be fitted with a moisture trap and an automatic oiler to protect and provide lubrication for all pneumatic cylinders, respectively.

The pneumatic system is further detailed in the schematic and in the operation of the machines.

C. In-Line Static Mixer and Sludge Feed Line

1. The in-line static mixer provides for and forces intimate contact and mixing between the sludge being dewaterd and the polymer and plyelectrolyte used for the sludge conditioning. (See sludge conditioning theory and polymer addition

sections for further information on conditioning).

A flanged section of schedule 80 PVC pipe with internal 304 stainless st fins bolted to the pipe make up the in-line static mixer. The long fins are po tioned at an angle from the vertical and are installed staggered between the t and bottom fins. The fins are also welded to a 304 stainless steel retainer pie

While passing through the static mixer, the combination of sludge and poly are forced into intimate mixing and blending. The mixing effect develops an eff tive coagulation/floc forming effect to enhance the first step in the dewateri process, the primary dewatering drum.

The polymer addition system is set up to be flexible since polymer additi ports exist before, in and after the static mixer. Flexibility or a choice of t polymer addition location allows the optimum polymer/sludge configuration to be s lected.

2. The sludge feed line between the static mixer and the specialty steel fe piece to the primary dewatering drum (P.D.D.) is schedule 80 PVC pipe. The flang one end open discharge specialty schedule 80 carbon steel feed piece is a half mo shape with the center cut out for the P.D.D. drive shaft. This unique sludge fe design provides even sludge distribution to the P.D.D. in a non-clog manner.

The feed piece is bolted to the frame that supports the P.D.D.. The compo ents of the piece are corrosion protected. The piece has a 3" opening around it entire arc.

D. Dewatering Units and Drive

1. General - The success of the operation of the belt filter press, pure from an operating standpoint, depends heavily on effective and consistent use the preliminary dewatering units. These consist of the dewatering drum and re section of bottom belt which provide the gravity zone on the press. The flow sludge through the press is in the order of 1) the primary dewatering drum; gravity drainage provided by the bottom belt; 3 and 4) the low and medium press stage provided by both belts, and 5) the high pressure rollers.

2. Primary Dewatering Drum (P.D.D.) - The primary dewatering drum consis of an open ended and open sided stainless steel drum constructed of 12 gauge 3 stainless steel with 4 compartments provided in the drum by baffle walls, each ba fle wall has either two or three openings depending on machine size. The drum driven by a variable speed, 3/4 hp DC motor through a gear reducer and chain dri The drive shaft is located in the center of the drum and is constructed of coat carbon steel. The drum is supported by flanged outboard bearings at both ends.

The drums vary in diameter depending on the size of the belt press, but the standard diameters ar 3' and 4'. All P.D.D.'s are 68" in length. The entire circumference of the horizontal cylinder of the primary dewatering drum is covered with a polyester belt material that is securely bolted and banded to the drum with stainless steel fastening materials. The belt material and mesh opening can be changed by purchasing different belt weaves, however, a plain open weave mesh is normally used on the drums.

Approximately 50 to 60% of the filtrate removed from the total dewatering of a sludge will be removed in the primary dewatering drum. The variable speed feature of the drum allows optimum dewatering to be obtained. As the P.D.D. revolves, the drum belt material is constantly kept clean with a spray header fitted with spray nozzles.

The primary dewatering drum is housed in a rectangular bolted and corrosion resistant painted steel frame enclosure with vinyl side curtains to allow access to the spray nozzles and drum belt media. The bottom panel of the enclosure is made of 304 stainless steel and is flange fitted with PVC drain line.

Paramount to the successful operation of the primary dewatering drum is proper chemical conditioning of the sludge being dewatered. The optimum chemical dosage must be used at all times or the drum will begin to blind. However, the advantage of the drum is that even if it is blinded by improper polymer dosing for hours at a time, it will respond to the proper dosage quickly and resume proper operation after several minutes due to the spray water effectiveness in cleaning the belt.

The primary dewatering drum is driven by a variable speed unit (SCR-DC drive) which allows easy speed variation by turning a speed control knob from the control panel. The P.D.D. is also covered in the oepration and troubleshooting sections of the manual.

3. Gravity Zone and Pressure Zone and Dewatering Belts

The press is fitted with one top and one bottom continuous belt which are characterized by their widths (1 meter, 1.5 meter, 2 meter or 2.5 meter) as well as their lengths and their weaves. All belts used are made of woven polyester filaments and belt closure is provided by overlapping schedule 316 stainless steel clippers secured by a stainless steel wire which runs the width of the belts. The belts are extremely durable and strong and normally last for several thousand hours of operation if properly treated and operated. The belt weave used is normally chosen during belt press testing; other weaves can be purchased and tried after operating experience is gained.

The bottom belt is longer than the top belt since the bottom belt provide gravity zone section of dewatering. As the sludge leaves the primary dewat drum, it still has free water to release and is allowed to do so on the gr section of the bottom belt. The sludge is evenly fed onto the gravity secti the machine by first flowing from the P.D.D. to the 304 stainless steel box contains a mixer. The sludge is fed to this box before the gravity section to the heavier sludge particles from imbedding into belt and causing premature r wear. From the box, the sludge flows evenly onto the bottom belt gravity which has channel with neoprene sealed edges on the sides and a pipe at th which controls the height of the thickened sludge. The sludge feed box mix· driven by a 1/3 hp constant speed drive and is remotely controlled from the co panel.

After the sludge passes under the level control pipe, it immediately e the pressure zone of the machine where it is constantly under pressure betwee top and bottom belts. The pressure is provided by the pneumatic extension extension) cylinders.

The sludge volume is large at the beginning of the pressure zone, there the sludge first goes around two large rollers (lower effective PSI) where tangential or shear forces are applied. A large volume of filtrate is release to the final quantities of free and some easily released capillary or bound leaving the sludge solids.

The second of the two large rollers that the sludge goes around is the roller which is driven by a variable speed drive unit. Location of the driv this point allows both of the belts to be driven by one drive unit. The units are 2 hp to 5 hp, depending on machine size. Speeds can be varied by a Re type variable sheave setup, frequency inverter A.C. motor or D.C. drive.

The sludge volume is now significantly reduced, (it resembles sludge cake) sludge can next go around rollers of smaller diameter (smaller radii and high fective PSI) where larger shear forces will be experienced. The last sets of s diameter rollers (not found on some machines) prior to the top and bottom disch rollers allow for additional high pressure to be applied via the press rol which are air operated from the control panel. High molecular weight polyethy wipers or doctor blades with adjustable counterweights at both ends are locate the top and bottom belts to insure proper discharge of the cake.

The belts separate at the discharge end of the machine and start their re route to the inlet end. On the return path the belts receive thorough cleanin the top and bottom belt spray headers. The tracking rollers and cylinders are located on the return route.

E. Drainage

Drainage of all washwater and filtrate is provided through placement of 14 gauge 304 stainless steel troughs and trays and schedule 40 PVC pipe.

The P.D.D. drainage consists of a bottom bolted tray sloped to the center where a 4" PVC pipe connects to the drain and transports the combination filtrate/ washwater to the basin below the machine.

All of the filtrate removed from the gravity and pressure zones falls onto stainless steel trays and troughs from where it flows by gravity to a common discharge location at the side of the machine which guides it to the basin below the machine.

The washwater for the top belt, after passing through the belt weave, falls onto a stainless steel tray, flows by gravity to a flange connected PVC pipe and then by gravity to the basins below the machine.

The washwater for the bottom belt, after passing through the belt weave, falls directly into the basin below the machine.

F. Belt Washwater Spray Headers

The machine is provided with 1-1/2" schedule 80 PVC pipe with PVC ball control valves to provide washwater for the cleaning of the top belt, bottom belt and primary dewatering drum belt fabric. The pipe is tapped and fitted the width of the top and bottom belts and the length of P.D.D. with replaceable PVC nozzles at the spray location.

To insure continuous spray washwater cleaning at all locations, it is recommended that dual filters be provided upstream of the PVC washwater line wherever plant effluent is used. Success has been experienced with the 300 - 1,000 micron filter elements and proper operator attention. (See Appendix for optional self-cleaning systems).

Specific pressures and gallons per minute (gpm) requirements for washwater are recommended and listed on Table No. 2. Booster pumps provided by the manufacturer for the required washwater are chosen based on the machine size and source of water available. These pumps are covered in the vendor maintenance section of this manual in the Appendix.

G. Electrical System

The press electrical system, which uses all copper wiring, consists of many components which are described herein below. The control circuit source is a fused (20 amp) 110 - 120 volt line to the control panel. The control panel is a wall mounted NEMA IV enclosure and contains internal wiring, a terminal strip, variable

speed D.C. SCR's for motors that require speed control, stop buttons, start tons, speed control knobs, control relays, a low air pressure switch, annunc relays, annunciator lights, a test and reset button.

The wiring between the control panel and the press is run in PVC conduit solvent fused joints. Located on the belt filter press is a junction box contains a terminal strip. The junction box wiring provides continuation of emergency shut down loop components, wire leads to the drive motor, any annunc functions and leads to the SCR D.C. driven motors.

An emergency loop is wired into the control circuitry connected to a cor relay on the starting circuit to provide shut down of the oeration should a prc occur. These emergency conditions are listed in Table No. 3 along with annunci functions. This circuit will shut down all belt press motors as well as plant's sludge pumps and polymer pumps.

A control schematic and point to point wiring diagram are attached for press. Note that on the control schematic the drive motor for the press does have to be started in order to start the other units, yet it will shut down ur alarm. This fact is important for the proper operation of the press and is cove under the Operations Section.

Table No. 2

Belt Filter Press Washwater Requirements

Machine Size (PSI)	Minimum Pressure * (GPM)	Gallons Per Minute
1 meter	70 - 95	30
1.5 meter	70 - 95	45
2 meter	70 - 95	60
2.5 meter	70 - 95	75

* Dependent on belt weave. Check with factory

Table No. 3

Belt Filter Press Emergency Loop and Annunciators

Automatic Functions

1. Low Air Pressure - pressure switch in panel
2. Belt Misalignment - limit switch wands on both sides of machine
3. High Belt Tension - limit switch on one side of frame near pneumatic arm
4. Low Belt Tension - limit switch on one side of frame near pneumatic
5. Drive Belt and/or Chain Broken - zero speed switch on roller arm

Manual

6. Emergency Stop Switch - located on both sides of machine for oprator's use

Annunciators

1. Low Air Pressure
2. Low Washwater Pressure
3. Belt Misalignment
4. High Belt Tension
5. Low Belt Tension
6. Drive Belt and/or Chain Broken - (optional)
7. Cake Detector - (optional)

H. Pneumatic System

The majority of the functions of the pneumatic system on the machine have been covered under Section No. 2. The remaining areas to be covered are the functional schematic of the pneumatic system equipment and the control panel.

The pressure source for the pneumatic system should be clean compressed air. It is suggested that the pressure fed to the panel be at least 100 psig and can be as high as 175 psig. All controls for the pneumatic system are mounted on the control panel. The air pressure regulator-controllers can be adjusted between 0 and 160 psig and can be turned On or Off with selector switches located below the controllers. Pressure gauges are located above the controller on the panel. The volume of air required to operate the press is minimal, 6 scfm is sufficient. (Maintenance of the air compressor is covered in the maintenance section of this manual, if the compressor was supplied by BDP).

Two types of tubing are used for the pneumatic system. Rigid wall plastic tubing is used in the control panel and between the control panel and the terminal block mounted on the machine. From the terminal block to all air cylinders, actuators and switches, neoprene tubing is used. The tubing between the control panel and the terminal block is run in a common PVC conduit over the top of the belt press.

A moisture trap should be located before the control panel to protect all pneumatic equipment. When instrument air is used, an automatic oiler should be installed to add a small quantity of oil for the lubrication of all air cylinders.

The simplicity, functional abilities, durability and dependability of the pneumatic system make it a superior way to provide the pressure and tracking required to operate a belt filter press.

II. SUMMARY OF MATERIALS OF CONSTRUCTION & EQUIPMENT

A. Structural Components

1. Frame - 6"x4"x1/4" heavy duty rectangular steel tubing
2. Rollers - Schedule 40 carbon steel pipe
   Journals - various diameter solid carbon steel with double flang ends
3. Protective Coatings
   a) rollers - 1/4" fiberglass or 1/8" neoprene over 1/4" fibergla
   b) exposed non-stainless steel, multi-coat polyurethane paint sy
4. Bearings - Rollers - heavy duty cast pillow block, double seal ball bearings
   P.D.D. - flanged, double sealed ball bearings

B. Belt Tension and Belt Tracking System

1. Pressure Cylinders (8) - brass with stainless steel extension ar steel connecting clevis, pin and stainless steel cotter key
2. Tracking Cylinders (2) - brass with stainless steel center riding
3. Tracking Paddle Limit Switches (4) - stainless steel
4. All cylinder tubing - 1/4" neoprene
5. Cylinder sizes (standard)

	Tension	Press Roll	Tracki
1 meter, 1.5 meter	3" dia x 16"	3" dia x 3"	4" dia
2 meter, 2.5 meter	4" dia x 16"	4" dia x 3"	4" dia

6. Tracking Cylinder Actuators (2) -

C. In-Line Static Mixer and Sludge Feed Line

1. In-line Static Mixer
   a. Mixer Pipe - schedule 80 PVC
   b. Mixer Fins - 11 gauge 304 stainless steel
   c. Mixer Nuts, Bolts, and Washers - stainless steel
2. Sludge Feed Line
   a. Static Mixer to Steel Inlet - schedule 80 PVC
   b. Steel Inlet - schedule 80 carbon steel Imron coated

D. Dewatering Units and Drives

1. Primary Dewatering Drum - 3' Ø x 68" long or 4' Ø x 68" long
   a. Drum - 12 gauge stainless steel
   b. Shaft - schedule 120 carbon steel, Imron coated
   c. Enclosure - coated 12 gauge steel sheeting with vinyl curtain on one side
   d. Drive - 3/4 hp, 90 volt, D.C. variable speed motor, gear reducer, drive and driven sprockets and chain
   e. Outboard Bearings (2) - Flanged 1-15/16" Ø
   f. Belt Material - Polyester - monofilament (plain weave)
   g. Belt Fasteneers - All stainless steel bars, bands and bolts
2. Gravity Zone and Pressure Zone and Dewatering Belts
   a. Dewatering Belts
      1. Polyester material - 1 top belt, 1 bottom belt
      2. Belt Closure - stainless steel clippers with stainless steel wire
      3. Characterized by width and length
   b. Sludge Feed Box to Gravity Zone
      1. 14 gauge stainless steel construction
      2. Mixer Drive - 1/3 hp, A.C. constant speed motor with gear reducer
      3. Mixer Paddle - carbon steel tubing, coated
   c. Gravity Zone
      1. Level control by adjustable coated steel pipe
      2. Sides - 2" x 6" Channel Steel coated with bolted neoprene bottom seal
      3. Adjustment hardware - 304 stainless steel
   d. Pressure - Rollers and Pneumatic Cylinders covered under A - Structural Components and B - Belt Tension and Belt Tracking System
      1. Discharge doctor or scraper blades - high density polyethylene with coated steel arms and counterweights
3. Dewatering Belt Drive Unit
   a. Variable Speed
   b. 208/240/480 volt, 3 phase, 60 Hz, A.C. or D.C.
   c. H.P. - 1 meter and 1.5 meter - 2 HP to 3 HP
      2 meter and 2.5 meter - 2 HP to 5 HP

E. Drainage

1. All 14 gauge 304 stainless steel trays and troughs
2. All drainage piping is 4" schedule 40 PVC

F. Belt Washwater Spray Headers

1. One (1) inch schedule 80 PVC pipe
2. PVC ball control valves (3) size 1-1/2"
3. PVC nozzles
4. Booster Pump (See Appendix for Specifications)
5. Neoprene deflector shield to minimize mist

G. Electrical System

1. All insulated copper wiring
2. All PVC conduit
3. Fused control circuit
4. NEMA IV Control Panel
5. Plastic junction box on machine frame
6. Terminal strips in control panel and junction box
7. All controls, relays, annunciators and auxiliary equipment house in c trol panel (See electrical schematics)
8. SCR control
9. Limit Switches

H. Pneumatic System

1. Moisture trap (optional)
2. Automatic Oiler (optional)
3. Control panel mounted pressure controllers, On-Off selector switches pressure indicating gauges
4. Rigid wall plastic tubing (1/4") in control panel and to machine term block
5. Neoprene tubing (1/4") from terminal block to cylinders
6. Tubing run in PVC conduit
7. Air compressor

III. OPERATION OF THE BELT FILTER PRESS

A. General

The operation of a belt filter press is quite simple providing:

1. All operating personnel become thoroughly familiar with all control interlocks and equipment.

2. All operating personnel thoroughly understand the proper opration of the machine and what effect each component system has on the other.

B. Key Operating Informational Statements

1. The slower the belt speed in the gravity and presure zones, the drier the cake will be and the more the press roll pressure can be applied.

2. The primary dewatering drum is the key to the driest sludge cake and highest machine throughput. In turn, it's operation is totally at the mercy of the proper conditioning of the sludge with polymer.

3. Some sludges will only release a certain quantity of bound water and no more (i.e., there is a limit to the cake dryness that can be obtained). See introduction for further information.

4. Generally, the higher the pressure is in the pressure zone, the drier the cake and the more solids in the filtrate.

5. Generally, the lower the pressure is in the pressure zone, the wetter the cake and the less solids in the filtrate.

6. The % solids of sludge feed to the belt filter press dictates what practical % solids in the cake can be achieved (i.e., the greater the % solids in the feed, the greater cake dryness of solids can be achieved)

7. The machine should be started with the belt drive off. Once the proper floc is reaching the gravity section of the machine, the belt drive should then be started.

8. Overdosing with polymer will affect the sludge nearly the same as underdosing. Foam in the P.D.D. indicates overdosing, the lack of a floc indicate underdosing (with underdosing, the filtrate is extremely dirty).

9. Once an operational change is made for any component on the press, the operator will know within 1 to 5 minutes whether the change has been successful.

10. Failure to keep the belts clean through negligence of the spray water system, improper polymer dosing or too fast a belt speed is extremely detrimental to the operational throughput or yield and % cake dryness.

11. The top belt pressure should be set approximately 20 psi higher tha bottom belt pressure since this equalizes the pressure on the belt systems and vents belt looping.

12. The pressure zone tension cylinder arms will extend and retract in sponsive manner to belt length, feed sludge characteristics and feed sludge he

13. Polymer secondary dilution water is normally effective in reducing pc dosages while not affecting the machine's operating dryness, filtrate quali throughput.

C. Operational Variables

In the operation of a belt filter press the operator has the ability to c the following dewatering and control mechanisms while the machine is running:

1. Polymer dosage and polymer entry location
2. Primary dewatering drum speed
3. Gravity zone sludge depth
4. Top belt pressure (tension)
5. Bottom belt pressure (tension)
6. Press roll pressure
7. Sludge feed rate
8. Belt speed

D. Machine Start-Up and Running Procedures

1. Turn on air supply.
2. Turn on control panel power.
3. Turn on belt drive circuit breaker.
4. Turn on top and bottom belt tension, increase PSI settings to desir point. Set top belt tension approximtely 20 PSI greater than bottom
5. Open spray water lines.
6. Turn on primary dewatering (P.D.D.) drum and belt drive. Set dr belt speed to desired speeds.
7. Let machine run for a few minutes to be sure top and bottom bel tracking properly.
8. Check annunciators.
9. Shut off belt drive, P.D.D. will stop. Restart P.D.D.
10. Start polymer pump, ensure polymer is at machine, then start sludge
11. When proper floc appears, start belt drive.
12. Adjust chemicals and sludge.

13. Make fine tune adjustments of belt press operation. (i.e., slowest belt speed for required throughput, belt tension adjustments, press roll adjustments, sludge height in gravity zone, etc.)
14. Turn on press roll(s) and adjust to proper pressure.
15. Adjust belt scraper blades to desired setting with counterweights if necessary.
16. Check spray washwater nozzles frequently and clean as necessary.

E. Visual Checks To Be Made While The Press Is In Operation

Through operating experience, an operator will know exactly where to best check the press while it is operating for his particular sludge. These points of checking will tell the operator whether the cake product and filtrate are expected to be normal. Combining these check points with the laboratory results and knowledge of the condition of the sludge will tell an operator the entire performance story.

The visual checks listed below serve as a general guide:

1. The P.D.D. Filtrate Release - Check the bottom of the P.D.D. as it is rotating. Each section should be releasing a large amount of filtrate at the bottom. If not all sections are releasing copious amounts of filtrate, then the Troubleshooting Chart (Condition 1) should be referred to.

2. Sludge Discharge From the P.D.D. - Looking at the sludge at the discharge end of the P.D.D. and finding it has the thickness and appearance of "cottage cheese" with no excessive foam means the P.D.D. operation is sound. An operator will, however, with experience know exactly what to expect to see for his sludge at the best possible press operation.

3. Under the Gravity Zone Belt - Looking under the gravity zone belt should reveal a continuous shower of water across the entire width of the cake and decreasing over the entire gravity zone. If the filtrate flow does not resemble this, refer to Condition 7 in the Troubleshooting Chart.

4. Check Sludge on Belt Gravity Zone - The sludge should resemble cake at the height adjustment end and the filtrate should not be releasing on the sides of the sludge mat. (A glossy filtrate on the sides normally means overdosing).

5. Check Both Large Press Rollers - These two rollers provide the first or low pressure step where the sludge should release large quantities of remaining free water and bound water. If this is not the case, then the conditioning of the sludge, belt weave and sludge quality should be checked.

6. Check Filtrate Release Over Smaller Pressure Rollers - The locatic amount of filtrate released will vary depending on the quality of the s Checking these rollers routinely will familiarize the operator with the dewa characteristics of the press and the sludge.

7. Check Press Roll Filtrate Release - This will tell the operator how tive the press rolls are and how much filtrate is squeezed out at this locati

8. Check Filtrate Discharge of P.D.D., Gravity & Pressure Zone - These checks serve to tell the operator exactly how effective his polymer condit and belt weave are. (See Troubleshooting Chart)

9. Check Cake At Discharge End - If the cake is cracking, then the op has reached a point where the dryness is normally 22% or greater. Cakes t not crack generally have a high portion of fines or colloids (See Introducti Also, check cake for uniformity of dryness.

10. Check Belts - If the cake is being pushed into the voids of the belt (either one or both belts), then the belts will eventually blind to some c (See Troubleshooting Chart). Both belts should be relatively clean, especial ter passing through the washwater section.

F. Laboratory Testing and Expected Results

1. Laboratory Testing - The following laboratory tests are recommended

Daily

Cake - Dryness and % Volatile

Filtrate - Total Suspended Solids and pH

Feed Sludge - % Solids, % Volatile and pH

Monthly

Gravity Zone Sludge % Solids

The cake dryness sample should be composited from several small taken across the belt width. The filtrate sample should be a combination P.D.D. filtrate and the gravity/pressure zone filtrate. Visual checks wi dictate where you want to sample and how much from a location.

The % Volatile Solids and pH are results that add a great deal of to not only the press operation, but the overall treatment plant operation ing a sludge quality.

2. Expected Results - (a) The cake dryness can vary greatly as explai shown in the Introduction. The volatile content depends on the plant operat can generally vary between 50% and 80%.

(b) The filtrate quality also depends on many factors including sludge quality and belt weave. Generally speaking, the % capture should be between 95% and 99%+ which means filtrate can vary between 100 mg/l and 4,000 mg/l. Normal values are 100 mg/l to 500 mg/l.. Filtrate pH should be the same as the feed sludge pH.

(c) The sludge feed % pH and volatile content normally dictate the results in (a) and (b). These figures can range from 0.4% to 8% for sludge feed %, from 50% to 80% for volatile content, and from 5 to 7 for pH for most sludges. As explained in the Introduction, these characteristics along with the sludge age and several others determine exactly what the press is capable of doing in terms of dryness, throughput and filtrate quality or % capture.

(d) Measuring the % solids in the gravity zone reveals what success of operation the P.D.D. is having when compared to Feed % Solids and allows a mass balance of the P.D.D. and the gravity/pressure zone of the press to be performed. The % solids readings at this point generally can vary from 4 - 10%.

G. Normal Shut Down

1. STOP sludge pumps and polymer pumps.
2. Once the last section of cake has discharged from the press, turn selector switch for press roll(s) to OFF.
3. Commence cleaning of the press. Keep water off the motors.
4. Hook up flushing connection at sludge pump inlet for P.D.D. and run water until all sludge is removed and/or P.D.D. can be manually cleaned of remaining material in front discharge chamber.
5. When the press is thoroughly cleaned, stop the P.D.D. drive and belt press drive.
6. Turn TOP belt tension to OFF.
7. Lower Bottom belt tension to ZERO. Turn selector seitch to OFF.
8. Turn off spray water valve and air supply line to panel.

H. Belt Looping

Belt looping is a phenomenon on a belt filter press caused by unequal pressure distribution between the top and bottom belts. As the belts move around the rollers together, it is necessary for the belts to slip over one another due to the fact that they are travelling slightly different distances (greater or less radii).

This principle is easily equated to the race cars speeding around an oval race track. If the car on the outside lane does not go faster than the car on the inside lane on the turn, the car on the outside lane will lose ground since both cars are not covering the same distances.

The fact that the belts must slip results in the shear or tangential forces on belt. Therefore, the belt tension must always be balanced for the top and bo belts. On these presses, the bottom belt has about 20 PSI greater pressure than the top belt due to the weight of the bottom tension cylinder. Therefore, top belt pressure would be set at 100 PSI if the bottom belt pressure were t set at 80 PSI. Normally, this type of proper tension set up will eliminate l ing.

Looping of belts will cause the belt that is unable to slip to become slac some point and tend to move off the track. If it is the top belt, the belt tend to walk off on the top tension arm roller. If it is the bottom belt, the misalignment wand limit switch will be hit and shut down the press.

Sometimes belt looping is caused by too dry a cake entering the pressure or a cake with too much grit entering the pressure zone or a combination of t Under these conditions, steps can be taken by the operator to prevent or mini the looping such as making the cake slightly wetter or adjusting top or bc tension pressures and belt speeds. However, if this condition is chronic, it be necessary to contact the factory.

I. What to Do If A Belt Tracks OFF THE PRESS

These procedures serve as a general guide for the correction of misaligr problems:

1. Belt Tracks Over To and Hits Misalignment Limit Switch - This is the iest situation of belt mistracking to correct since most of the time the belts quickly be retracked.

a. Belt Empty (no sludge) - New belts will stretch as they wear in will sometimes track off the press when it is being run before start-up. Wher misalignment occurs under these conditions, the belts should be made slack by: reducing the tension on the top belt and 2) making the bottom belt recede slig into the cylinder by turning up the tension pressure with the selector switc the OFF position.

Now that the belts are slack, they can e pushed over to their proper posi and then restarted. If the belts tend to track over to the same side and go the tracking paddle, then the tracking cylinder should be adjusted by: 1) loc ing the yoke clamp and 2) moving the clamp slightly in the direction the cyli is tracking towards, then retightening the yoke clamp.

This procedure should alleviate most misalignment due to belt stretching. Occassionally, it is necessary to adjust the tracking cylinder more than once.

b. Belts Full of Sludge and Cake - This condition is more difficult than when the belts are empty since the combined added weight and volume of the sludge and cake is a factor. The first step is to try the same general procedure as when the belts are empty presented in (a) with the added information that it will be necessary to retract the cylinder arms farther to achieve slackness in the belts.

If the (a) procedure is not successful, then a careful evaluation of the four tracking paddles should be made to be sure that they are functioning properly.

Under extreme conditions, when the belts cannot be repositioned due to the added weight; 1) the tracking cylinder for the belt that is misaligned can first be adjusted; 2) the misalignment actuating wand removed and , 3) the machine slowly run or jogged to see if the belts will track the proper way.

If all of the above fails, it will then be necessary to remove all of the sludge by thoroughly hosing it from between the slackened belts. Then procedure (a) should definitely work. Remember to replace the limit switch wand.

If procedure (a) does not work when sludge is reintroduced on the machine, then the rollers should be checked for wear, and belt looping as described in H should be checked.

C. Low Belt Tension Limit Switch Actuated - If the top belt loops or slacks enough to cause the top cylinder to retract enough to actuate the low belt tension limit switch, then the process of retracking and aligning is a bit more difficult. Understanding the entire mahcine is very helpful since the cause is due to a looping problem.. (See H., Belt Looping)

Since the top belt has tried to walk off of the machine, it may be quite slack in some areas which means it may have misaligned in more than one place. First, the belts must be slightly slacked and sometimes, it is necessary to remove the limit switch arm to run the machine to get the belt realigned. After the belts are slightly slack and you are able to jog the machine, the top belt should be pushed back in the proper direction and the machine slowly run. After observing any other problem areas and stopping and readjusting the top belt, it should be slowly worked in the right direction. By patiently slacking the belts, pushing them in the right direction and jogging the drive, you should eventually get it back to where it should be. Under extreme circumstances, all of the sludge must be removed by a thorough hosing between belts.

After the belts are again aligned, the cause of the looping must be i gated and corrected or the same problem will occur. Remember to reinstall t it switch arm.

J. What To Do If A Belt Breaks

The polyester belts are extremely durable and strong. Normally, there ly two reasons that a baelt will break:

1. A fold or crease in the belt will eventually develop into a tear.

2. The belt stainless steel clippers tear out of the belt.

The fold or crease in a belt will usually only occur due to: 1) impro stallation of the belt when it is first started up, 2) gross uneven weight bution of sludge onto the belts, 3) installation of improper sized belts debris in the sludge damaging an area of the belt.

The clippers pulling out of a belt is not uncommon and is probably t cause of premature belt failure. If a crease develops in one of your be eventually becomes a tear, evaluation of the other belt should be made and be necessary to only replace a top or bottom belt.

If the clippers pull out and enough extra length is available in th then the belt can be reclipped and re-used.

IV. MAINTENANCE OF THE BELT FILTER PRESS

A. General

As complicated as a belt press appears, the maintenance involved with it is quite minimal and uncomplicated. This is mainly due to the design of the machine coupled with the facts that there are many duplicated components and these components are extremely durable.

B. Preventive Maintenance

The best method to continued operation of the press is through an effective preventive maintenance program. An effective preventive maintenance program will greatly minimize any remedial maintenance work on the press. The following program is presentd to serve as a guide for proper maintenance of the press.

Once Per Week

Roller Pillow Block Bearings and P.D.D. Flanged Bearings - Lubricate once a week while the press is running with standard bearing grease, one stroke on a grease gun or until slight resistance is felt. DO NOT FORCE GREASE INTO BEARING AS BEARING SEALS COULD BE BLOWN AND PREMATURE BEARING FAILURE WILL RESULT. Observe grease displaced by fresh grease for condition and water.

Tracking Cylinder Wear Plate - Put a couple of shots of grease on the wear plates. Check yoke clamp plumpness and alignment and cylinder clearance over wear plate.

Check the Following:

Hoses - for any minor leaks

Cylinders - operability

Rollers & Bearings - for any shaft movement

Paddle Switches - operability

Once Per Month

Grease and adjust all drive chains

Check P.D.D. fabric

Check rollers for wear

Check belt closures and fabrics

Check pivot points and pins

Per Original Equipment Instruction

Washwater booster pump

Instrument air compressor

Air drier
Belt press drive
P.D.D. drive

C. Changing Bearings

If a roller bearing does fail, the design of the machine allows room enc replace the bearing without removing the roller. After removing the mc bolts, properly supporting the roller and removing the locking collar set scr heavy duty puller should be used to free and remove the bearing. If a pul not available, impact may work in removing the bearings, however, the cast block housings may be cracked or broken if too much direct impact is applied.

Normally, considerable pressure or impact is necessary to remove the be since:

1. With proper lubrication, the bearings do not require replacemen often (years of operation).
2. Being exposed to vapors over a period of years does lead to some oxi of internal surface. This oxidation (rust) bond must be broken t the pillow block bering assembly.

Once the bearing is removed with the pillow block assembly intact, the t can be slipped out of the housing. After checking the pillow block housi wear and concluding that it is not worn, a new bearing insert can be slippe the housing. The pillow block assembly can next be reinstalled on the shaft proper impact on the inner race may be necessary) and securely bolted o mounting pad. After the shaft is centered in the bearing, the lock coll screws can then be put back in place and tightened.

D. Changing Rollers

The primary purpose of the fiberglass and neoprene surface covering th lers is to provide a wear surface and protect a wear surface and protect the tubing against corrosion. A wear surface is necessary due to the abrasive of some sludges. After a period of time (normally years), the fiberglass c prene surface will wear to the extent that resurfacing of the roller with wear surface is required.

Removal of the rollers is quite easy providing proper and safe lifting dures are used. The location, size and weight of the rollers is the deter factor in the best methods of removal. A jib crane, planks, slings and ma all are necessary for proper and safe roller removal. A heavy roller should be removed by those competent in rigging procedures after a safe plan of unbc supporting, moving and lifting is devised.

Roller reinstallation is the opposite of roller removal. The purchase of one or more spare rollers of each size should be considered as an option where only one belt press exists or sludge inventories are critical.

E. Changing Belts

1. General - The procedure for changing belts is quite easy, however, it is extremely important and must be done properly or premature belt failure can occur. This is due to the fact that improper installation of a belt can result in an immediate crease or fold due to uneven stress distribution.

The changing of belts can be performed by plant personnel providing they are deliberate in their procedures and follow the guidance as detailed in this section.

The procedures for belt changing are specifically written assuming stainless steel clippers are the closure for the belt since most of the belts on the market use this method of belt closure. Seamless belts can also be changed by these steps.

2. Belt Changing Guidance Statements - These procedural statements and rules listed below hold true whether one belt is being changed or both the top and bottom belts are being changed since only one belt is changed at a time.

a. The belt will be fed through the press from the gravity end with about one half of the belt being fed through the pressure zone to the discharge end (top or bottom discharge roller), and the remaining half being fed through the return rollers on top or bottom (depending on which belt it is) and will meet it's other end at the discharge roller. The belt closure will be made at the discharge roller sicne this is both an easy and convenient place to do it.

b. A plain weave belt can be put on the press with either side up since the weave is the same on both sides. A multi-weave belt drains on one side only and must be fed with the correct side up. (The drainage side must make direct contact with the sludge on both the top and bottom belts.)

c. Each belt can be changed individually from the other; that is to say that the top belt can be changed without taking off the bottom belt and vice versa.

d. After a belt is replaced, prior to starting the belt press drive, it must first be ascertained that the belt is lined up straight on each and every roller around the machine in it's path.

e. After belt closure is made with the stainless steel wire drawn t the stainless steel clippers, the wire shall be cut about 1" lon each side than necessary for closure and bent back under the clipp the side opposite the sludge so the wire does not catch on the density polyethylene wipers.

f. Belts can be attached to a belt on the machine to allow it to t through the machine into their proper path in several ways, depend whether the belts are dry or wet.

1. If the machine belt is dry, duct tape can be used to atta new belt to the machine belt. The duct tape should be appl the ends where the new belt rests on the belt in the machi perpendicular to the end of the new belt.
2. If the machine belt is wet, fine wires can be used to atta new belt after inserting a stainless steel wire in it's cl to the closure of the belt on the machine.

g. A new bottom belt can be drawn through the pressure zone by att it to the machine's top belt or bottom belt, and a new top belt c drawn though the pressure zone by attaching it to the machine's t belt or top belt. Experience will dictate which is easiest for a p workcrew.

h. Only a small amount of pneumatic tension should be applied on a that is guiding a new belt through the pressure zone pathway.

i. A belt is best changed or put on the machine by a trio of worker a worker on each side of the press helping to guide the belt proper the other starting and stopping the drive.

j. A belt should only be fed through the machine at minimum drive s

k. If the machine has no belts on it, the first belt (top or bottom be hand fed through using the belt pattern shown on the print pr with the press.

3. Step By Step Example of Changing a Belt Situation:

The top belt has broken where a crease existed at an angle across the press. personnel have removed the top belt.

a. A new top belt is brought up to the back (gravity section) of the press and one end is attached to the bottom belt (either with duct tape or wires covered in 2f). Before attaching the belt, the workers have placed it on the bottom belt in the gravity drainage area and ascertained (since it is a multi-weave) that the correct side faces the sludge. Bottom belt tension is set at 10-20 PSI.

b. Once the new belt is securely fastened to the bottom belt on the machine, one worker positions himself at the control panel and operates the drive unit while the other two workers (one on each side of the machine) ensure that the belt feeds properly through the pressure zone and that the belt in the gravity drainage area unrolls properly. This procedure requires several starts and stops of the drive and is carried out at a minimum drive speed.

c. After the bottom belt is fed through the pressure zone to the discharge roller, the drive is stopped. The workers then hand feed the other half of the belt over the top of the machine and in the proper pattern shown on the machine belt path diagram. Once this half reaches the discharge roller and meets it's other clipper end, all that remains is the closure.

d. The closure is made with the stainless steel wire provided with the new belt. The clippers are properly lined up starting at one end and the stainless steel wire is slowly fed through as the clippers are carefully fitted in between one another. The closure must be continuous with all clips made an integral part of the system. After the wire is laced through all of the clippers, a 1" excess is left on each end and bent over on the seam to the side opposite the sludge as described in 2.e.. The belt is now ready for normal first start-up procedure.

V. BELT DEWATERING PRESS

Troubleshooting Chart

Condition 1 - Poor Quality of Sludge Out of PDD

Possible Causes:

1) Improper polymer dosing
2) Spray nozzles plugged
3) PDD belt fabric plugged (sprays will it)
4) PDD not turning
5) PDD turning at improper speed
6) Belt fabric mesh too tight
7) Poor quality of feed sludge

Remedies:

1) Check polymer feed system
1a) Visually check filtrate quality
2) Clean spray nozzles
3) Steam clean belt fabric on PDD
4) Check drive control, chain, power supp
5) Adjust speed of PDD
6) Change to larger mesh belt
7) Blend feed sludge, if possible

Condition 2 - Belts Blinding With Sludge

Possible Causes:

1) Overdosing or underdosing of polymer
2) Too much pressure on press rolls
3) Belt speed too fast
4) Washwater sprays plugged
5) Wrong belt weave for floc size
6) Extremely old and septic sludge (poor

Remedies:

1) Adjust polymer dosage
2) Reduce press roll pressure
3) Slow down belt drive
4) Clean washwater spray nozzles
5) Replace with different belt weave
6) Blend sludge, if possible

clea

Condition 3 - Wet Cake at Machine Discharge End

Possible Causes:

1) Belt speed too fast
2) Improper conditioning with polymer (underdosing or overdosing)
3) Feed sludge of poor quality
4) Improper pressure on belts
5) Improper pressure on press rolls
6) Belt blinded or dirty
7) Gravity drainage level low
8) PDD problem - See Condition 1
9) Belt fabric weave too tight

Remedies:

1) Slow belt speed
2) Adjust plymer system
3) Blend sludge, if possible
4) Increase belt pressure
5) Increase press roll pressure
6) See Condition 2 for Causes and Remedies
7) Slow belt, increase sludge feed or adjust level control pipe
8) PDD problem - See Condition 1
9) Replace with more open mesh fabric

uality

Condition 4 - Poor Quality of Filtrate - PDD

Possible Causes:

1) Improper polymer dosage (underdosing or
polymer
2) PDD leaking sludge due to torn belt material
end of drum leaking
3) Belt material mesh too large for conditi
sludge particles
4) Processing septic sludge or sludge with
fines

Remedies:

1) Check polymer system, adjust dosing, check
lution water
2) Replace or repair belt fabric, install
screws on end bands
3) Install baelt fabric with tighter mesh
4) Reduce sludge inventory, reschedule sludge
watering if necessary, blend sludge if poss

Condition 5 - Poor Quality of Filtrate - Gravity & Pressure Zones

Possible Causes:

1) Sludge improperly conditioned in gravity zo
2) Belt or belts have tears in them
3) Belt weave too large for floc
4) Sludge - old and septic - lot of fines
5) Too high a pressure on belts

Remedies:

1) Adjust polymer conditioning
2) Repair or replace belt or belts
3) Replace belts with tighter belts
4) Blend sludge if possible
5) Evaluate dryness vs. filtrate quality and
just pressure accordingly

Condition 6 - Sludge Cake Sticking to Belts

Possible Causes:
1) Cake is wet
2) Too much pressure on high pressure rolls
3) Belts
4) Doctor blades
5) Over conditioning

Remedies:
1) See Condition 3
2) Reduce pressure on rolls, possible change belt, different weave
3) See Condition 2
4) Renew edge or replace doctor blade
5) Adjust polymer

Condition 7 - Poor Drainage - Gravity Section

Possible Causes:
1) Improper polymer conditioning (overdosing or underdosing)
2) Belt weave too tight
3) Feed sludge quality bad, poor dewatering characteristics
4) Sludge exceptionally dry leaving PDD

Remedies:
1) Check and adjust polymer conditioning of sludge
2) Use plant weaave belt with more open mesh
3) Blend sludge if possible or live with sludge at hand until sludge inventory is reduced.
4) If very dry, no problem unless belts on roller show signs of looping and track off machine

Condition 8 - Belt Tracks Off Machine & Hits Misalignment Limit Switch

Possible Causes:
1) Belt stretching unevenly
2) Belt tracking paddle malfunctioning
3) Cake extremely dry or contains large quantities of debris and grit
4) Belts looping
5) Tracking cylinder yoke clamp loose
6) Tracking paddle improper position setting

Remedies:

1) Adjust tracking cylinder position
2) Free paddles and actuate
3a) Try rebalancing top and bottom belt tensi
3b) Make cake slightly wetter in gravity zone
3c) Persistent problem requires further actio
duce debris & grit if possible
4) Check belt tension to insure top and
balance, check air lines
5) Tighten yoke clamp
6) Adjust paddle location

Condition 9 - Belt Press Drive Will Not Start

Possible Causes:

1) Belt misalignment switch actuated
2) Air pressure not on
3) Drive motor thermal overload actuated
4) Motor circuit breaker tripped
5) Motor power not on
6) Control circuit fuse blown
7) Emergency stop switch stuck open
8) Spray washwater not on

Remedies:

1) Adjust belt & check tracking. Retra
tracking cylinders clamp adjustment if
sary
2a) Turn on air pressure
2b) Check air comprssors
3) Reset overload, if repeats, check overl
ing, if proper, have motor checked
4) Reset, try to restart, if trips oper
have electrical system and motor checke
5) Turn breaker on
6) Replace fuse, if reoccurs, have control
system troubleshot
7) Repair or replace emergency stop switch
8) Turn on washwater

Condition 10 - Belt Press Drive Stops

Possible Causes:

1) Belt misalignment switch actuated
2) Emergency stop button momentarily engaged
3) Drive motor thermal overloads actuated
4) Drive motor circuit breaker trips
5) Air pressure lost
6) Control circuit fuse blows
7) Washwater pressure low

Remedies:

1) Adjust belt, check tracking and adjust if necessary
2) Restart system
3) Reset overload and check motor amperage draw
4) Check B.P. electrical system for source of ground fault or short
5) Check source of compressed air
6) Replace fuse, check control circuitry
7) Check belt washwater system

Condition 11 - Belts Stop Moving - Motor Running

Possible Causes:

1) Drive belt broken
2) Drive chain broken
3) Sheared key

Remedies:

1) Replace drive belt
2) Repair or replace drive chain
3) Replace key

Condition 12 - PDD Stops Turning - Motor Running

Possible Causes:

1) Drive chain broken
2) Sheared key

Remedies:

1) Repair or replace chain
2) Replace key

Condition 13 - Cake Discharge Wiper Blades Not Working Properly

Possible Causes:

1) Wipers worn unevenly
2) Counterweights not properly set
3) Extremely poor quality sludge
4) Cake wet

Remedies:

1) Machine wiper blades evenly and check alig on belts
2) Reset counterweights
3) Blend sludge if possible
4) See Condition 3

LOCATION: West Point, New York

LIST OF PARTS

BELT DEWATERING PRESS

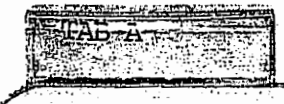
ITEM	MANUFACTURER	SPECS	QUANTITY
		MAIN DRIVE	
Motor	Baldor	3 HP, 1140 RPM, 230 V.	1
AC Freq. Drive	Toshiba	3 HP, VFIDP-2030 BO	1
Speed Reducer	Hub City	Series 450, Model 454	1
Sprocket - Drive Roll	Browning	60R112	1
Sprocket - Gear Box	Browning	H60P17	1
Bushings	Browning	R 2 15/16 P 1 15/16	1 1
Chain	Browning	60 Pitch	As Req
		PRELIMINARY DRAINAGE DRUM DRIVE	
Motor	Wer	3/4 HP, TEFC, DC, 90 V., 1750 RPM	1
DC Drive	Emerson	Focus I	1
Speed Reducer	Hub City	Series 210, Model 214	1
Sprocket	Browning	40Q70	1
Sprocket - Gear Box	Browning	H40B12	1
Bushing	Browning	Q 1 15/16	1
Chain	Browning	40 Pitch	As Req
		DISTRIBUTION BOX DRIVE	
Motor	Baldor	1/3 HP, 230/480 V., 1750 RPM Constant Speed	1
Speed Reducer	Hub City	Series 130, Model 134	1

LOCATION: West Point, New York

ITEM	MANUFACTURER	SPECS	QUANTITY
		BEARINGS	
Ball Bearing Pillow Block	Link Belt	P3-U216N	10
Ball Bearing Pillow Block	Link Belt	1 15/16 - P3-U23IN	36
Roller Bearing Pillow Block	Link Belt	1 15/16 - P-331/PE-331	5 ea
Ball Bearing Pillow Block	Link Belt	2 15/16" P247	2
Flange Bearing 4 Bolt	Link Belt	1 15/16" - F3-U23IN 1" - F3-U216N	2 2
		PNEUMATIC COMPONENTS	
Air Gauge	Clark Empeo	R6.3.12	
Air Regulator	Wilkerson	R21-02-000	
Air Selector Valve	Kay Pneumatic	KV45-5-044	
Air Valve 2 Way	Schrader Bellows Div	31513-9000	
Bleed Pilot	Allenair	VSA 1/4"	
Air Pressure Switch	SOR		
Belt Alignment	Allenair	Type CD-Double Ended 4" Bore x 4" Stroke	2
Top & Bottom Tension	Allenair	Type A - Single Ended 3" Bore x 16" Stroke	4
Air Cylinder: 1st Press:	Allenair	Type A - Single Ended 3" Bore x 3" Stroke	2
2nd Press:	Allenair	Type A - Single Ended 3" Bore x 3" Stroke	2
Top Belt	Industrial Fabrics	#6838 - 45'10" x 44"	1
Bottom Belt	Industrial Fabrics	#6838 - 49' x 44"	1

LOCATION: West Point, New York

ITEM	MANUFACTURER	SPECS	QUANTIT
Surface Coating	DuPont Imron		
Shower Nozzles	Spraying Systems, Inc.	#6508 - 1/8 VV	50
Electrical Components	Cutler-Hammer		
Air Compressor	Rolair	3 HP	2
Water Booster Pump	Goulds	3 HP w 1 1/2 x 6 closed Coupling	1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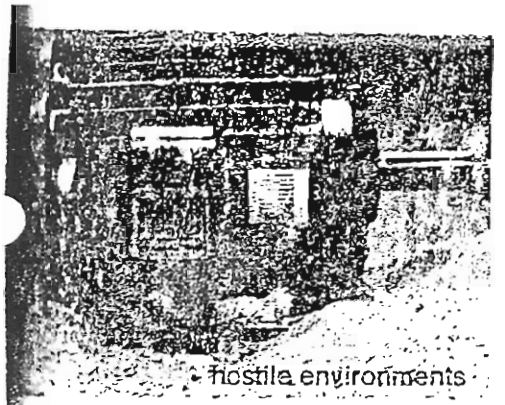

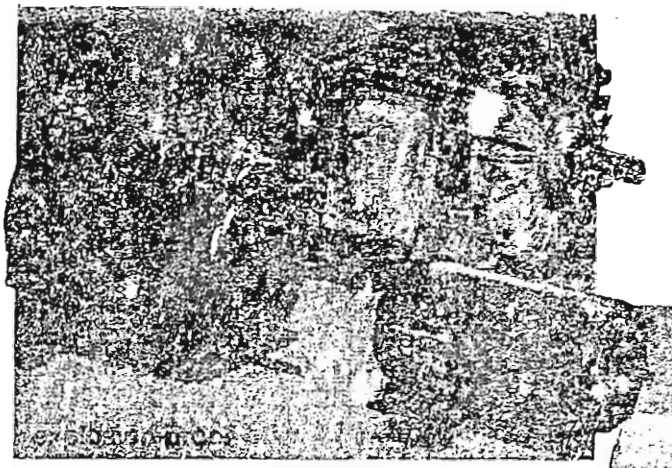

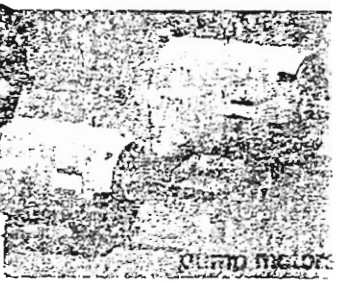

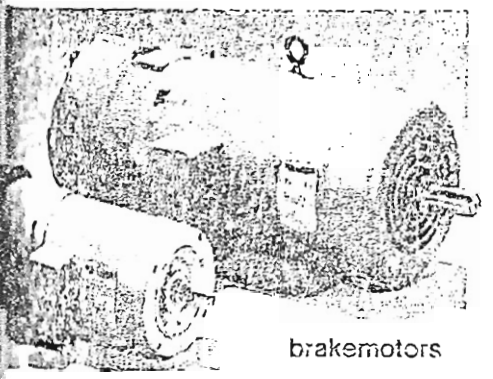

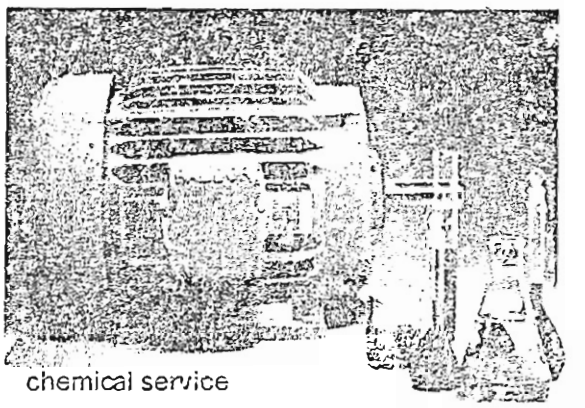

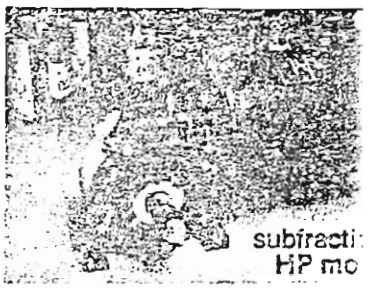

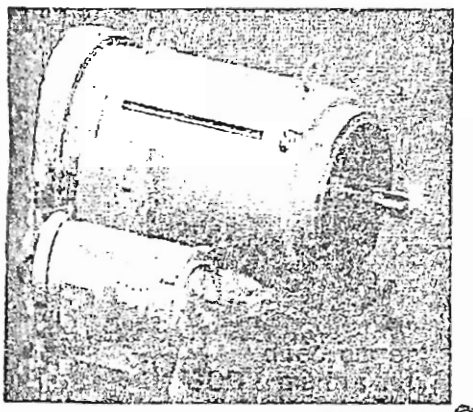

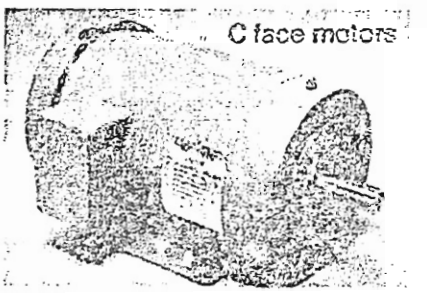

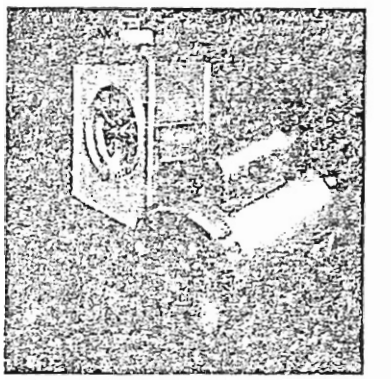

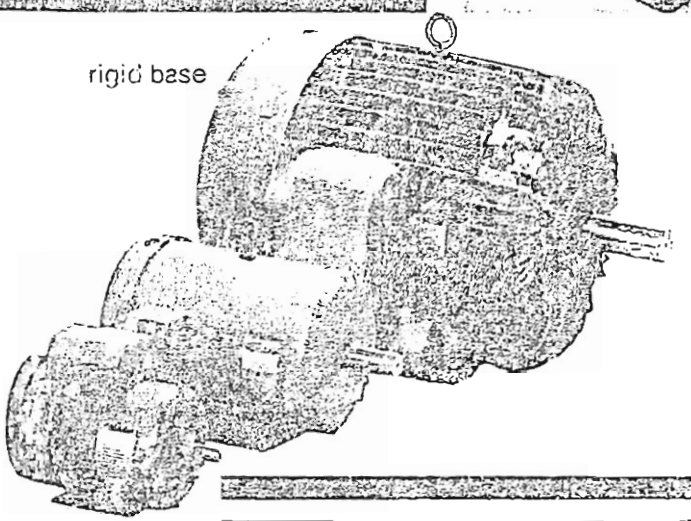

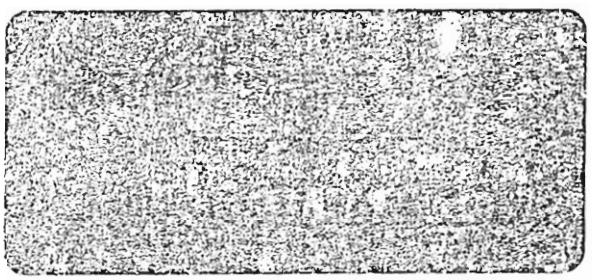

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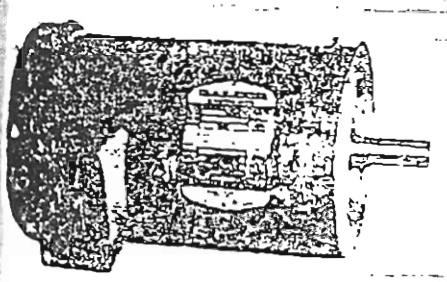
Industrial Electric Motors

Energy-saving electric motors since 1920 – from stock.



SINGLE & THREE PHASE
TOTALLY ENCLOSED FAN COOLED C FACE

1/6 THRU 5 H.P.
NEMA 56C THRU 215TC

Applications:
Pumps, valves, fans, conveyors, machine tools, gear reducers.

Features:
Pressure cast aluminum end plates ribbed design for rigidity. Cast iron endplates on 182 frame and up. Ball bearings. Heavy gauge steel frame.

			SINGLE PHASE								THREE PHASE							
H.P.	R.P.M. 60 HZ.	NEMA FRAME	CATALOG NO.	LIST PRICE	CATALOG NO.	LIST PRICE	MULT. SYM.	TYPE V or C	APX. SHPG. WGT.	VOLT. CODE	CATALOG NO.	LIST PRICE	CATALOG NO.	LIST PRICE	MULT. SYM.	TYPE V or C	APX SHPG. WGT.	VOLT. CODE
1/6	1725	56C	KL3400	$ 99			K	413L	20	A								
1/6	1140	56C	KL3401**	131			K	420L	25	A								
1/4	1725	56C	KL3403	102			K	415L	23	A	KM3454	$ 106			K	410M	18	E
1/4	1140	56C									VM3531	150			K	513M	22	E
1/3	3450	56C	KL3405	90			K	413L	20	A	KM3457	95			K	410M	18	E
1/3	1725	56C	VL3501	121	CL3501	$ 123	K	424L	27	A	VM3534	121	CM3534	$ 123	K	413M	22	E
1/3	1140	56C									VM3535	159			K	513M	24	E
1/2	3450	56C	VL3503	108	CL3503	110	K	416L	21	A	VM3537	113	CM3537	115	K	410M	19	E
1/2	1725	56C	VL3504**	140	CL3504**	142	K	429L	31	A	VM3538	135	CM3538	137	K	416M	22	E
1/2	1140	56C	VL3505	216			K	529L	40	A	VM3539	174	CM3539	176	K	516M	32	E
3/4	3450	56C	VL3506	124	CL3506	126	K	424L	37	B	VM3541	123	CM3541	125	K	413M	22	E
3/4	3450	56C	VL3506A	128			K	516L	36	B								
3/4	1725	56C	VL3507	168	CL3507	170	K	524L	35	A	VM3542	149	CM3542	151	K	420M	26	E
3/4	1140	56C	VL3508**	237			K	529LC	43	A	VM3543	174	CM3543	176	K	524M	39	E
3/4	1140	143TC									VM3543T	169			L-1	524M	40	E
1	3450	56C	VL3509	141	CL3509	143	K	524L	40	A	VM3545	138	CM3545	140	K	416M	24	E
1	3450	56C	VL3509A	145			K	524L	40	B								
1	1725	56C	VL3510**	184	CL3510**	186	K	535L	41	A	VM3546	151	CM3546	153	K	516M	33	E
1	1725	143TC	VL3510T**	176			L-1	535L	41	A	VM3546T	146	CM3546T	148	L-1	516M	40	E
1	1725	182C									VM3603	200			L-1	614M	50	E
1	1140	56C									VM3556	192			K	524M	42	E
1	1140	145TC									VM3556T	185	CM3556T	185	L-1	524M	39	E
1½	3450	56C	VL3513**	179	CL3513**	181	K	535L	45	A	VM3550	165	CM3550	167	K	516M	33	E
1½	3450	143TC	VL3513T**	172			L-1	528L	44	A	VM3550T	157	CM3550T	157	L-1	516M	34	E
1½	1725	56C	VL3514**	228	CL3514**	230	K	535LC	51	A	VM3554**	166	CM3554**	168	K	520M	35	E
1½	1725	145TC	VL3514T**	219			L-1	535LC	52	A	VM3554T**	158	CM3554T**	158	L-1	520M	36	E
1½	1725	184C	VL3603d	285			L-1	628L	66	A	VM3605	217			L-1	617M	56	E
1½	1140	56C									VM3557**	209			K	528M	44	E
1½	1140	145TC									VM3557T**	198	CM3557T**	198	L-1	528M	43	E
1½	1140	184C									VM3607	222			L-1	623M	58	E
2	3450	56C	VL3515**	217			K	535L	48	A	VM3555**	191			K	524M	38	E
2	3450	145TC	VL3515T**	207	CL3515T**	207	L-1	535L	53	A	VM3555T**	182	CM3555T**	182	L-1	524M	40	E
2	1725	56C									VM3558**	181			K	528M	41	E
2	1725	145TC									VM3558T**	171	CM3558	171	L-1	528M	45	E
2	1725	182TC	VL3605T**	304			L-1	634L	78	A								
2	1725	184C	VL3605**	304			L-1	634L	76	A	VM3609	229			L-1	620M	58	E
2	1725	213C																
2	1140	184C									VM3614	239			L-1	628M	72	E
2	1140	184TC									VM3614T	229	CM3614T	236	L-1	628M	70	E
3	3450	56C									VM3559**	214			K	535M	59	E
3	3450	145TC									VM3559T**	202	CM3559T**	202	L-1	535M	51	E
3	3450	182TC	VL3606T**	392			L-1	634L	80	A	VM3610T	223	CM3610T	223	L-1	620M	60	E
3	3450	184C	VL3606**◊	392			L-1	634L	77	A	VM3610	223			L-1	620M	67	E
3	1725	182TC									VM3611T**	229	CM3611T**	229	L-1	623M	65	E
3	1725	184C									VM3611**	229			L-1	623M	63	E
3	1725	184TC	VL3609T	404			L-1	645LC	100	A								
3	1725	213C									VM3703	299			L-1	717M	99	E
3	1140	213TC									VM3704T	301	CM3704T	301	L-1	726M	112	F
3	1140	215C									VM3704	301			L-1	726M	112	F
5	3450	184C									VM3613**◊	289			L-1	634M	69	E
5	3450	184TC									VM3613T**◊	205	CM3613T	285	L-1	634M	73	E
5	3450	213C									VM3708d	329			L-1	717M	98	E
5	1725	184C									VM3615T◊	239			L-1	634M	75	E
5	1725	184TC									VM3615T1◊	239	CM3615T1◊	239	L-1	634M	79	E
5	1725	215C									VM3707	321			L-1	726M	106	E
5	1140	215TC									VM3705**◊	448	CM3705T	448	L-1	736M	148	F

Voltage Codes:
A 115/208-230 E 200-208/416-460

NOTE: STYLE K IS NEMA C FACE LESS BASE, NO DRIP COVER
STYLE V IS NEMA C FACE LESS BASE, NO DRIP COVER

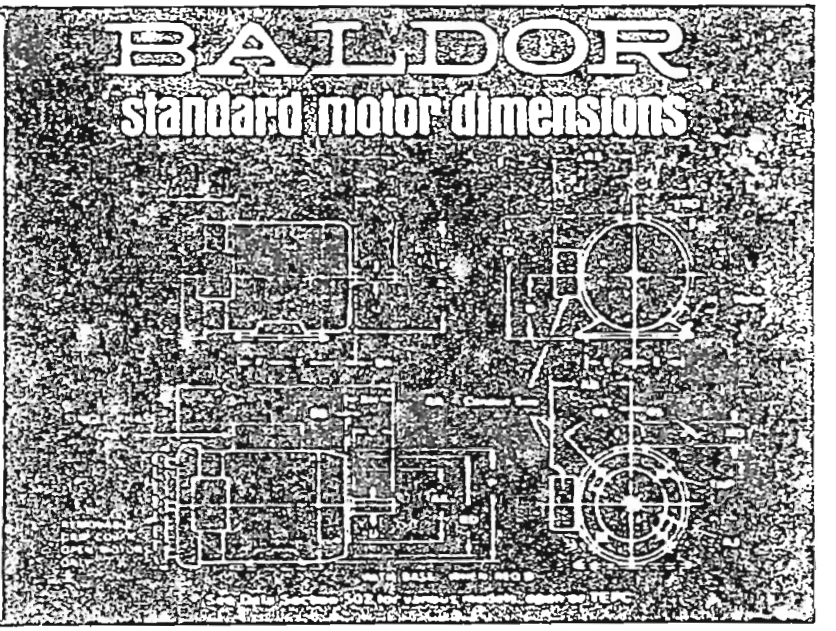
THREE PHASE — PERFORMANCE DATA
Totally-Enclosed, Fan-Cooled • NEMA 48 thru 447T (Cont'd)

HP	Full Load R.P.M.	NEMA Frame	Catalog Number	Type	Winding Number	Amperes-460V			Torque—Pound Feet			% Effy Full Load	% Power Factor Full Load	Comm. Degrees Number
						No Load	Full Load	Locked	Full Load	Brk. Down	Locked			
1	3440	56	M3559**	535M	35-863	1.5	3.65	27.25	1.45	1.52	1.47	81	87	10275
1	3440	145T	M3559T**	535M	35-863	1.5	3.65	27.25	1.45	1.52	1.47	81	87	10275
1	3460	182T	M3610T	520M	36-105	1.7	4	26	1.45	20	16	80	87	10275
1	3460	184	M3610	520M	36-105	1.7	4	26	1.45	20	16	80	87	10275
1	1730	182T	M3611T**	623M	36-1868	2.8	4.5	32	9	36	31	84	75	10275
1	1730	184	M3611**	623M	36-1863	2.8	4.5	32	9	36	31	84	75	10275
1	1730	213	M3703	717M	37Y02	2.6	4.5	28	9	30.2	28	81	78	10275
1	1140	213T	M3704T	726M	37-80	2.5	4.8	20.5	10.5	37.4	36	80	75	10275
1	1140	215	M3704	726M	37-80	2.5	4.8	20.5	10.5	37.4	36	80	75	10275
1	840	215T	M3705T*	735M	37-429	3.75	6	22	18	41	31	76	60	10275
1½	3445	184T	M3613T**	628M	36-1864	3.3	6	44	7.5	29	29	85	94	10275
1½	3460	213	M3705	717M	37X86	4	7	40	7.5	24	17	83	86	10275
1½	1730	184T	M3615T*	634M	36-1872	3.7	7	45	15	60	50	85	80	10275
1½	1730	215	M3707	728M	37X87	3.3	7.2	40	15	51	37	85	80	10275
1½	1140	215T	M3708T**	744M	37-128	4.3	8	45	20	66.4	59	86	73	10275
1½	1170	254U	M2275	926M	309-75	4.7	8	48	22.5	71	45	83	72	10275
1½	870	254T	M2280T**	913M	309-76	3	10	46	30	78	51	80	60	10275
2	3500	184T	M3616T**	646M	36-193	3.5	9.7	85	11.5	65	63	85	85	10275
2	3480	213T	M3709T**	722M	37X35	3	9.4	70	11.25	42	25	84	90	10275
2	3480	215	M3709	733M	37X75	3	9.4	70	11.25	42	28	84	90	10275
2	1735	213T	M3710T	729M	37X93	4.5	10	68	22.5	78	56	86	82	10275
2	1725	254U	M2237	922M	309-M08	5.2	11	60	22.5	63	42	85	79	10275
2	1170	254T	M2276T	932M	309-69	5	12	64	34.5	95	55	85	70	10275
2	1170	256U	M2275	932M	309-69	5	12	64	34.5	95	65	85	70	10275
3	870	256T	M2401T**	946M	309-72	9	14	65	45	118	72	81	63	10275
3	870	284U	M2401	1039M	10X44	8.0	13	56	45	112	92	88	65	10275
3	3450	215T	M3711T**	735M	37X66	5.5	12	105	15	66	53	87	92	10275
3	3450	254U	M2393	924M	309-27	5.8	13.3	77	15	67	42	84	87	10275
3	1750	215T	M3714T	740M	37X80	6.6	12	95	30	110	75	89	82	10275
3	1735	256U	M2238	928M	309-M**	6.7	13	74	30	90	60	88	82	10275
3	1170	256T	M2332T**	940M	309-74	7.5	16	89	45	120	81	85	75	10275
3	1160	284U	M2332	1036M	310X45	7.5	14	77	45	111	81	89	75	10275
3	865	284T	M2402T	1040M	10X43	8.8	16	73	60	144	113	86	67	10275
5	3455	215T	M3713T**	740M	37X49	8.5	17	140	23	120	80	89	92	10275
5	3440	254T	M2394T	932M	309-28	9.5	18.5	110	22.5	75	52	85	90	10275
5	3440	256U	M2394	932M	309-28	9.5	18.5	110	22.5	75	52	84	90	10275
5	1730	254T	M2333T**	936M	309-108*	8.6	16	127	45	140	108	91	80	10275
5	1760	284U	M2333	1038M	310X51	7.6	13	119	45	127	101	91	84	10275
5	1165	284T	M4102T**	1042M	310X45	10	21	96	67	152	127	90	76	10275
5	1160	324U	M4102	1042M	310X53	8.5	22	139	67	150	140	91	76	10275
5	855	286T	M2397T**	1039M	310X4	10	24	92	90	166	150	85	68	10275
5	865	326U	M4105	1045M	312X64	14	24	110	90	208	174	89	86	10275
7½	3455	256T	M4106T*	940M	309-M52	6.8	25	157	30	89	67	87	89	10275
7½	3490	284U	M4106**	1038M	310-65	6.8	25	130	30	121	81	88	90	10275
7½	1755	256T	M2334T*	944M	309-1080	9	24	145	60	140	107	91	80	10275
7½	1750	286U	M2334	1038M	310X30	8.8	25	147	60	165	115	92	80	10275
7½	1165	286T	M4103T**	1050M	312X35	12	27	137	90	230	190	90	79	10275
7½	1165	326U	M4103	1048M	312X50	11.4	27	136	90	200	162	90	79	10275
7½	870	324T	M4110T**	1050M	312X48	12	31	151	120	260	210	90	68	10275
10	3480	284ST	M4107T**	1044M	310X66	7	31	169	31	112	66	89	91	10275
10	3490	286U	M4107**	1044M	310X66	7	31	169	31	112	66	88	91	10275
10	1760	284T	M4103T**	1044M	310X37	10.5	30	195	75	215	162	92	86	10275
10	1760	324U	M4103	1048M	312X66	10.8	32	180	75	194	141	90	83	10275
10	1170	324T	M4111T**	1056M	312X39	12.8	32	180	112	330	220	91	80	10275
10	875	326T	M4114T*	1052M	312X47	9.1	39	145	150	340	225	85	59	10275
10	3500	286ST	M4108T*	1050M	310-265	9	36	209	45	121	81	88	90	10275
10	1760	286T	M4104T**	1050M	312X35	11.0	36	226	90	246	177	90	87	10275
10	1765	326U	M4104	1249M	312X40	13.5	38	180	90	220	170	90	83	10275
10	1175	326T	M4117T*	1252M	312X38	15	39	215	135	335	300	93	81	10275
10	1165	365U	M4304	1440M	314-66	14.5	39	215	135	350	190	90	83	10275
40	3480	324ST	M4109T**	1246M	312-60	12	50	266	60	132	80	66	90	10275
40	1765	324T	M4110T**	1256M	312X94	15	40	250	120	340	190	92	84	10275
40	1765	364U	M4307	1444M	314-56	22	52	290	120	346	234	91	83	10275
40	1160	364T	M4303T	1450M	314-76	18	48	280	180	540	263	91	86	10275

* For Low Voltage Ampere Value, Double The High Voltage Value
** Class B Continuous Duty
† Class F Continuous Duty
†† Class H Continuous Duty

ORE INFORMATION CONTACT:

BALDOR
standard motor dimensions



D	F	I	H	N	O	P	U	V	AA	AB	AH	AJ	AK	BA	BB	BD	XO	TAP
	1¼	2	slot	1	5	4	⅜	1	⅜	4	1½	3¾	3	2¾	⅛	4½	1¾	¼-20
	2	1½	slot	1	5¼	5	½	1	½	4½	1¾	3¾	3	2½	⅛	5⅛	2¼	¼-20
	2¼	1½	slot	2	6¼	6½	⅝	1⅜	½	5	2⅛	5½	4½	2¾	⅛	6½	2	⅜-16
	2½	2 2½	slot	2	5⅝	6⅝	⅝	2	¾	5¼	2⅛	5⅛	4½	2¼	⅛	6½	2¼	⅜-16
	3½	2 2½ 2¼ 2½	⅜	2⅞ 3⅜	8⅛	7⅝	⅞ 1⅛	2¼ 2½	⅝	5⅛	2⅛ 2⅝	5⅛ 7¼	4½ 8½	2¾	⅛ ¼	6½ 9	2⅝	⅜-16 ½-13
	4½	2½ 3½ 2¼ 3½	½	3½ 3⅝	10¼	9¼	1⅛ 1⅜	3 3½	¾	7⅛	2⅝ 3⅜	7¼	8½	3½	¼	9	2½	½-13
	5	4⅛ 5 4⅞ 5	½	4⅛ 4⅝	13	13⅛	1⅜ 1⅝	3½ 4	1	9⅛	3½ 3¾	7¼	8½	4¼	½	9⅛	-	½-13
	5½	4½ 5½ 4½ 5½	½	5⅛ 4⅞	14¾	15½	1⅜ 1⅞	4⅛ 4⅜	1⅛	12⅛	4⅛ 4⅜	9	10½	4¾	¼	11⅛	-	½-13
	6½	5¼ 6 5⅝ 6	⅝	5⅞ 5½	16⅛	17¼	1⅝ 2⅛	5⅛ 5¼	1⅛	13⅜	5⅛ 5	11	12½	5¼	¼	13⅜	-	⅝-11
	7	5⅛ 6¼ 5⅝ 6¼	⅝	6¼ 6¼	18¾	19½	2⅛ 2⅝	6⅛ 5¼	2	14½	6¼ 5⅝	11	12½	5⅛	¼	14	-	⅝-11
	9	6¼ 6⅝ 6⅛ 6⅝	⅝	7¼ 7⅝	23	20½	2⅛ 2¼	7⅛ 7⅛	3	14½	6¼ 7	11	12½	6⅝	¼	15½	-	⅝11
	9	7¼ 6⅛ 7¼ 6⅝ 10	⅝	8⅝ 6¼	26¼ 22¼	23 23½	2¼ 3⅜ 2⅝	8⅛ 6¼ 4⅝	3	16¼ 19⅛	8⅝ 6⅝	14	16	7½	¼	18	-	⅝-11

254-6TC NEMA C Face DA Dimension is 4⅝

NEMA T Frame Dimensions shown in shaded area where they differ from previous NEMA Standard Frames.

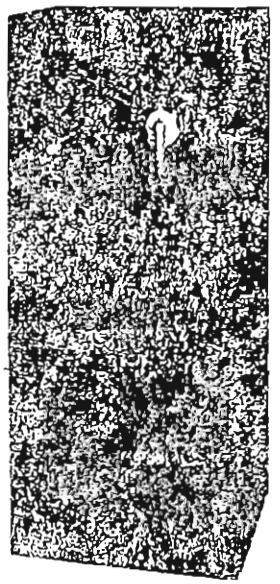
Specifications Subject to Change Without Notice

TOSHIBA/HOUSTON
INTERNATIONAL CORPORATION

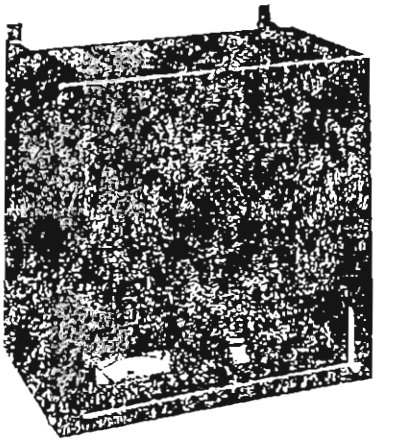
ESP-130 SERIES

ADJUSTABLE SPEED DRIVE

GENERAL PURPOSE TRANSISTORIZED INVERTER



- Sinusoidal Pulse Width Modulation (PWM)
- Giant Transistor (G-TR) Technology
- Microcomputer Controlled
- Excellent Starting Characteristics
- Reduced Torque Pulsation
- 50/60 Hz Operation
- 1-100 HP Ratings



Toshiba has combined our broad experience in adjustable speed drives together with our excellent quality production capability in giant transistors, integrated circuits including the highly sophisticated microcomputer IC, printed circuit board assembly, and our long production and design experience in motor manufacturing to create the ESP-130 transistorized general purpose AC adjustable speed drive inverter. Coupled with an AC induction motor, the inverter can provide a viable variable speed system for greater productivity and energy savings.

TOSHIBA/HOUSTON
INTERNATIONAL CORPORATION

13131 West Little York Road • Houston, Texas 77041 • 713/466-0277

Low & Medium Voltage Motors Controls Systems

TIC 8.

GENERAL PURPOSE

Toshiba's ESP-130 Series Inverter is a sinusoidal PWM controlled voltage type inverter using Toshiba Giant Transistors (G-TR's) and Toshiba microcomputer technologies.

RATINGS

Model #	HP	3ø Voltage	KVA	Rated Current (A)
VFS13023010	1.0	230	1.5	4.5
VFS13023020	2.0	230	2.9	7.0
VFS13023030	3.0	230	3.9	9.0
VFS13023050	5.0	230	6.9	15.0
ESP130230075	7.5	230	8.0	20.0
ESP130460075	7.5	460	8.0	8.0
ESP130230100	10.0	230	11.0	30.0
ESP130460100	10.0	460	11.0	15.0
ESP130230150	15.0	230	16.0	45.0
ESP130460150	15.0	460	16.0	20.0
ESP130230200	20.0	230	22.0	60.0
ESP130460200	20.0	460	22.0	30.0
ESP130230250	25.0	230	27.0	75.0
ESP130460250	25.0	460	27.0	37.0
ESP130230300	30.0	230	33.0	90.0
ESP130460300	30.0	460	33.0	45.0
ESP130230400	40.0	230	40.0	108.0
ESP130460400	40.0	460	40.0	54.0
ESP130230500	50.0	230	50.0	140.0
ESP130460500	50.0	460	50.0	70.0
ESP130230600	60.0	230	60.0	170.0
ESP130460600	60.0	460	60.0	90.0
ESP130460750	75.0	460	75.0	100.0
ESP130461000	100.0	460	104.0	140.0

Ambient Operating Temperature 0° to 40°C
Storage Temperature – 25° to 70°C
Relative Humidity Max 90% RH. No Condensation
Vibration Less Than 0.5G

*Nema 1 Enclosure

ESP-130 SERIES
ADJUSTABLE SPEED DRIVE

NSISTORIZED INVERTER

STANDARD FEATURES

1 - 5 HP RATINGS		7.5 - 10 HP RATINGS
50/60 Hz, ± 2 Hz, 230 VAC*	Input Voltage	3Ø, 50/60 Hz, ± 2 Hz, 230*/460 VAC
mmend Customer Supplied Outside Std. Enclosure	Incoming Circuit Breaker	Standard Feature
mmend Customer Supplied Outside Std. Enclosure	Incoming Main Starting Contactor	Standard Feature
mmend Customer Supplied Outside Std. Enclosure	3Ø Input Fuse Protection	Standard on 15 HP and above
mmend Customer Supplied Outside Std. Enclosure	Surge Suppressor	Standard Feature
mmend Customer Supplied Outside Std. Enclosure	Overcurrent Relay for Motor Protection	Standard Feature
ndard Feature	LED Diagnostic Fault Indicators	Standard Feature
ndard Feature	LED DC Bus Charged Indicator	Standard Feature
ndard Feature	Adjustable V/f Ratio (Low Speed Torque)	Standard Feature
ndard Feature	Adjustable Voltage Boost	Standard Feature
Sec	Acceleration Rate	6 - 60 Sec.
Sec	Deceleration Rate	6 - 60 Sec.
z; 5-160 Hz; 12-320 Hz	Frequency Range	3 - 90 Hz
	Protect Functions:	
ndard Feature	Stall Prevention	Standard Feature
IET (trips fault)	Overcurrent	250% IET (trips fault)
(trips fault)	Short Circuit	Ø-Ø (trips fault)
DC Bus Voltage (trips fault	Overcurrent	High DC Bus Voltage (trips fault)
trips fault)	Undervoltage	20% Low (trips fault)
Milliseconds	Momentary Power Failure	10 Milliseconds
Bus Fuse Protection	Burn-Out	DC Bus Fuse Protection or 3Ø Input Fusing
1C Relay	Fault Detecting Signal	1C Relay
Run/Stop, Speed Pot (one turn), Frequency Meter (Analog)	Front Panel Control	Run/Stop; Speed Pot (one turn); Frequency Meter (Analog) Power on Light (CB) Fault/Reset
NEMA 1	Enclosure	NEMA 1
Maximum Frequency 25°C ± 10°C	Frequency Regulation	.5% Max. Freq. 25°C ± 10°C
Optional Features	4-20 mA Signal Follower	Standard Feature (Speed Potentiometer must be disconnected)
ndard Feature	Ramp to Stop (Fault causes Coast Stop	Standard Feature
Regenerative power is charged back through the DC Bus smoothing capacitor to produce an approximate 20% continuous braking torque. For larger braking torques optional dynamic braking units are available.	Regeneration	Regeneration power is charged back through the DC Bus smoothing capacitor to produce an approximate 125% continuous braking torque. For larger braking torques optional braking units are available.

VAC with field modification

ENCLOSURES

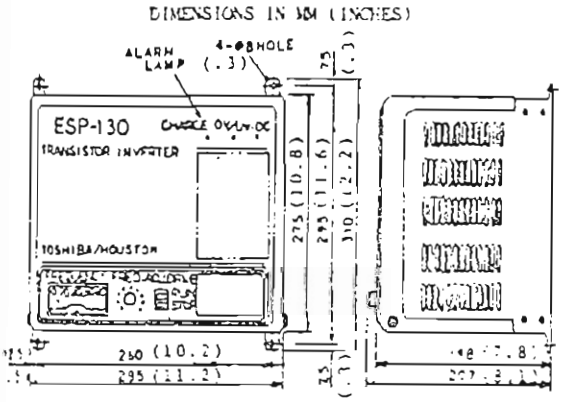


Figure 1

Wall type

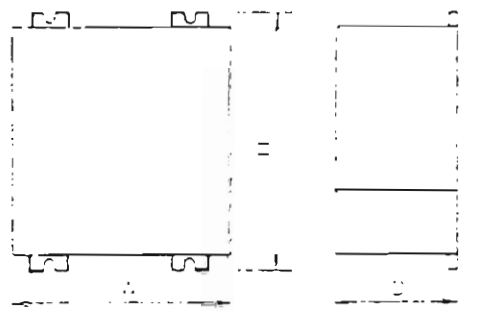


Figure 2

NG (HP)	ENCLOSURE	WEIGHT KG	WEIGHT LBS	MM H × W × D	INCHES H × W × D
	NEMA 1	9.1	20	See Figure 1	
	NEMA 4 & 12	36.5	85	610 × 508 × 254	24 × 20 × 10
	NEMA 1	9.5	21	See Figure 1	
	NEMA 4 & 12	36.5	85	610 × 508 × 254	24 × 20 × 10
	NEMA 1	9.5	21	See Figure 1	
	NEMA 4 & 12	45.4	100	915 × 762 × 254	36 × 30 × 10
	NEMA 1	9.5	21	See Figure 1	
	NEMA 4 & 12	45.4	100	915 × 762 × 254	36 × 30 × 10
	NEMA 1	154.2	340	1372 × 610 × 508	54 × 24 × 20
	NEMA 4 & 12	158.8	350	1372 × 610 × 508	54 × 24 × 20
	NEMA 1	154.2	340	1372 × 914 × 508	54 × 36 × 20
	NEMA 4 & 12	158.8	350	1372 × 914 × 508	54 × 36 × 20
	NEMA 1	163.3	360	1372 × 610 × 508	54 × 24 × 20
	NEMA 4 & 12	204.1	450	1829 × 914 × 508	72 × 36 × 20
	NEMA 1	233.6	515	1372 × 914 × 508	54 × 36 × 20
	NEMA 4 & 12	288.0	635	1372 × 914 × 508	54 × 36 × 20
	NEMA 1	235.9	520	1372 × 914 × 508	54 × 36 × 20
	NEMA 4 & 12	290.3	640	1372 × 914 × 508	54 × 36 × 20
	NEMA 1	235.9	520	1372 × 914 × 508	54 × 36 × 20
	NEMA 4 & 12	290.3	640	1372 × 914 × 508	54 × 36 × 20
	NEMA 1	310.0	590	1372 × 914 × 508	54 × 36 × 20
	NEMA 4 & 12	376.7	710	1372 × 914 × 508	54 × 36 × 20
(20CV)	NEMA 1	385.6	850	1829 × 1219 × 508*	72 × 48 × 20*
(25CV)	NEMA 4 & 12	440.0	970	1829 × 1219 × 508*	72 × 48 × 20*
(30CV)	NEMA 1	385.6	850	1372 × 914 × 508	54 × 36 × 20
(40CV)	NEMA 4 & 12	440.0	970	1372 × 914 × 508	54 × 36 × 20
	NEMA 1	385.6	850	1829 × 1219 × 508*	72 × 48 × 20*
	NEMA 4 & 12	440.6	970	1829 × 1219 × 508*	72 × 48 × 20*
	NEMA 1	440.6	970	1829 × 1219 × 508*	72 × 48 × 20*
	NEMA 4 & 12	494.4	1090	1829 × 1219 × 508*	72 × 48 × 20*
	NEMA 1	440.6	970	1829 × 1219 × 508*	72 × 48 × 20*
	NEMA 4 & 12	494.4	1090	1829 × 1219 × 508*	72 × 48 × 20*

*20 HP and above all NEMA 4 and NEMA 12 Enclosures include a side mounted air conditioner (right hand side as looking at panel). Allow an extra 12 inches (305 mm) clearance to the width on these models.

ESP-130 SERIES
ADJUSTABLE SPEED DRIVE

NSISTORIZED INVERTER

AVAILABLE OPTIONS

Enclosures: Standard NEMA 4 and NEMA 12 enclosures may be specified (see previous page for dimensions). Mounting feet for all enclosures except NEMA 1 enclosures on the 1 thru 5 HP models are available.

Isolation Transformers: For added equipment protection, added personnel protection and lightning protection isolation transformers are available in 230V/230V, 460V/460V, and 460V/230V models and mounted in separate NEMA 1 enclosures. Autotransformers are also available in 460V/230V and 230V/460V models.

ISOLATION TRANSFORMER RECOMMENDATIONS

HP	KVA	Weight KG	Weight LB	MM H x W x D	IN H x W x D
1.0	1.5		Contact Factory		
2.0	3.3				
3.0	3.3				
5.0	6.0	65	144	508 x 559 x 356	20 x 22 x 14
7.5	8.0	85	188	508 x 559 x 356	20 x 22 x 14
10.0	12.0	94	208	508 x 559 x 356	20 x 22 x 14
15.0	17.0	121	268	508 x 559 x 356	20 x 22 x 14
20.0	23.0	129	285	508 x 559 x 356	20 x 22 x 14
25.0	29.0	169	373	610 x 610 x 406	24 x 24 x 16
30.0	35.0	182	402	610 x 610 x 406	24 x 24 x 16
40.0	42.0	197	435	610 x 610 x 406	24 x 24 x 16
50.0	53.0	251	554	711 x 711 x 508	28 x 28 x 20
60.0	63.0	283	624	711 x 711 x 508	28 x 28 x 20
75.0	75.0		Contact Factory		
100.0	104.0				

Special 1-5 HP Packaging: Includes a NEMA 12 enclosure, circuit breaker, input starting contactor, overcurrent relay, and operator's devices mounted on enclosure door.

By-Pass Operation: Allows the user to switch the motor from the speed control of the inverter to across the line and vice versa. A switch and two additional contactors are provided to achieve this. For by-pass operation on the 1-5 HP units, special 1-5 HP packaging must also be ordered.

Speed Signal Follower: The inverter speed can be controlled from an external signal source such as pressure sensors, flow meters, thermocouple, etc. which output a 0-10VDC signal or 4-20 mA DC signal to input into the inverter (The 7.5-100 HP models come with standard 4-20 mA follower circuitry). When external speed signal sources are used the speed control pot supplied with the inverter must be disconnected.

ESP-130 SERIES
ADJUSTABLE SPEED DRIVE

TRANSISTORIZED INVERTER

AVAILABLE OPTIONS

- **Special Meters:** The ESP-130 series come with a standard analog frequency meter. Optional meters include: digital frequency meter, analog or digital ammeter (0-10 mA DC); analog or digital voltmeter which measure the A-B phase. Three phase current output or input. Three phase voltage output or input, or wattmeters can also be provided.
- **Remote Station:** Remote stations can contain any combination of operator devices. The standard remote station (NEMA 1 enclosure) contains an analog frequency meter, a single turn speed pot, a run/stop selector and on the 7.5 HP and above models a power-on light. Normally if a remote station is specified there are no controls on the power unit.
- **Local/Remote Operation:** For applications when remote or local control (controls on the power unit) is required. (When specified for 1-5 HP models, special 1-5 HP packaging must also be specified.)
- **Dynamic Braking:** For applications requiring frequent quick deceleration and stopping or applications with a high inertia load, a dynamic brake unit may be required to absorb the regenerative energy of the motor (in excess of the 12% continuous). Standard 20% duty cycle and 100% duty cycle dynamic braking units are available for mounting exterior to that of the power units.

USEFUL INFORMATION WHEN ORDERING

Application: _____ Type Load ☐ Constant Torque ☐ Constant HP ☐ Variable Torque

_____ HP

Speed/Frequency Range: _____ Mechanical Reduction Drive Used? _____

Starting Torque Required: _____ Accelerating Torque Required: _____

Acceleration Time Required: _____ Deacceleration Time Required: _____

Enclosure: _____

Power Supply: 3Ø _____ V

AC Motor Information ☐ New ☐ Existing

Frame Size: _____ HP: _____ Service Factor: _____

RPM: _____ Volts: _____ Hz: _____ Class Insulation: _____ ____

Required Options:

_____ _____

AVAILABLE OPTIONS

Manual/Auto Selections: Speed control of the inverter can be alternated between the speed pot supplied with the drive and an external speed control source. Any change in speed resulting from the switch causes the inverter to follow the accel/decel rate to attain the new selected speed. A relay is used to disconnect whichever signal is not desired and connect the desired signal source.

Multiple Speed Selection: Any number of speed control pots may be used for multiple speed selection. Miniature relays are used to select which speed pot determines the output frequency. The standard drive comes with one speed control potentiometer. Additional speed control selection units are available.

Ten Turn Speed Control Pot: A ten turn speed potentiometer may be substituted for the standard one turn speed potentiometer allowing for easier operator regulation of speed selection.

Forward/Reverse Operation: Forward/Reverse operation is performed electronically and performed by a selector switch which either signals the forward or reverse signal to the microprocessor. When going from forward to reverse or vice versa, the output follows the decel rate to zero and then follows the accel rate.

Jogging: Jogging operation is available and determined by jog time and accel or decel rates selected.

Fault Light Indicator: Fault LED indicators are standard on the PC board of the inverters. An optional fault pilot light with amber lens and legend plate reading "Fault" displays when a fault condition exists (under/overcurrent, overvoltage, overheat (drive), and thermal overload condition of the motors. If desired for 1-5 HP models special 1-5 HP packaging must be specified.)

Voltage Feedback Control: For applications requiring highly stabilized constant-torque characteristics especially in the low speed range a voltage control feedback circuit is available on the 7.5 HP-100 HP models.

Tach Feedback Control Circuitry: For applications requiring extremely accurate speed regulation which take into account motor slip, the inverter speed may be regulated by a tach feedback signal through the inverter. The tachometer is not furnished in this option and should be a single phase, 24 P, 1800 RPM, 25 Volt type.

Max/Min Frequency Settings: Constant frequency operation or limited operating frequency range is available through use of PC board adjustments or speed pot additions.

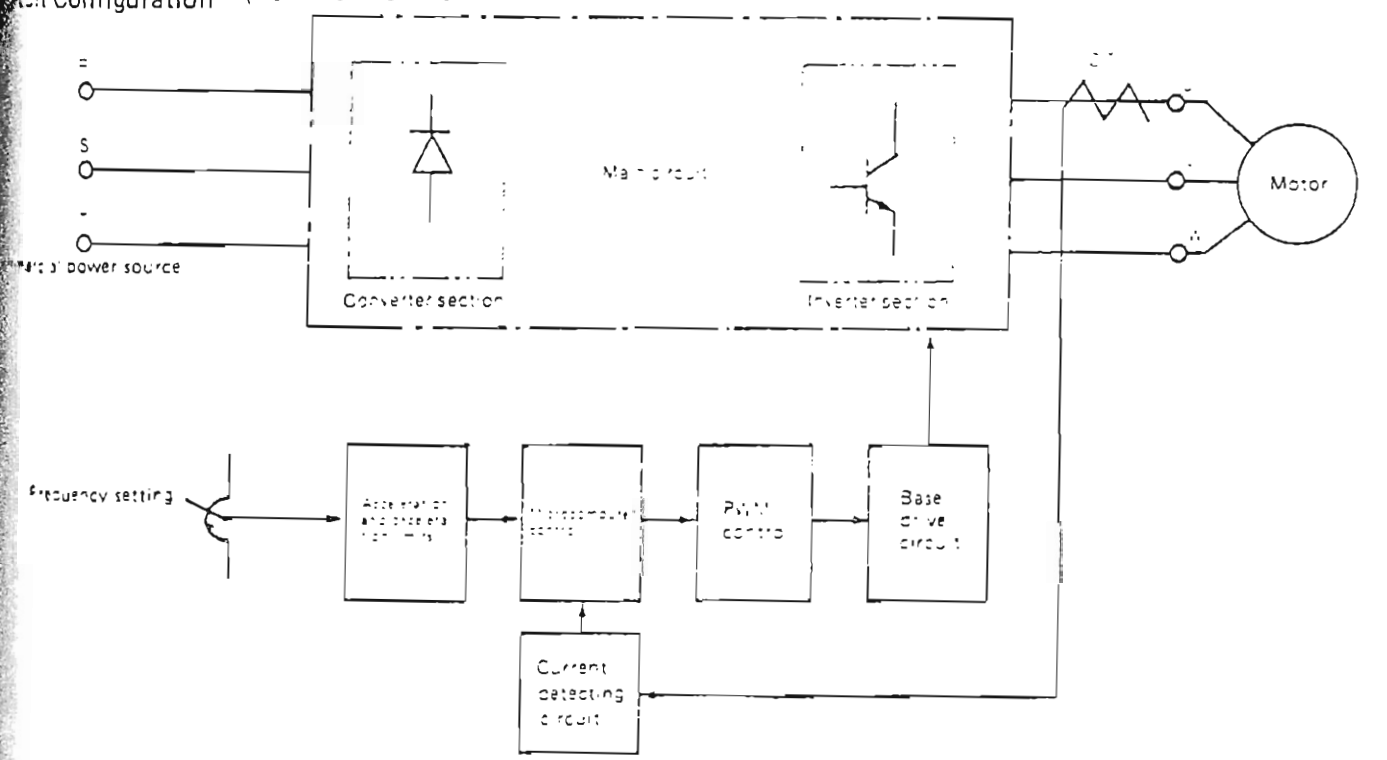
Additional Contacts: Additional contacts, NO or NC, can be suplied to terminal blocks for customer's use. (If this option is specified on the 1-5 HP unit, special 1-5 HP packaging must also be specified.)

ESP-130 SERIES

ADJUSTABLE SPEED DRIVE

GENERAL PURPOSE TRANSISTORIZED INVERTER

Circuit Configuration (7.5 HP and above)



WARRANTY: Toshiba/Houston warrants that all products or parts described and sold by it to the purchaser or any other products or parts sold or furnished to the purchaser will be free from defects in materials and workmanship. THIS WARRANTY SHALL EXPIRE EIGHTEEN (18) MONTHS FOLLOWING THE DATE OF SHIPMENT OF SUCH PRODUCTS OR PARTS TO THE PURCHASER OR TWELVE (12) MONTHS AFTER SUCH PARTS OR PRODUCTS ARE FIRST PLACED IN OPERATION, WHICHEVER PEROID SHALL FIRST EXPIRE. Toshiba/Houston is the sole determinate of the validity of all claims under warranty and no credit will be allowed for damaged equipment resulting from improper installations or unauthorized repairs or alterations.

TOSHIBA/HOUSTON
INTERNATIONAL CORPORATION

13131 West Little York Road • Houston, Texas 77041 • 713/466-0277

ERIES 450 WORM GEAR REDUCERS

ODEL 454

lange reducer — C-flange design permits motor shaft to be plugged directly into quill-type shaft permitting Installation in the smallest possible space.

roller bearings on low speed shaft. Double row ball bearings on high speed shaft.

quill is Parco-Lubrited and coated with Molybdenum Disulfide lubricant to provide protec- against fretting corrosion.

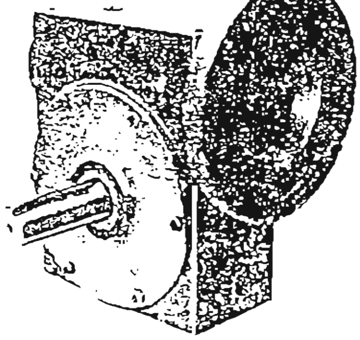
City Adjustable Base Kit featuring elongated slots for mounting bolts and adjusting for ease of positioning. (Refer to page 144.)

rsal Base Kits to interchange with Browning, Perfection, and Winsmith. (Refer to page

Mounting Kits for side wall and ceiling mounting. (Refer to page 146.)

Fan Kit, Thermal Block Kit and Synthetic Lube available to increase thermal capacity. to pages 147 and 326.)

City Lubricant recommended. (Refer to page 326.)



4.50 CENTER DISTANCE

TING TABLE

	MECHANICAL RATING — SERVICE FACTOR 1.00		1.25		1.50		1.75			THERMAL RATING — DESIGN OPTION: Basic Unit		With Synthetic Lube		With Fan		With Fan and Synthetic Lube		With Fan and Thermal Block		With Fan Therm Block Syn Lube	
Ratio	Input H.P.	Output Torque	Input H.P.	Output Torque	Input H.P.	Output Torque	Input H.P.	Output Torque	Eff. %	Input H.P.	Output Torque	Input H.P.	Output Torque	Input H.P.	Output Torque	Input H.P.	Output Torque	Input H.P.	Output Torque	Input H.P.	Output Torque
1750 RPM INPUT SPEED (HIGH SPEED SHAFT)																					
[illegible]	[illegible]	5130	13.0	4104	10.9	3420	9.31	2931	87.4	7.66	2376	6.68	2732	10.5	3326	12.2	3925	11.5	3659	13.4	4205
[illegible]	[illegible]	5570	10.1	4496	8.27	3680	7.09	3154	82.4	5.35	2382	6.15	2739	7.50	3339	8.61	3835	8.24	3668	9.47	4219
[illegible]	[illegible]	5940	8.16	4752	6.80	3960	5.83	3394	80.3	4.53	2638	5.21	3034	6.34	3693	7.50	4369	6.98	4063	8.02	4672
[illegible]	7.31	5781	5.94	4560	5.01	3846	4.25	3257	71.0	3.02	2316	3.38	2593	4.12	3157	4.73	3631	4.53	3473	5.21	3994
[illegible]	6.01	5950	5.01	4956	4.01	3967	3.43	3400	68.8	2.65	2624	3.05	3018	3.71	3674	4.27	4225	4.08	4041	4.69	4647
[illegible]	5.01	5930	4.01	4744	3.34	3953	3.01	3567	65.7	2.30	2722	2.65	3130	3.22	3811	3.70	4382	3.54	4192	4.07	4821
[illegible]	4.23	5740	3.38	4593	2.82	3827	2.42	3280	62.9	2.07	2809	2.38	3230	3.00	3933	3.45	4522	3.30	4325	3.80	4975
1150 RPM INPUT SPEED (HIGH SPEED SHAFT)																					
[illegible]	[illegible]	6400	10.6	5120	8.80	4267	7.54	3657	88.5	6.18	2995	7.11	3445	8.03	3895	9.24	4479	8.84	4284	10.2	4927
[illegible]	[illegible]	7040	7.90	5504	6.58	4587	5.64	3931	84.7	4.47	3115	5.14	3583	5.81	4051	6.68	4658	6.39	4456	7.50	5229
[illegible]	[illegible]	7460	6.54	5968	5.45	4973	4.67	4263	83.2	3.89	3548	4.47	4080	5.06	4612	5.82	5304	5.56	5074	6.40	5835
[illegible]	[illegible]	7100	4.65	5680	3.87	4733	3.32	4057	74.3	2.62	3214	3.02	3696	3.42	4179	3.93	4805	3.76	4596	4.32	5265
[illegible]	[illegible]	7460	3.79	5368	3.16	4973	2.71	4263	72.0	2.31	3835	2.66	4121	3.00	4727	3.45	5436	3.30	5199	3.80	5979
[illegible]	[illegible]	7460	3.16	5968	2.63	4973	2.26	4263	68.9	2.05	[illegible]	2.36	4452	2.67	5034	3.06	5799	3.01	5665	3.37	5268
[illegible]	[illegible]	7290	2.69	5832	2.24	4860	2.01	4361	65.8	1.87	4057	2.15	4666	2.43	5274	2.80	6065	2.67	5802	3.09	6672
850 RPM INPUT SPEED (HIGH SPEED SHAFT)																					
[illegible]	[illegible]	7640	9.20	6112	7.67	5093	6.57	4366	89.5	5.66	3760	6.51	4324	6.23	4135	7.50	4982	6.85	4550	7.89	5232
[illegible]	[illegible]	8230	6.90	6584	5.75	5487	5.01	4779	85.6	4.14	3343	5.01	4779	4.55	4343	5.24	4994	5.01	4777	5.76	5494
[illegible]	[illegible]	8850	5.68	7080	4.73	5900	4.06	5057	84.1	3.62	4525	4.17	5204	3.93	4979	4.59	5724	4.39	5475	5.05	6297
[illegible]	[illegible]	8500	3.62	6800	3.01	5667	2.58	4857	75.7	2.46	4625	2.83	5320	2.71	5089	3.11	5852	3.01	5652	3.42	6437
[illegible]	[illegible]	8520	3.26	6816	2.71	5680	2.33	4869	73.0	2.19	4534	2.52	5272	2.41	5042	2.77	5799	2.65	5547	3.05	6379
[illegible]	[illegible]	8700	2.71	7024	2.26	5853	2.00	5172	69.9	2.02	5231	2.25	5837	2.15	5524	2.48	6421	2.37	6142	2.73	7063
[illegible]	[illegible]	7610	2.04	6088	1.70	5073	1.46	4349	66.8	1.78	5312	2.05	6109	2.01	5992	2.25	6720	2.15	6428	2.48	7392
690 RPM INPUT SPEED (HIGH SPEED SHAFT)																					
[illegible]	[illegible]	8480	8.32	6784	6.93	5653	5.94	4846	89.3	5.44	4436	6.26	5101	5.71	4658	6.57	5356	6.28	[illegible]	[illegible]	[illegible]
[illegible]	[illegible]	9090	6.18	7272	5.15	6060	4.41	5194	85.9	4.00	4716	4.60	5417	4.20	4946	5.01	5899	4.62	5440	[illegible]	6256
[illegible]	[illegible]	9740	5.06	7792	4.22	6493	3.62	5566	84.2	3.51	5401	4.04	5211	3.69	5671	4.24	6522	4.05	6230	4.66	[illegible]
[illegible]	[illegible]	9390	3.60	7512	3.00	6260	2.57	5366	76.7	2.39	4987	2.75	5735	2.51	5236	3.01	6272	2.78	5760	3.17	6624
[illegible]	[illegible]	9730	3.01	6051	2.43	6487	2.08	5580	73.0	2.13	5694	2.45	6548	2.24	5979	2.57	6876	2.46	6577	2.83	[illegible]
[illegible]	[illegible]	9570	2.40	7656	2.00	6380	1.71	5469	69.9	2.01	6412	2.19	6970	2.00	6364	2.29	7319	2.19	7000	2.52	8051
[illegible]	[illegible]	7610	1.66	6088	1.38	5073	1.18	4349	67.1	1.74	[illegible]	2.00	7357	1.83	6717	2.10	7724	2.01	7389	2.07	7610
100 RPM INPUT SPEED (HIGH SPEED SHAFT)																					
[illegible]	[illegible]	[illegible]	2.01	10386	1.62	[illegible]	1.39	7180	81.8												
[illegible]	[illegible]	[illegible]	1.50	10103	1.24	[illegible]	1.06	[illegible]	75.0												
[illegible]	[illegible]	12340	1.08	9872	.90	8227	.77	7051	72.9												
[illegible]	[illegible]	[illegible]	.94	10896	.78	9080	.67	7783	61.0												
[illegible]	[illegible]	[illegible]	.70	10056	.58	8380	.50	7183	57.0												
[illegible]	[illegible]	[illegible]	.46	7656	.38	6380	.33	5635	52.5												
[illegible]	[illegible]	[illegible]	.23	6088	.28	5073	.24	4349	48.7												

THERMAL RATING EQUALS MECHANICAL RATING.

OVERHUNG LOAD-LOW SPEED SHAFT — 2200 LBS. AT CENTER POINT OF SHAFT EXTENSION

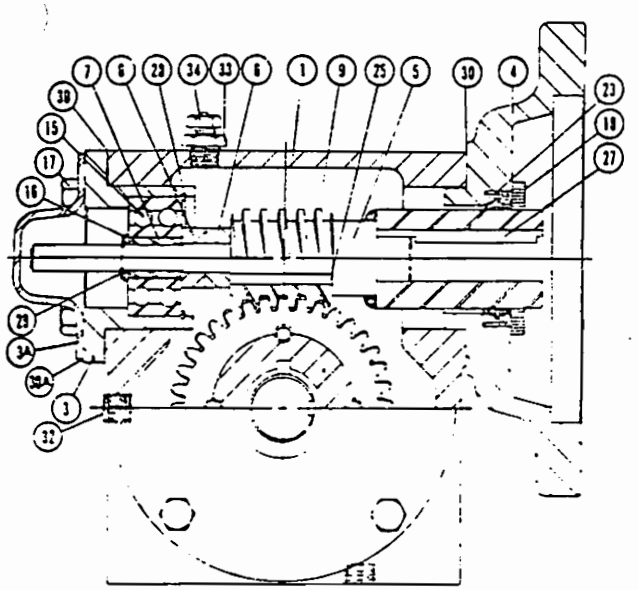
Hub City

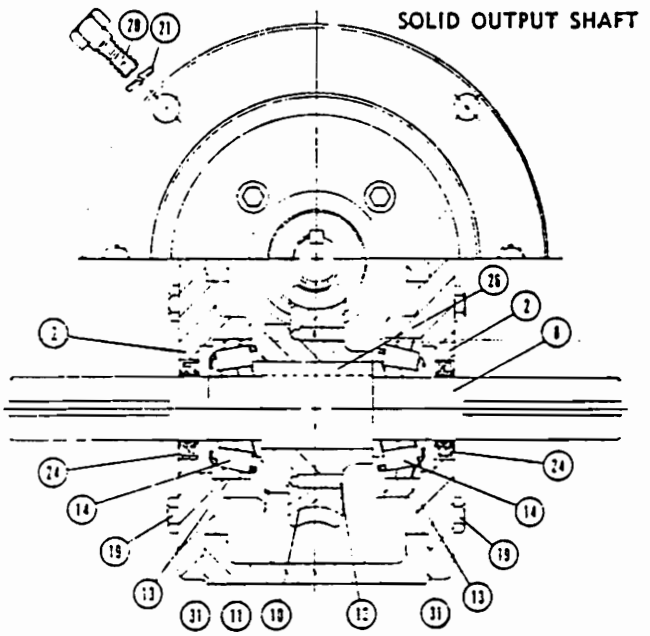
WORM GEAR SPEED REDUCER

PARTS LIST

SERIES 450
MODEL 454

NEMA "C" FLANGE
SOLID OUTPUT SHAFT





REF. NO.	PART NUMBER	DESCRIPTION	NO. REQ.
1	02-23-02647-450	Housing	1
2		Cap, Output	2
	02-23-02648-450	Open (Style A requires 2; Style B or C requires 1)	
	02-23-02649-450	Closed (Style B or C requires 1)	
3	02-23-02656-450	Cap, Open Input	1
3A	02-23-02657-450	Cap, Closed Input	1
4		Flange, Motor	1
	02-23-02654-450	56C, 143TC, 145TC, 182C, 184C	
	02-23-02655-450	182TC, 184TC, 213C, 215C, 213TC, 215TC	
5		Shaft, Input	1
	02-23-02637-450	5/8 Diameter Quill, 56C	
	02-23-02638-450	7/8 Diameter Quill, 143TC, 145TC, 182C, 184C	
	02-23-02639-450	1 1/8 Diameter Quill, 182TC, 184TC, 213C, 215C	
	02-23-02640-450	1 3/8 Diameter Quill, 182TC, 184TC, 213TC, 215TC	
6	02-23-01788-516	Spacer, Input	2
7	02-23-02650-450	Bushing, Input Bearing	1
8		Shaft, Output	1
	02-23-02662-450	Style A (Double Extension)	
	02-23-02663-450	Style B or C (Single Extension)	

CAUTION — Hub City recommends that both the worm and worm gear be replaced to obtain maximum life from the repaired unit. Replacement of only one member will result in an unsatisfactory life.

REF. NO.	PART NUMBER	DESCRIPTION	NO. REQ.
9		Worm	1
	02-23-02644-450	40:1 Ratio	
	02-23-02645-450	50:1 Ratio	
	02-23-02646-450	60:1 Ratio	
	02-23-02647-450	80:1 Ratio	

REF. NO.	PART NUMBER	DESCRIPTION	NO. REQ.
9		Worm, Continued	
	02-23-02643-450	40:1 Ratio	
	02-23-02644-450	50:1 Ratio	
	02-23-02645-450	60:1 Ratio	
	02-23-02646-450	80:1 Ratio	
11		Gear, Worm, Assembly	1
		(Includes Gear Carrier 11, Set Screws 12)	
	02-23-02652-450	40:1 Ratio	
	02-23-02653-450	50:1 Ratio	
	02-23-02654-450	60:1 Ratio	
	02-23-02655-450	80:1 Ratio	
	02-23-02656-450	40:1 Ratio	
	02-23-02657-450	50:1 Ratio	
	02-23-02658-450	60:1 Ratio	
	02-23-02659-450	80:1 Ratio	
11		Carrier, Gear, Part of Item 10	
12		Screw, Socket Set, Part of Item 10	
13	8-130-01-61-007	Cup, Bearing, Timken M802011	2
14	8-130-01-61-006	Cone, Bearing, Timken M802048	2
15	8-82-11-06-011	Bearing, Ball, 5007K	1
16	02-23-02651-450	Washer	1
17	8-47-14-04-006	Screw, Hex Cap, 3/8 NC x 1 1/4	4
18	8-47-11-44-021	Screw, Socket Hd. Cap, 3/8 NC x 1 1/4	4
19	8-47-14-04-139	Screw, Hex Cap, 5/16 NC x 7/8	12
20		Screw, Hex Cap	4
	8-47-14-04-008	3/8 NC x 1 for 56C, 143TC, 145TC, 182C, 184C	
	8-47-14-04-010	3/8 NC x 1 1/4 for 182TC, 184TC, 213C, 215, 213TC, 215TC	
21		Washer, Locking	4
	8-47-16-11-008	3/8 Diameter	
	8-47-16-11-009	1/2 Diameter	

22	02-23-02698-450	KIT, REPAIR (INCLUDES ITEMS 23-34) THESE ITEMS ARE AVAILABLE IN REPAIR KIT ONLY	
23		Seal, Input Shaft	1
	8-74-21-25-017	5/8 and 7/8 Diameter Quill (C/R 13535)	
	8-74-21-25-134	1 1/8 Diameter Quill (C/R 16118)	
	8-74-12-25-142	1 3/8 Diameter Quill (C/R 19210)	
24	8-74-21-25-033	Seal, Output Shaft (C/R 16246) (Style A requires 2) (Style B or C requires 1)	
25	8-47-17-05-025	Key, P G W (1/4 sq x 2 1/2)	1
26	8-47-17-05-112	Key, P G W (1/2 sq x 2 1/4)	1
27		Key, P G W, Input Quill	1
	8-47-17-05-030	5/16 sq x 1 3/8 for 5/8 & 7/8 Diameter Quill	
	8-47-17-05-042	1/4 sq x 1 3/4 for 1 1/8 Diameter Quill	
	8-47-17-05-127	5/16 sq x 1 3/4 for 1 3/8 Diameter Quill	
28	8-47-17-66-007	Ring, Retaining (Truarc N5100-28)	1
29	8-47-17-66-006	Ring, Retaining	1
30	02-23-02660-450	Gasket, Input Cap	10
30A	8-66-00-00-012	Loctite 515 (6ML Tube)	1
31	02-23-02661-450	Gasket, Output Cap	10
32	8-63-12-61-004	Plug, Pipe, Socket (1/2 NPT)	4
33	8-63-12-51-002	Bushing, Pipe (1/2 x 1/4)	1
34	8-63-12-71-001	Plug, Vented (1/8 NPT)	1

PARTS ORDERING INFORMATION

When ordering replacement or spare parts, check metal tag on the gear case of your unit and furnish ALL of the following information:

GENERAL

1 Assembly Number
2 Model Number
3 Ratio
4 Style
5 Shipping Code

SPECIFIC

6 Part Number
7 Complete Description
8 Quantity Desired
9 Your Name
Address, Zip Code
and Phone Number

PHONE OR WRITE

Your nearest Hub City Sales Office or Industrial Power Transmission Distributor listed in the Yellow Pages, or the Factory Sales Office.

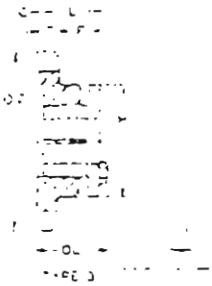
NOTE — When more than one part number is listed after a reference number, examine each description carefully to determine which parts fit your need. Parts will be shipped "best way" unless specified.

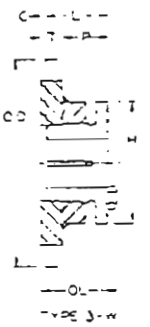
Litho in USA

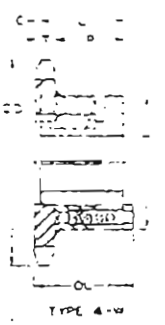
Sprockets for No. 60, ¾" Pitch ANSI Chain

Steel Single Sprockets with Split Taper Bushings

Table No. 1 — HARDENED TEETH







Part No	Bushing	Diameters Outside	Diameters Pitch	No. Teeth	Type	Dimensions T	Dimensions OL	Dimensions L	Dimensions P	Dimensions C	Dimensions H	Wt. Less Bushing
H60G10	G	2.76"	2.427"	10	3	.459"	1¾"	1"	1 15/32"	5/8"	2"	.6
H60G11▪	G	2.96	2.662	11	3	.459	1¼	1	1 15/32	5/8	2	.5
H60H11	H	2.96	2.662	11	3	.459	1 13/16	1¼	1 15/32	5/8	2 1/2	.7
H60G12▫	G	3.25	2.893	12	3	.459	1¼	1	1 15/32	5/8	2	.6
H60H12	H	3.25	2.893	12	3	.459	1¾	1¼	1 15/32	5/8	2 1/2	.8
H60P13	P1	3.45	3.134	13	4	.459	2 1/16	1 13/16	1 15/32	0	3	1.4
H60H14	H	3.74	3.371	14	3	.459	1½	1¼	1 15/32	5/8	2 1/2	1.1
H60P14	P1	3.74	3.371	14	4	.459	2 1/16	1 13/16	1 15/32	0	3	1.4
H60H15	H	3.98	3.607	15	3	.459	1½	1¼	1 15/32	5/8	2 1/2	1.4
H60P15	P1	3.98	3.607	15	4	.459	2 1/16	1 13/16	1 15/32	0	3	1.7
H60H16	H	4.22	3.844	16	3	.459	1½	1¼	1 15/32	5/8	2 1/2	1.3
H60P16	P1	4.22	3.844	16	4	.459	2 1/16	1 13/16	1 15/32	0	3	1.8
H60H17	H	4.46	4.082	17	3	.459	1½	1¼	1 15/32	5/8	2 1/2	1.5
H60P17	P1	4.46	4.082	17	4	.459	2 1/16	1 13/16	1 15/32	0	3	2.1
H60H18	H	4.70	4.319	18	3	.459	1½	1¼	1 15/32	5/8	2 1/2	1.7
H60P18	P1	4.70	4.319	18	4	.459	2 1/16	1 13/16	1 15/32	0	3	2.2
H60H19	H	4.95	4.557	19	3	.459	1½	1¼	1 15/32	5/8	2 1/2	1.9
H60P19	P1	4.95	4.557	19	4	.459	2 1/16	1 13/16	1 15/32	0	3	2.5
H60H20	H	5.19	4.794	20	3	.459	1½	1¼	1 15/32	5/8	2 1/2	2.1
H60P20	P1	5.19	4.794	20	4	.459	2 1/16	1 13/16	1 15/32	0	3	3.1
H60Q20	Q1	5.19	4.794	20	4	.459	2 15/32	2 1/2	2 15/32	0	4 1/8	3.5
H60H21▪	H	5.43	5.032	21	3	.459	1½	1¼	1 15/32	5/8	2 1/2	2.4
H60P21	P1	5.43	5.032	21	4	.459	2 1/16	1 13/16	1 15/32	0	3	2.9
H60Q21	Q1	5.43	5.032	21	4	.459	2 15/32	2 1/2	2 15/32	0	4 1/8	3.6
H60H22	H	5.67	5.270	22	3	.459	1½	1¼	1 15/32	5/8	2 1/2	2.6
H60P22	P1	5.67	5.270	22	4	.459	2 1/16	1 13/16	1 15/32	0	3	3.2
H60Q22	Q1	5.67	5.270	22	4	.459	2 15/32	2 1/2	2 15/32	0	4 1/8	4.0
H60H23▪	H	5.91	5.508	23	3	.459	1½	1¼	1 15/32	5/8	2 1/2	2.8
H60P23	P1	5.91	5.508	23	4	.459	2 1/16	1 13/16	1 15/32	0	3	3.5
H60Q23	Q1	5.91	5.508	23	4	.459	2 15/32	2 1/2	2 15/32	0	4 1/8	4.1
H60H24	H	6.15	5.746	24	3	.459	1½	1¼	1 15/32	5/8	2 1/2	3.0
H60P24	P1	6.15	5.746	24	4	.459	2 1/16	1 13/16	1 15/32	0	3	3.8
H60Q24	Q1	6.15	5.746	24	4	.459	2 15/32	2 1/2	2 15/32	0	4 1/8	4.5
H60H25▫▲	H	6.39	5.984	25	3	.459	1½	1¼	1 15/32	5/8	2 1/2	3.4
H60P25	P1	6.39	5.984	25	4	.459	2 1/16	1 13/16	1 15/32	0	3	4.1
H60Q25	Q1	6.39	5.984	25	4	.459	2 15/32	2 1/2	2 15/32	0	4 1/8	5.9
H60H26▫▲	H	6.63	6.222	26	3	.459	1½	1¼	1 15/32	5/8	2 1/2	3.8
H60P26	P1	6.63	6.222	26	4	.459	2 1/16	1 13/16	1 15/32	0	3	4.3
H60Q26	Q1	6.63	6.222	26	4	.459	2 15/32	2 1/2	2 15/32	0	4 1/8	6.3
H60H27▫▲	H	6.87	6.460	27	3	.459	1½	1¼	1 15/32	5/8	2 1/2	4.1
H60P27	P1	6.87	6.460	27	4	.459	2 1/16	1 13/16	1 15/32	0	3	4.5
H60Q27	Q1	6.87	6.460	27	4	.459	2 15/32	2 1/2	2 15/32	0	4 1/8	6.4
H60H28▫▲	H	7.11	6.699	28	3	.459	1½	1¼	1 15/32	5/8	2 1/2	4.5
H60P28	P1	7.11	6.999	28	4	.459	2 1/16	1 13/16	1 15/32	0	3	4.9
H60Q28	Q1	7.11	6.699	28	4	.459	2 15/32	2 1/2	2 15/32	0	4 1/8	6.9
H60H29▫▲	H	7.35	6.937	29	3	.459	1½	1¼	1 15/32	5/8	2 1/2	4.8
H60Q29	Q1	7.35	6.937	29	4	.459	2 15/32	2 1/2	2 15/32	0	4 1/8	7.3
H60H30▲	H	7.59	7.175	30	3	.459	1½	1¼	1 15/32	5/8	2 1/2	5.1
H60P30	P1	7.59	7.175	30	4	.459	2 1/16	1 13/16	1 15/32	0	3	5.6
H60Q30	Q1	7.59	7.175	30	4	.459	2 15/32	2 1/2	2 15/32	0	4 1/8	7.6

▲Transmitted torque must not exceed 2500 in.-lbs. for these sizes.

Table No. 2 — Steel Single Sprockets with Split Taper Bushings

Part No	Bushing	Diameters Outside	Diameters Pitch	No. Teeth	Type	Dimensions T	Dimensions OL	Dimensions L	Dimensions P	Dimensions C	Dimensions H	Wt. Less Bushing
50G10	G	2.76"	2.427"	10	3	.459"	1¾"	1"	1 15/32"	5/8"	2"	.6
60H11	H	2.96	2.662	11	3	.459	1 13/16	1¼	1 15/32	5/8	2 1/2	.7
60H12	H	3.25	2.893	12	3	.459	1¾	1¼	1 15/32	5/8	2 1/2	.8
60H13	H	3.45	3.134	13	3	.459	1½	1¼	1 15/32	5/8	2 1/2	.8
60P13	P1	3.45	3.134	13	4	.459	2 1/16	1 13/16	1 15/32	0	3	1.1
60H14	H	3.74	3.371	14	3	.459	1½	1¼	1 15/32	5/8	2 1/2	1.0
60P14	P1	3.74	3.371	14	4	.459	2 1/16	1 13/16	1 15/32	0	3	1.2
60H15	H	3.98	3.607	15	3	.459	1½	1¼	1 15/32	5/8	2 1/2	1.2
60P15	P1	3.98	3.607	15	4	.459	2 1/16	1 13/16	1 15/32	0	3	1.6
60P16	P1	4.22	3.844	16	4	.459	2 1/16	1 13/16	1 15/32	0	3	2.0
60P17	P1	4.46	4.082	17	4	.459	2 1/16	1 13/16	1 15/32	0	3	2.2
60P18	P1	4.70	4.319	18	4	.459	2 1/16	1 13/16	1 15/32	0	3	2.4
60P19	P1	4.95	4.557	19	4	.459	2 1/16	1 13/16	1 15/32	0	3	2.5
60P20	P1	5.19	4.794	20	4	.459	2 1/16	1 13/16	1 15/32	0	3	3.0
60Q20	Q1	5.19	4.794	20	4	.459	2 15/32	2 1/2	2 15/32	0	4 1/8	3.5
60P21	P1	5.43	5.032	21	4-W	.469	2 1/16	1 13/16	1 15/32	0	3	3.0
60Q21	Q1	5.43	5.032	21	4	.459	2 15/32	2 1/2	2 15/32	0	4 1/8	3.8
60P22	P1	5.67	5.270	22	4-W	.453	2 1/16	1 13/16	1 15/32	0	3	3.3

LARGER SIZES ON NEXT PAGE

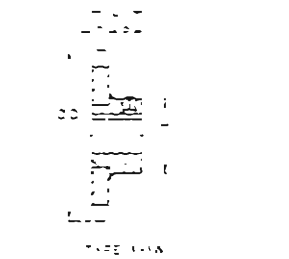
Sizes carried in stock; available from production ...

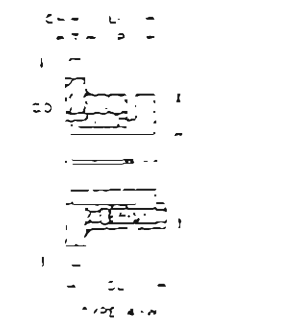
Sprockets for No. 60, ¾" Pitch ANSI Chain

Table No. 1 — Steel Single Sprockets with Split Taper Bushings

Part No.	Bushing	DIAMETERS Outside	DIAMETERS Pitch	No. Teeth	Type	DIMENSIONS CL	L	P	C	H	Wt. Less Bushing
SMALLER SIZES ON PREVIOUS PAGE											
60Q22	Q1	5.67"	5.270"	22	4	.459"	2 3/32"	2 1/2"	2 13/32"	0"	4 1/8"	4.1
60P23	P1	5.91	5.508	23	4-W	.459	2 3/4	1 15/32	1 13/32	0	3	3.5
60Q23	Q1	5.91	5.508	23	4	.459	2 3/32	2 1/2	2 13/32	0	4 1/8	4.3
60P24	P1	6.15	5.746	24	4-W	.459	2 3/4	1 15/32	1 13/32	0	3	3.9
60Q24	Q1	6.15	5.746	24	4	.459	2 3/32	2 1/2	2 13/32	0	4 1/8	4.5
60P25	P1	6.39	5.984	25	4-W	.459	2 3/4	1 15/32	1 13/32	0	3	4.3
60Q25	Q1	6.39	5.984	25	4-W	.459	2 3/32	2 1/2	2 13/32	0	4 1/8	6.0
60P26	P1	6.63	6.222	26	4-W	.459	2 3/4	1 15/32	1 13/32	0	3	4.3
60Q26	Q1	6.63	6.222	26	4-W	.459	2 3/32	2 1/2	2 13/32	0	4 1/8	6.4
60P27	P1	6.87	6.460	27	4-W	.459	2 3/4	1 15/32	1 13/32	0	3	4.6
60Q27	Q1	6.87	6.460	27	4-W	.459	2 3/32	2 1/2	2 13/32	0	4 1/8	6.6
60P28	P1	7.11	6.699	28	4-W	.459	2 3/4	1 15/32	1 13/32	0	3	5.0
60Q28	Q1	7.11	6.699	28	4-W	.459	2 3/32	2 1/2	2 13/32	0	4 1/8	6.9
60Q29	Q1	7.35	6.937	29	4-W	.459	2 3/32	2 1/2	2 13/32	0	4 1/8	7.3
60P30	P1	7.59	7.175	30	4-W	.459	2 3/4	1 15/32	1 13/32	0	3	5.6
60Q30	Q1	7.59	7.175	30	4-W	.459	2 3/32	2 1/2	2 13/32	0	4 1/8	7.7
60Q31	Q1	7.83	7.413	31	4-W	.459	2 3/32	2 1/2	2 13/32	0	4 1/8	7.8
60Q32	Q1	8.07	7.652	32	4-W	.459	2 3/32	2 1/2	2 13/32	0	4 1/8	8.3
60Q33	Q1	8.30	7.890	33	4-W	.459	2 3/32	2 1/2	2 13/32	0	4 1/8	8.7
60Q34	Q1	8.54	8.129	34	4-W	.459	2 3/32	2 1/2	2 13/32	0	4 1/8	9.1
60Q35	Q1	8.78	8.367	35	4-W	.459	2 3/32	2 1/2	2 13/32	0	4 1/8	9.3
[illegible]	Q1	9.02	8.605	36	4-W	.459	2 3/32	2 1/2	2 13/32	0	4 1/8	9.9
[illegible]	Q1	9.26	8.844	37	4-W	.459	2 3/32	2 1/2	2 13/32	0	4 1/8	10.3
60Q38	Q1	9.50	9.082	38	4-W	.459	2 3/32	2 1/2	2 13/32	0	4 1/8	10.6
60Q39	Q1	9.74	9.321	39	4-W	.459	2 3/32	2 1/2	2 13/32	0	4 1/8	11.1
60Q40	Q1	9.98	9.559	40	4-W	.459	2 3/32	2 1/2	2 13/32	0	4 1/8	11.6
60Q41	Q1	10.22	9.798	41	4-W	.459	2 3/32	2 1/2	2 13/32	0	4 1/8	11.9
60Q42	Q1	10.46	10.036	42	4-W	.459	2 3/32	2 1/2	2 13/32	0	4 1/8	12.6
60Q42a	Q1	10.70	10.275	43	4-W	.459	2 3/32	2 1/2	2 13/32	0	4 1/8	12.5
60Q44	Q1	10.94	10.513	44	4-W	.459	2 3/32	2 1/2	2 13/32	0	4 1/8	13.4
60Q45	Q1	11.18	10.752	45	4-W	.459	2 3/32	2 1/2	2 13/32	0	4 1/8	13.9
60Q46a	Q1	11.42	10.990	46	4-W	.459	2 3/32	2 1/2	2 13/32	0	4 1/8	14.1
60Q47	Q1	11.65	11.229	47	4-W	.459	2 3/32	2 1/2	2 13/32	0	4 1/8	16.3
60Q48	Q1	11.89	11.467	48	4-W	.459	2 3/32	2 1/2	2 13/32	0	4 1/8	16.4
60Q49a	Q1	12.13	11.706	49	4-W	.459	2 3/32	2 1/2	2 13/32	0	4 1/8	16.8
60Q50	Q1	12.37	11.945	50	4-W	.459	2 3/32	2 1/2	2 13/32	0	4 1/8	16.9
60Q51a	Q1	12.61	12.183	51	4-W	.459	2 3/32	2 1/2	2 13/32	0	4 1/8	17.0
60Q52a	Q1	12.85	12.422	52	4-W	.459	2 3/32	2 1/2	2 13/32	0	4 1/8	17.5
60Q53a	Q1	13.09	12.660	53	4-W	.459	2 3/32	2 1/2	2 13/32	0	4 1/8	18.1
60Q54	Q1	13.33	12.899	54	4-W	.459	2 3/32	2 1/2	2 13/32	0	4 1/8	19.6
60Q56	Q1	13.81	13.376	56	4-W	.459	2 3/32	2 1/2	2 13/32	0	4 1/8	20.3
60Q57a	Q1	14.04	13.615	57	4-W	.459	2 3/32	2 1/2	2 13/32	0	4 1/8	20.7
60Q58a	Q1	14.28	13.853	58	4-W	.459	2 3/32	2 1/2	2 13/32	0	4 1/8	21.4
60Q59a	Q1	14.52	14.092	59	4-W	.459	2 3/32	2 1/2	2 13/32	0	4 1/8	22.0
60Q60	Q1	14.73	14.331	60	4-W	.459	2 3/32	2 1/2	2 13/32	0	4 1/8	22.9
60Q64a	Q1	15.72	15.285	64	4-W	.459	2 3/32	2 1/2	2 13/32	0	4 1/8	25.6
60Q65a	Q1	15.96	15.524	65	4-W	.459	2 3/32	2 1/2	2 13/32	0	4 1/8	26.4
60Q67a	Q1	16.43	16.001	67	4-W	.459	2 3/32	2 1/2	2 13/32	0	4 1/8	27.9
60Q68a	Q1	16.67	16.240	68	4-W	.459	2 3/32	2 1/2	2 13/32	0	4 1/8	28.7
60Q70	Q1	17.12	16.717	70	4-W	.459	2 3/32	2 1/2	2 13/32	0	4 1/8	30.9
60R70	R1	17.12	16.717	70	4-W	.459	3 3/32	2 7/8	2 13/32	0	5 3/8	31.8
60Q72	Q1	17.63	17.194	72	4-W	.459	2 3/32	2 1/2	2 13/32	0	4 1/8	31.9
60R72	R1	17.63	17.194	72	4-W	.459	3 3/32	2 7/8	2 13/32	0	5 3/8	34.1
60R76a	R1	18.58	18.149	76	4-W	.459	3 3/32	2 7/8	2 13/32	0	5 3/8	37.5
60Q80	Q1	19.54	19.103	80	4-W	.459	2 3/32	2 1/2	2 13/32	0	4 1/8	39.1
60R80	R1	19.54	19.103	80	4-W	.459	3 3/32	2 7/8	2 13/32	0	5 3/8	41.5
60Q84	Q1	20.49	20.058	84	4-W	.459	2 3/32	2 1/2	2 13/32	0	4 1/8	41.8
60R84	R1	20.49	20.058	84	4-W	.459	3 3/32	2 7/8	2 13/32	0	5 3/8	44.8
60R90a	R1	21.93	21.490	90	4-W	.459	3 3/32	2 7/8	2 13/32	0	5 3/8	51.0
60R95a	R1	22.12	22.683	95	4-W	.459	3 3/32	2 7/8	2 13/32	0	5 3/8	58.4
[illegible]	Q1	23.26	22.922	96	4-W	.459	2 3/32	2 1/2	2 13/32	0	4 1/8	54.0
[illegible]	R1	23.35	22.922	96	4-W	.459	3 3/32	2 7/8	2 13/32	0	5 3/8	63.0
[illegible]	R1	24.79	24.354	102	4-W	.459	3 3/32	2 7/8	2 13/32	0	5 3/8	64.4
60Q112	Q1	27.18	25.742	112	4-W	.459	2 3/32	2 1/2	2 13/32	0	4 1/8	73.0
60R112	R1	27.18	25.742	112	4-W	.459	3 3/32	2 7/8	2 13/32	0	5 3/8	76.5
60R120a	R1	28.09	28.651	120	4-W	.459	3 3/32	2 7/8	2 13/32	0	5 3/8	87.7

[illegible] available from stock.





Bore Range

Table No. 2

Bushing	Bore Range
P1	½" — 1 3/4"
Q1	⅜ — 2 15/16
R1	1 7/16 — 3 7/8

Standard Keyseats

Table No. 3

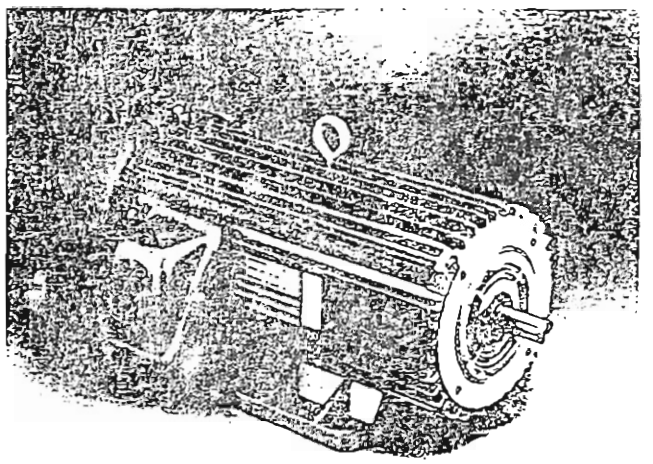
Bore Range	Keyseat
½" — 9/16"	1/16" x 1/16"
5/8 — 7/8	3/16 x 3/32
15/16 — 1 1/4	1/4 x 1/8
1 5/16 — 1 3/8	5/16 x 5/32
1 7/16 — 1 3/4	3/8 x 3/16
1 13/16 — 2 1/4	1/2 x 1/4
2 5/16 — 2 3/4	5/8 x 5/16
2 15/16 — 3 3/8	3/4 x 3/8
3 7/16 — 3 7/8	7/8 x 7/16

TAB B

FOCUS on Experience

Single Source for a Complete Drive

PERMANENT MAGNET DC MOTORS

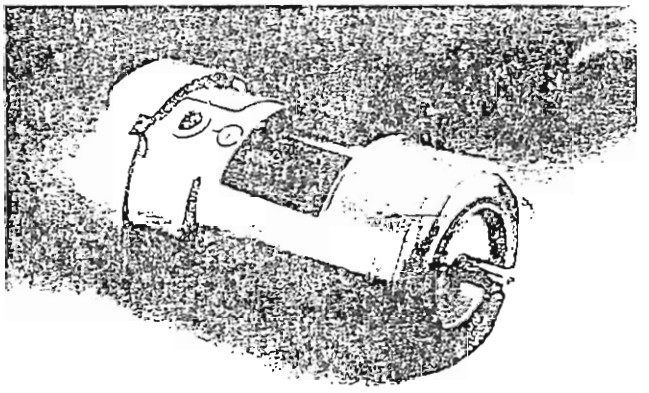


90 VDC			
HP	RPM	FRAME	ENCLOSURE
[illegible]	[illegible]	[illegible]	[illegible]
	2500		
	1750		TEFC
	1750		
	1750		
	2500		

180 VDC			
HP	RPM	FRAME	ENCLOSURE
	2500		
	1750		
	1750		
	2500		
	2500		

SHUNT WOUND DC MOTORS

(18 VDC Armature, 200 VDC Field)



HP	RPM	FRAME	ENCLOSURE
1	2500	146ATC	TEFC
	1750	146ATC	TEFC
	1150	148ATC	TEFC
1½	2500	148ATC	TEFC
	1750	186ATCZ	TENV
	1750	148ATC	TEFC
	1150	1412ATC	TEFC
2	2500	148ATC	TEFC
	1750	186ATCZ	TENV
	1750	148ATC	TEFC
	1150	1412ATC	TEFC
3	2500	1412ATC	TEFC
	1750	186ATCZ	TENV
	1750	1412ATC	TEFC
5	1750	2110ATC	TENV

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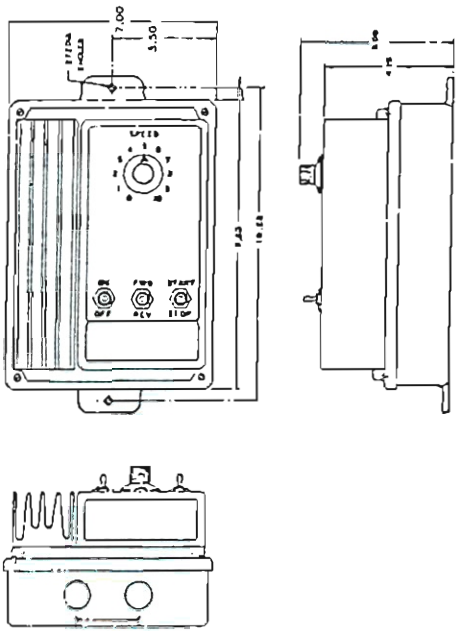
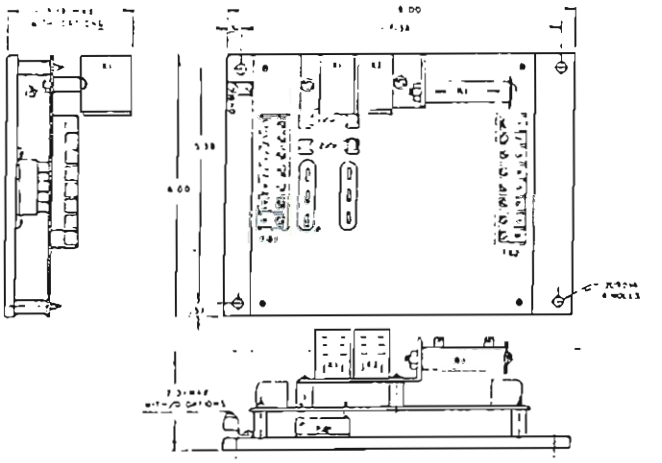
FOCUS 1
DIMENSIONS



OUTLINE AND MOUNTING
DIMENSION DATA
FOCUS 1 ENCLOSED CONTROL
PRINT #2400-3005

OUTLINE AND MOUNTING
DIMENSION DATA
FOCUS 1 CHASSIS CONTROL
PRINT #2400-3006



SPECIFICATIONS

	FOCUS 1		FOCUS 2		FOCUS 2
	Enclosed	Chassis	Enclosed	Dead Front	Chassis
Power Ratings					
Reconnectable Dual Voltage					
120V	1/4-1 HP		1/4-1 HP		1 4-1 HP
240V	1/2-2 HP		1/2-2 HP		1 2-2HP
Single Voltage					
240V	—		3-5 HP		3-5 HP
Output Voltage-Arm/Field	120V 1/4-1 HP 90/100 VDC 240V 1/2-2 HP 180/200 VDC		120V 1/4-1 HP 90/100 VDC 240V 1/2-5 HP 180/200 VDC	120V 240V	1 4-1 HP 90 100 VDC 1/2-5 HP 180 200 VDC
Drive Service Factor	1.0 Max Rating		1.0 Max Rating		1.0 Max Rating
Adjustments					
Max Speed	70-115%		70-120%		70-120%
Min Speed	0- 30%		0- 30%		0- 30%
IR Compensation	0- 20%		0- 20%		0- 20%
Current Limit	Fixed 150%		0-150%		0-150%
Selectable in Ranges					
Acceleration/Deceleration	Fixed Accel 2-3 Sec.		0-30 Linear		0-30 Linear
Operator Functions					
Speed Adjust	STD.		STD.		STD.
Power on/off	STD.	Cust. Supl.	STD.	Option Kit	Cus Supplied
Run/Stop	STD.	Cust. Supl.	STD.	Cust. Supl.	Cus Supplied
Run/Jog	N/A		STD.	Cust. Supl.	Cus. Supplied
Forward/Reverse	Option Kit		Option Kit		Option Kit
Auto/Manual	N/A		Option Kit		Option Kit ②
External Current Limit	N/A		Option Kit		Option Kit ②
Enclosure					
NEMA 1	STD.		Exceeded	Exceeded w/ Op Kit	
NEMA 4 and 12	Option Kit		STD.	Option Kit	STD
Customer Programmable —					
Input Voltage (1/4-2HP only)	STD.		STD		STD
Current Limit	3 Ranges		3 Ranges		3 Ranges
Feedback	HI/LO Armature		HI/MED/LO Armature/Tach		HI MED LO Armature Tach
Regulation Mode	Speed/Torque		Speed/Torque		Speed Torque
①Speed Regulation					
Armature Voltage w/ 95% Load Change	2-5%		2-5%		2-5%
Tach Feedback AC/DC	N/A		1%		1%
Operating Conditions					
Altitude (w/o De-rating)	3300 Ft.		3300 Ft.		3300 Ft
Ambient Temp	0-40°C	0-55°C	0-40°C	0-55°C	0-55°C
TENV Enclosure Volume Requirement for Chassis Unit	—	800 cu in/HP	—	800 cu in/HP	800 cu in HP
Line Voltage Variation	±10%		±10%		±10%
Frequency Variation	48-62 Hz		48-62 Hz		48-62 Hz
Overload Capacity (As a percent of Max Rating)	150% (1 minute)		150% (1 minute)		150% (1 minute)
Efficiency					
Control (minimum)	98%		98%		98%
Drive (typical)	86%		86%		86%
Option Kits					
M Contactor	Yes		Yes		Yes
M Contactor w/ aux. cont.	No		Yes		Yes
Dynamic Braking	Yes		Yes		Yes
Reversing	Yes		Yes		Yes
NEMA 4 and 12	Yes	N/A	STD	Yes	N/A
Signal Follower	No		Yes		②Yes
External Current Limit	No		Yes		②Yes
Torque Taper	No		Yes		②Yes
Jog at Separately Adjustable Preset Speed	No		Yes		②Yes
Master Reference	No		Yes		Yes
Dead Front	Yes	N/A	Yes	Yes	N/A
Option Mounting Panel	No		No		Yes

① For all other variables
Voltage regulated-changes up to 15% of top speed can result from temperature, voltage, and frequency variations plus drift.

② NOTE: — These options can be used with the chassis mount control, however, panel mounting and interconnection must be done by customer. The Option Mounting Panel (P/N 2450-9048) for use with the chassis mount control provides mounting space for either the Reversing or Armature Contactor Option Kits and the D.B. Option Kit.

SERIES 210
MODEL 214

WORM GEAR REDUCERS

"C" flange reducer — C-flange design permits motor shaft to be plugged directly into quill-type input shaft permitting installation in the smallest possible space.

Taper roller bearings on low speed shaft. Double row ball bearings on high speed shaft.

Input quill is Parco-Lubrited and coated with Molybdenum Disulfide lubricant to provide protection against fretting corrosion.

Hub City Adjustable Base Kit featuring elongated slots for mounting bolts and adjusting screws for ease of positioning. (Refer to page 60.)

Universal Base Kits to interchange with Boston, Browning, Perfection, Ohio, Morse, and Winsmith. (Refer to page 61.)

Side Mounting Kits for side wall and ceiling mounting. (Refer to page 62.)

Cooling Fan Kit and Synthetic Lube available to increase thermal capacity. (Refer to pages 63 and 326.)

Hub City Lubricant recommended. (Refer to page 326.)

2.06 CENTER DISTANCE

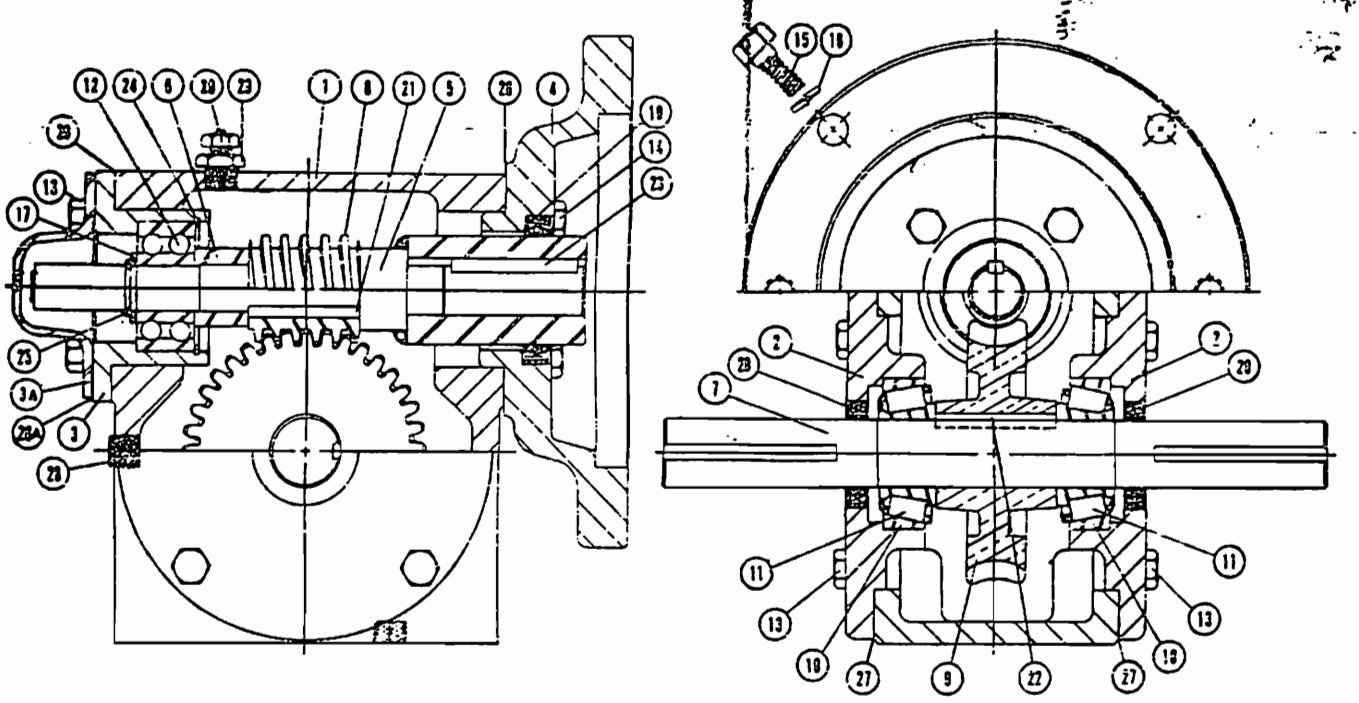
RATING TABLE

RATIO	Output R.P.M.	MECHANICAL RATING — SERVICE FACTOR 1.00 Input H.P.	1.00 Output Torque	1.25 Input H.P.	1.25 Output Torque	1.50 Input H.P.	1.50 Output Torque	1.75 Input H.P.	1.75 Output Torque	Efficiency %	THERMAL RATING — DESIGN OPTION Basic Unit Input H.P.	Basic Unit Output Torque	With Synthetic Lube Input H.P.	With Synthetic Lube Output Torque	With Fan Input H.P.	With Fan Output Torque
1750 RPM INPUT SPEED (HIGH SPEED SHAFT)																
5	350.0	3.01	482	3.76	602	4.51	723	5.26	843	80.8	2.26	362	2.80	434		
10	175.0	2.01	621	2.51	777	3.01	934	3.51	1090	83.8	1.40	433	1.81	496	THERMAL RATING EQUALS MECHANICAL RATING.	
15	116.6	1.64	660	2.05	827	2.46	992	2.87	1160	80.7	1.07	446	1.37	572		
20	87.5	1.37	748	1.71	938	2.05	1120	2.39	1310	78.3	0.91	524	1.05	603		
25	70.0	1.18	804	1.48	1010	1.77	1210	2.07	1410	77.2	0.81	565	0.93	651		
30	58.3	1.02	854	1.28	1070	1.53	1280	1.79	1500	76.1	0.73	603	0.83	688		
40	43.8	0.87	968	1.09	1210	1.31	1450	1.53	1700	74.0	0.67	739	0.77	852		
50	35.0	0.78	1080	0.98	1350	1.17	1620	1.37	1890	72.1	0.64	884	0.74	1020		
60	29.2	0.71	1180	0.89	1480	1.07	1780	1.25	2080	70.4	0.62	1030	0.72	1200		
1150 RPM INPUT SPEED (HIGH SPEED SHAFT)																
5	230.0	2.40	421	3.00	526	3.60	631	4.20	736	81.8	2.20	386	2.80	492		
10	115.0	1.64	722	2.05	903	2.46	1080	2.87	1260	80.7	1.40	615	1.81	716	THERMAL RATING EQUALS MECHANICAL RATING.	
15	76.6	1.23	826	1.54	1030	1.84	1240	2.15	1450	78.7	1.05	706	1.39	730		
20	57.5	1.05	919	1.31	1150	1.56	1370	1.82	1600	77.3	0.91	796	1.01	883		
25	46.0	0.74	929	0.93	1160	1.11	1390	1.30	1630	76.4	0.81	851	0.91	929		
30	38.3	0.75	1120	0.93	1400	1.12	1680	1.31	1960	75.3	0.73	1090	0.83	1240		
40	28.8	0.62	1240	0.77	1550	0.93	1860	1.08	2170	73.5	0.67	1340	0.77	1540		
50	23.0	0.53	1330	0.66	1660	0.79	1990	0.92	2320	71.8	0.64	1600	0.74	1850		
60	19.1	0.47	1410	0.59	1760	0.71	2120	0.83	2470	70.2	0.62	1860	0.72	2160		
850 RPM INPUT SPEED (HIGH SPEED SHAFT)																
5	170.0	2.02	595	2.52	744	3.03	892	3.53	1040	81.8	2.02	595				
10	85.0	1.36	811	1.69	1010	2.03	1210	2.37	1410	80.4	1.22	731				
15	56.6	1.03	909	1.29	1140	1.54	1360	1.80	1590	78.7	0.95	836				
20	42.5	0.73	973	1.09	1460	1.31	1750	1.53	2040	77.3	0.81	1080			THERMAL RATING EQUALS MECHANICAL RATING.	
25	34.0	0.69	1150	0.86	1430	1.04	1730	1.21	2020	76.1	0.73	1210				
30	28.3	0.64	1280	0.80	1600	0.96	1920	1.12	2240	75.0	0.67	1340				
40	21.2	0.52	1390	0.65	1740	0.78	2090	0.91	2440	73.2	0.64	1710				
50	17.0	0.47	1560	0.59	1950	0.71	2340	0.83	2730	71.5	0.62	2070				
60	14.2	0.42	1690	0.53	2110	0.63	2540	0.74	2960	70.0	0.62	2500				
690 RPM INPUT SPEED (HIGH SPEED SHAFT)																
5	138.0	1.77	735	2.21	919	2.66	1100	3.10	1290	80.9						
10	69.0	1.19	928	1.49	1160	1.78	1390	2.08	1620	79.4						
15	46.0	0.88	987	1.10	1230	1.32	1480	1.54	1730	78.2						
20	34.5	0.75	1170	0.94	1460	1.13	1760	1.32	2060	77.2					THERMAL RATING EQUALS MECHANICAL RATING.	
25	27.6	0.67	1300	0.84	1630	1.01	1960	1.18	2290	76.1						
30	23.0	0.60	1400	0.75	1750	0.90	2100	1.05	2450	75.0						
40	17.2	0.53	1650	0.66	2060	0.79	2470	0.92	2880	73.2						
50	13.8	0.48	1850	0.60	2310	0.72	2770	0.84	3230	71.5						
60	11.5	0.44	2030	0.55	2540	0.66	3050	0.77	3560	70.0						
100 RPM INPUT SPEED (HIGH SPEED SHAFT)																
5	20.0	0.64	939	0.81	1190	0.97	1430	1.13	1660	79.1						
10	10.0	0.53	1550	0.67	1960	0.80	2350	0.93	2730	77.1						
15	6.6	0.42	1840	0.53	2320	0.64	2800	0.74	3270	75.5						
20	5.0	0.36	2000	0.45	2520	0.54	3030	0.63	3540	74.1					THERMAL RATING EQUALS MECHANICAL RATING.	
25	4.0	0.34	2360	0.43	2980	0.51	3580	0.60	4180	72.7						
30	3.3	0.32	2700	0.40	3400	0.48	4090	0.56	4770	71.4						
40	2.5	0.29	3200	0.36	4040	0.43	4850	0.50	5660	69.1						
50	2.0	0.27	3600	0.34	4540	0.40	5450	0.47	6360	67.1						
60	1.6	0.25	3980	0.31	5020	0.37	6030	0.43	7030	65.3						

OVERHUNG LOAD-LOW SPEED SHAFT — 650 LBS. AT CENTER POINT OF SHAFT EXTENSION

Hub City PARTS LIST MODEL 214

NEMA "C" FLANGE
SOLID OUTPUT SHAFT



REF. NO.	PART NUMBER	DESCRIPTION	NO. REQ.
1	02-23-01633-210	Housing	1
2		Cap, Output	2
	02-23-01634-210	Open (Style A Requires 2) (Style B or C requires 1)	
	02-23-02227-210	Closed (Style B or C requires 1)	
3	02-23-02515-210	Cap, Open Input	1
3A	02-23-02518-210	Cap, Closed Input	1
4	02-23-02514-210	Flange, Motor (56C, 143TC, 145TC, 182C, 184C)	1
5		Shaft, Input	1
	02-23-02517-210	⅝" Diameter Quill (56C)	
	02-23-02519-210	⅞" Diameter Quill (143TC, 145TC, 182C, 184C)	
6	02-23-02516-210	Spacer, Input Shaft	1
7		Shaft, Output	1
	02-23-01638-210	Style A (Double Extension)	
	02-23-02250-210	Style B or C (Single Extension)	

CAUTION — Hub City recommends that both the worm and worm gear be replaced to obtain maximum life from the repaired unit. Replacement of only one member will result in an unsatisfactory life.

REF. NO.	PART NUMBER	DESCRIPTION	NO. REQ.
8		Worm	1
	02-23-01616-210	5.1 Ratio	
	02-23-01618-210	10.1 Ratio	

REF. NO.	PART NUMBER	DESCRIPTION	NO. REQ.
9		Worm (Continued)	
	02-23-01621-210	15.1 Ratio	
	02-23-01622-210	20.1 Ratio	
	02-23-01624-210	25.1 Ratio	
	02-23-01626-210	30.1 Ratio	
	02-23-01628-210	40.1 Ratio	
	02-23-01630-210	50.1 Ratio	
	02-23-01632-210	60.1 Ratio	
9		Gear, Worm	1
	02-23-02561-210	5.1 Ratio	
	02-23-02562-210	10.1 Ratio	
	02-23-02563-210	15.1 Ratio	
	02-23-02564-210	20.1 Ratio	
	02-23-02565-210	25.1 Ratio	
	02-23-02566-210	30.1 Ratio	
	02-23-02567-210	40.1 Ratio	
	02-23-02568-210	50.1 Ratio	
	02-23-02569-210	60.1 Ratio	
10	8-63-03-65-169	Cup, Bearing (Timken M12610)	2
11	8-63-03-65-169	Cone, Bearing (Timken M12649)	2
12	8-63-03-06-008	Bearing, Ball 5312K	1
13	8-47-17-84-012	Screw, Hex Cap ¼ NC x ⅝	12
14	8-47-17-84-012	Screw, Hex Cap ¼ NC x ⅝	4
15	8-47-17-84-020	Screw, Hex Cap ⅜ NC x 1	4
16	8-47-17-05-379	Washer, Locking ⅜	4
17	02-23-01635-210	Spacer	1

18	02-23-02639-210	KIT, REPAIR (INCLUDES ITEMS 19-30) THESE ITEMS ARE AVAILABLE IN REPAIR KIT ONLY	
19	8-74-21-25-017	Seal, Input Shaft (C/R 13535)	1
20	8-74-21-25-006	Seal, Output Shaft (C/R 8550) (Style A requires 2) (Style B or C requires 1)	
21	8-47-17-05-092	Key (⅜ sq. x 1⅜)	1
22	8-47-17-05-149	Key (⅜ sq. x 1½)	1
23	8-47-17-05-080	Key (⅜ sq. x 1⅝)	1
24	8-47-17-86-080	Ring, Retaining (Truarc N5000-165)	1
25	8-47-17-86-084	Ring, Retaining (Truarc 5160-59)	1
26	02-23-01641-210	Gasket, Input Cap	10
26A	8-66-00-00-012	Loctite 515 (5ML Tube)	1
27	02-23-01640-210	Gasket, Output Cap	10
28	8-63-12-61-001	Plug, Pipe, Socket (¼ NPT)	4
29	8-63-12-51-001	Bushing, Pipe (¼ x ⅛)	1
30	8-63-12-71-001	Plug, Vented (⅛ NPT)	1

PARTS ORDERING INFORMATION

When ordering replacement or spare parts, check metal tag on the gear case of your unit and furnish ALL of the following information:

GENERAL

1. Assembly Number
2. Model Number
3. Ratio
4. Style
5. Shipping Code

SPECIFIC

6. Part Number
7. Complete Description
8. Quantity Desired
9. Your Name, Address, Zip Code, and Phone Number

PHONE OR WRITE

Your nearest Hub City Sales Office or Industrial Power Transmission Distributor listed in the Yellow Pages, or the Factory Sales Office.

NOTE — When more than one part number is listed after a reference number, examine each description carefully to determine which parts fit your need. Parts will be shipped "best way" unless specified.

Table No. 1 — Type "A" Steel Plate Sprockets

Part No.	Outside Dia.	Pitch Dia.	No. Teeth	Stock Bore	T (Nom.)	Wt. Lbs.	Part No.	Outside Dia.	Pitch Dia.	No. Teeth	Stock Bore	T (Nom.)	Wt. Lbs.
40A50	9.84"	9.554"	60	3/4"	.284"	5.7	40A72	11.75"	11.463"	72	1"	.284"	8.2
40A61□	10.00	9.713	61	3/4	.284	6.1	40A76□	12.39	12.099	76	1	.284	9.2
40A62□	10.16	9.872	62	3/4	.284	6.1	40A80	13.03	12.736	80	1	.284	9.8
40A63□	10.32	10.031	63	3/4	.284	6.5	40A84	13.66	13.372	84	1	.284	11.8
40A64	10.43	10.190	64	3/4	.284	6.5	40A90□	14.60	14.327	90	1	.284	12.9
40A65□	10.64	10.349	65	3/4	.284	6.7	40A96□	15.41	15.122	95	1	.284	14.4
40A66□	10.80	10.508	66	3/4	.284	6.9	40A96	15.57	15.281	96	1	.284	14.5
40A67□	10.96	10.667	67	3/4	.284	7.2	40A102	16.53	16.236	102	1	.284	16.6
40A68□	11.12	10.826	68	3/4	.284	7.4	40A112	18.12	17.828	112	1	.284	18.4
40A69□	11.27	10.986	69	3/4	.284	7.6	40A120	19.39	19.101	120	1	.284	23.0
40A70	11.43	11.145	70	3/4	.284	7.6							

Table No. 2 — Steel Single Type "B" Minimum Bore Sprockets

Part No.	DIAMETERS		No. Teeth	Type	BORE		DIMENSIONS				Wt. Lbs.
	Outside	Pitch			Stock	Max.*	T	Min.	P	H	
40B8	1.50"	1.307"	8	B	1/2"	1/2"	.284"	7/8"	1 3/32"	1 5/16"†	.1
40B9	1.67	1.462	9	B	1/2	5/8	.284	7/8	1 3/32	1 5/16†	.2
40B10	1.84	1.618	10	B	1/2	3/4	.284	7/8	1 3/32	1 5/16†	.3
40B11	2.00	1.775	11	B	1/2	7/8	.284	7/8	1 3/32	1 1/16†	.3
40B12	2.17	1.932	12	B	1/2	1	.284	7/8	1 3/32	1 13/16†	.4
40B13	2.30	2.089	13	B	1/2	1	.284	7/8	1 3/32	1 3/4†	.5
40B14	2.49	2.247	14	B	1/2	1 1/8	.284	7/8	1 3/32	1 7/8†	.6
40B15	2.65	2.405	15	B	1/2	1 1/8	.284	7/8	1 3/32	2†	.7
40B16	2.80	2.563	16	B	5/8	1 1/4	.284	7/8	1 3/32	2 1/16	.8
40B17	2.96	2.721	17	B	5/8	1 3/8	.284	7/8	1 3/32	2 1/8	.9
40B18	3.14	2.879	18	B	5/8	1 1/2	.284	7/8	1 3/32	2 3/8	1.1
40B19	3.30	3.038	19	B	5/8	1 5/8	.284	7/8	1 3/32	2 1/2	1.3
40B20	3.45	3.196	20	B	5/8	1 5/8	.284	1	1 3/32	2 1/2	1.4
40B21	3.62	3.355	21	B	5/8	1 3/4	.284	1	1 3/32	2 1/2	1.5
40B22	3.75	3.513	22	B	5/8	1 3/4	.284	1	1 3/32	2 1/2	1.6
40B23	3.94	3.672	23	B-W	5/8	1 7/8	.284	1	1 3/32	2 1/2	1.7
40B24	4.10	3.831	24	B-W	5/8	1 7/8	.284	1	3/4	2 1/2	1.8
40B25	4.26	3.989	25	B-W	5/8	1 7/8	.284	1	3/4	2 1/2	1.9
40B26	4.42	4.148	26	B-W	5/8	1 7/8	.284	1	3/4	2 1/2	2.0
40B27	4.58	4.307	27	B-W	5/8	1 7/8	.284	1	3/4	2 1/2	2.0
40B28	4.74	4.466	28	B-W	5/8	1 7/8	.284	1	3/4	2 1/2	2.2
40B29□	4.90	4.625	29	B-W	5/8	1 7/8	.284	1	3/4	2 1/2	2.3
40B30	5.06	4.783	30	B-W	5/8	1 7/8	.284	1	3/4	2 1/2	2.4
40B31□	5.22	4.942	31	B-W	5/8	1 7/8	.284	1	3/4	2 1/2	2.5
40B32	5.39	5.101	32	B-W	5/8	2	.284	1	3/4	3	3.0
40B33	5.54	5.260	33	B-W	5/8	2	.284	1	3/4	3	3.1
40B34	5.70	5.419	34	B-W	5/8	2	.284	1	3/4	3	3.2
40B35	5.86	5.578	35	B-W	5/8	2	.284	1	3/4	3	3.3
40B36	6.02	5.737	36	B-W	5/8	2	.284	1	3/4	3	3.4
40B37□	6.18	5.896	37	B-W	5/8	2	.284	1	3/4	3	3.6
40B38	6.33	6.055	38	B-W	5/8	2	.284	1	3/4	3	3.6
40B39□	6.49	6.214	39	B-W	5/8	2	.284	1	3/4	3	3.9
40B40	6.65	6.373	40	B-W	5/8	2 5/8	.284	1 1/8	1 3/32	3 1/2	3.9
40B41□	6.81	6.532	41	B-W	5/8	2 5/8	.284	1 1/8	1 3/32	3 1/2	4.0
40B42	6.97	6.691	42	B-W	5/8	2 5/8	.284	1 1/8	1 3/32	3 1/2	4.1
40B43□	7.13	6.850	43	B-W	5/8	2 5/8	.284	1 1/8	1 3/32	3 1/2	4.3
40B44□	7.29	7.009	44	B-W	5/8	2 5/8	.284	1 1/8	1 3/32	3 1/2	4.5
40B45	7.45	7.168	45	B-W	5/8	2 5/8	.284	1 1/8	1 3/32	3 1/2	4.5
40B46□	7.61	7.327	46	B-W	5/8	2 5/8	.284	1 1/8	1 3/32	3 1/2	4.8
40B47□	7.77	7.486	47	B-W	5/8	2 5/8	.284	1 1/8	1 3/32	3 1/2	4.9
40B48	7.93	7.645	48	B-W	5/8	2 5/8	.284	1 1/8	1 3/32	3 1/2	5.1
40B49□	8.09	7.804	49	B-W	5/8	2 5/8	.284	1 1/8	1 3/32	3 1/2	6.0
40B50	8.25	7.963	50	B-W	5/8	2 5/8	.284	1 1/8	1 3/32	3 1/2	6.2
40B51□	8.41	8.122	51	B-W	5/8	2 5/8	.284	1 1/8	1 3/32	3 1/2	6.3
40B52□	8.57	8.281	52	B-W	5/8	2 5/8	.284	1 1/8	1 3/32	3 1/2	6.5
40B53□	8.73	8.440	53	B-W	5/8	2 5/8	.284	1 1/8	1 3/32	3 1/2	6.6
40B54	8.89	8.599	54	B-W	5/8	2 5/8	.284	1 1/8	1 3/32	3 1/2	5.6
40B55□	9.04	8.758	55	B-W	5/8	2 5/8	.284	1 1/8	1 3/32	3 1/2	7.0
40B56□	9.20	8.917	56	B-W	5/8	2 5/8	.284	1 1/8	1 3/32	3 1/2	7.2
40B57□	9.36	9.076	57	B-W	5/8	2 5/8	.284	1 1/8	1 3/32	3 1/2	7.4
40B58□	9.52	9.236	58	B-W	5/8	2 5/8	.284	1 1/8	1 3/32	3 1/2	7.5
40B59□	9.68	9.395	59	B-W	5/8	2 5/8	.284	1 1/8	1 3/32	3 1/2	7.7
40B60	9.84	9.554	60	B-W	5/8	2 5/8	.284	1 1/8	1 3/32	3 1/2	7.7
40B64□	10.48	10.190	64	B-W	5/8	2 5/8	.284	1 1/8	1 3/32	3 1/2	8.7
40B65□	10.64	10.349	65	B-W	5/8	2 5/8	.284	1 1/8	1 3/32	3 1/2	8.9
40B68□	11.12	10.826	68	B-W	5/8	2 5/8	.284	1 1/8	1 3/32	3 1/2	9.6
40B70	11.43	11.145	70	B-W	5/8	2 5/8	.284	1 1/8	1 3/32	3 1/2	9.9
40B72	11.75	11.463	72	B-W	1	3	.284	1 1/4	1	4	10.0
40B76□	12.39	12.099	76	B-W	1	3	.284	1 1/4	1	4	12.5
40B80	13.03	12.736	80	B-W	1	3	.284	1 1/4	1	4	12.5
40B84	13.66	13.372	84	B-W	1	3	.284	1 1/4	1	4	13.0
40B90□	14.60	14.327	90	B-W	1	3	.284	1 1/4	1	4	16.2
40D95□	15.41	15.122	95	B-W	1	3	.284	1 1/4	1	4	17.7
40B96	15.57	15.281	96	B-W	1	3	.284	1 1/4	1	4	17.7
40B102□	16.53	16.236	102	B-W	1	3	.284	1 1/4	1	4	19.9
40B112	18.12	17.828	112	B-W	1	3	.284	1 1/4	1	4	22.8
40B120□	19.39	19.101	120	B-W	1	3	.284	1 1/4	1	4	28.3

*Not carried in stock; available from production.

**Maximum bore shown is with standard keyway and setscrew over keyway. Slightly larger bores are possible with no keyway, shallow keyway or setscrew at angle to keyway.

†H/G is recessed 1/4" wide for chain clearance.

Type "B" Sprockets are made without keyways and setscrews. They are furnished with minimum bore which can be reamed to size, keyseated and setscrewed for a reasonable extra charge.

Bore Range

Table No. 1

Bushing	Bore Range
G	3/8" — 1"
H	3/8 — 1 1/2
P1	5/8 — 1 3/8
Q1	3/4 — 2 1/16

Standard Keyseats

Table No. 2

Bore Range	Keyseat
3/8" — 7/16"	None
1/2 — 9/16	1/8 x 1/16"
5/8 — 7/8	3/16 x 3/32
15/16 — 1 1/4	1/4 x 1/8
1 5/16 — 1 3/8	5/16 x 5/32
1 7/16 — 1 3/4	3/8 x 3/16
1 15/16 — 2 1/4	1/2 x 1/4
2 5/16 — 2 1/16	5/8 x 5/16

1 3/4" Bore Bushings also available with 3/8" x 3/16" Keyseat.

Table No. 3 Steel Single Sprockets with Split Taper Bushings

Part No.	Bushing	DIAMETERS Outside	DIAMETERS Pitch	No. Teeth	Type	DIMENSIONS T	DIMENSIONS C	DIMENSIONS L	DIMENSIONS P	DIMENSIONS C	DIMENSIONS H	Wt. Less Bushing
40P55a	P1	9.01"	8.758"	55	4-W	.284"	2 3/4"	1 1/4"	1 13/32"	—	3"	5.9
40P56	P1	9.20	8.917	56	4-W	.284	2 3/4	1 1/4	1 13/32	—	3	5.9
40P57a	P1	9.36	9.076	57	4-W	.234	2 3/4	1 1/4	1 13/32	—	3	6.2
40P58a	P1	9.52	9.235	58	4-W	.284	2 3/4	1 1/4	1 13/32	—	3	6.4
40P59a	P1	9.68	9.395	59	4-W	.284	2 3/4	1 1/4	1 13/32	—	3	6.6
40P60	P1	9.84	9.554	60	4-W	.284	2 3/4	1 1/4	1 13/32	—	3	6.6
40Q60	Q1	9.84	9.554	60	4-W	.284	2 3/4	2 1/16	2 1/4	—	4 1/8	8.8
40P64a	P1	10.48	10.190	64	4-W	.284	2 3/4	1 1/4	1 13/32	—	3	7.0
40P65a	P1	10.64	10.349	65	4-W	.284	2 3/4	1 1/4	1 13/32	—	3	7.2
40P66a	P1	10.80	10.508	66	4-W	.284	2 3/4	1 1/4	1 13/32	—	3	8.4
40P70	P1	11.43	11.145	70	4-W	.284	2 3/4	1 1/4	1 13/32	—	3	6.6
40Q70	Q1	11.43	11.145	70	4-W	.284	2 3/4	2 1/16	2 1/32	—	4 1/8	11.0
40Q72	Q1	11.75	11.465	72	4-W	.284	2 3/4	2 1/16	2 1/32	—	4 1/8	11.2
40Q76a	Q1	12.39	12.099	76	4-W	.284	2 3/4	2 1/16	2 1/32	—	4 1/8	11.4
40Q80	Q1	13.03	12.736	80	4-W	.284	2 3/4	2 1/16	2 1/32	—	4 1/8	13.1
40Q84	Q1	13.66	13.372	84	4-W	.284	2 3/4	2 1/16	2 1/32	—	4 1/8	14.1
40Q90a	Q1	14.62	14.327	90	4-W	.284	2 3/4	2 1/16	2 1/32	—	4 1/8	15.1
40Q95a	Q1	15.41	15.122	95	4-W	.284	2 3/4	2 1/16	2 1/32	—	4 1/8	15.6
40Q96	Q1	15.57	15.281	96	4-W	.284	2 3/4	2 1/16	2 1/32	—	4 1/8	17.0
40Q102a	Q1	16.53	16.236	102	4-W	.284	2 3/4	2 1/16	2 1/32	—	4 1/8	15.8
40Q112	Q1	18.12	17.828	112	4-W	.284	2 3/4	2 1/16	2 1/32	—	4 1/8	12.9
40Q120a	Q1	19.191	19.39	120	4-W	.284	2 3/4	2 1/16	2 1/32	—	4 1/8	21.2

aNot carried in stock; available from production.

Where two sprockets with the same number of teeth but different bushings are offered, we suggest using the sprocket bushing for heavier service drives.

Table No. 4 Finished Bore Sprockets

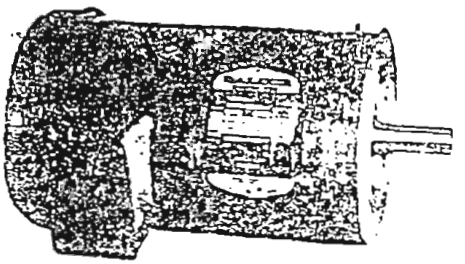
Part No.	Diameters Outside	Diameters Pitch	No. Teeth	Type	Stock Bores Marked "X" 1/2"	5/8"	3/4"	7/8"	1"	1 1/8"	1 1/4"	Dimensions T Nom.	L Max.	P	H	Wt. Lbs.
STOCK Steel Sprockets with HARDENED TEETH																
H4009	1.67"	1.462"	9	1	—	X	—	—	—	—	—	.284"	7/8"	1 3/32"	1 1/8"†	.2
H4010	1.81	1.618	10	1	X	X	X	—	—	—	—	.284	7/8	1 3/32	1 1/8†	.3
H4011	2.00	1.775	11	1	X	X	X	X	—	—	—	.284	7/8	1 3/32	1 1/8†	.4
H4012	2.17	1.932	12	1	X	X	X	X	X	—	—	.284	7/8	1 3/32	1 1/8†	.4
H4013	2.30	2.089	13	1	—	X	X	X	X	—	—	.284	7/8	1 3/32	1 3/4†	.5
H4014	2.49	2.247	14	1	X	X	X	X	X	X	—	.284	7/8	1 3/32	1 7/8†	.6
H4015	2.65	2.405	15	1	—	X	X	X	X	—	X	.284	7/8	1 3/32	2"	.7
H4016	2.80	2.563	16	1	—	X	X	X	X	X	X	.284	7/8	1 3/32	2 1/16	.8
H4017	2.96	2.721	17	1	—	—	X	—	X	—	—	.284	7/8	1 3/32	2 1/16	.9
H4018	3.14	2.879	18	1	—	X	X	—	X	—	—	.284	7/8	1 3/32	2 3/16	1.1
H4019	3.30	3.035	19	1	—	—	X	—	X	—	—	.284	7/8	1 3/32	2 1/32	1.2
H4020	3.45	3.196	20	1	—	X	X	—	X	—	X	.284	1	1 3/32	2 1/32	1.4
H4021	3.62	3.355	21	1	—	—	X	—	X	—	—	.284	1	1 3/32	2 1/32	1.6
H4022	3.75	3.513	22	1	—	—	X	—	X	—	—	.284	1	1 3/32	2 1/32	1.7
H4023	3.94	3.672	23	1-W	—	—	X	—	X	—	—	.284	1	1 3/32	1 3/4	1.6
H4024	4.10	3.831	24	1-W	—	X	—	—	—	—	X	.284	1	1 3/32	2	1.8
H4024	4.10	3.831	24	1-W	—	—	X	—	X	—	—	.284	1	1 3/32	1 3/4	1.7
H4025	4.26	3.989	25	1-W	—	—	X	—	X	—	—	.284	1	1 3/32	1 3/4	1.8
H4026	4.42	4.148	26	1-W	—	—	—	—	X	—	—	.284	1	1 3/32	1 3/4	1.9
H4028	4.74	4.466	28	1-W	—	—	X	—	X	—	—	.284	1	1 3/32	1 3/4	2.1
H4030	5.06	4.783	30	1-W	—	—	—	—	X	—	—	.284	1	1 3/32	1 3/4	2.2
STOCK Steel Sprockets																
4009	1.67"	1.462"	9	1	X	X	—	—	—	—	—	.284"	7/8"	1 3/32"	1 1/8"†	.2
4010	1.84	1.618	10	1	X	X	X	—	—	—	—	.284	7/8	1 3/32	1 1/8†	.3
4011	2.00	1.775	11	1	X	X	X	X	—	—	—	.284	7/8	1 3/32	1 1/8†	.4
4012	2.17	1.932	12	1	X	X	X	X	X	—	—	.284	7/8	1 3/32	1 1/8†	.4
4013	2.30	2.089	13	1	X	X	X	X	X	—	—	.284	7/8	1 3/32	1 3/4†	.5
4014	2.49	2.247	14	1	X	X	X	X	X	X	—	.284	7/8	1 3/32	1 7/8†	.6
4015	2.65	2.405	15	1	—	X	X	X	X	X	X	.284	7/8	1 3/32	2†	.7
4016	2.80	2.563	16	1	—	—	X	X	X	X	X	.284	7/8	1 3/32	2 1/16	.8
4017	2.96	2.721	17	1	—	—	X	X	X	X	—	.284	7/8	1 3/32	2 1/16	.9
4018	3.14	2.879	18	1	—	—	X	X	X	X	X	.284	7/8	1 3/32	2 3/16	1.1
4019	3.30	3.035	19	1	—	—	X	X	X	—	X	.284	7/8	1 3/32	2 1/32	1.2
4020	3.45	3.196	20	1	—	—	X	X	X	X	X	.284	1	1 3/32	2 1/32	1.4
4021	3.62	3.355	21	1	—	—	X	X	X	—	X	.284	1	1 3/32	2 1/32	1.6
4022	3.75	3.513	22	1	—	—	X	X	X	—	X	.284	1	1 3/32	2 1/32	1.7
4023	3.94	3.672	23	1-W	—	—	X	—	X	—	—	.284	1	1 3/32	1 3/4	1.6
4023	3.94	3.672	23	1-W	—	—	—	X	—	—	—	.284	1	1/4	2	1.6
4024	4.10	3.831	24	1-W	—	X	—	—	X	X	—	.284	1	1/4	2	1.8
4024	4.10	3.831	24	1-W	—	—	X	—	—	—	X	.284	1	1/4	1 3/4	1.7
4025	4.26	3.989	25	1-W	—	—	X	X	—	—	—	.284	1	1/4	1 3/4	1.8
4026	4.42	4.148	26	1-W	—	—	—	X	—	—	—	.284	1	1/4	1 3/4	1.9
4028	4.74	4.466	28	1-W	—	—	X	X	—	—	—	.284	1	1/4	1 3/4	2.0
4028	4.74	4.466	28	1-W	—	—	—	X	—	X	—	.284	1	1/4	2 1/2	2.1
4030	5.06	4.783	30	1-W	—	—	X	X	—	—	—	.284	1	1/4	1 3/4	2.1
4030	5.06	4.783	30	1-W	—	—	—	—	X	X	—	.284	1	1/4	2	2.2

All Finished Bore Sprockets are furnished with Standard Keyway and Flat-pan Head Set Screw over Keyway, except 1/2" Bore which has no Keyway.

Stock Sprockets with HARDENED TEETH have an additional Set Screw at 90° to Keyway.

†Hub is recessed 1/16" wide for Chain Clearance.

TAB C



SINGLE & THREE PHASE
TOTALLY ENCLOSED FAN COOLED C FACE

1/6 THRU 5 H.P.
NEMA 56C THRU 215TC

Applications:
Pumps, valves, fans, conveyors, machine tools, gear reducers.

Features:
Pressure cast aluminum end plates ribbed design for rigidity. Cast iron endplates on 182 frame and up. Ball bearings. Heavy gauge steel frame.

			SINGLE PHASE								THREE PHASE							
H.P.	R.P.M. 60 HZ.	NEMA FRAME	CATALOG NO.	LIST PRICE	CATALOG NO.	LIST PRICE	MULT. SYM.	TYPE V or C	APX. SHPG. WGT.	VOLT. CODE	CATALOG NO.	LIST PRICE	CATALOG NO.	LIST PRICE	MULT. SYM.	TYPE V or C	APX SHPG. WGT.	VOLT. CODE
1/6	1725	56C	KL3400	$ 99			K	413L	20	A								
1/6	1140	56C	KL3401**	131			K	429L	25	A								
1/4	1725	56C	KL3403	102			K	416L	23	A	KM3454	$ 106			K	410M	18	E
1/4	1140	56C									VM3531	150			K	513M	20	E
1/3	3450	56C	KL3405	90			K	413L	20	A	KM3457	95			K	410M	18	E
1/3	1725	56C	VL3501	121	CL3501	$ 123	K	424L	27	A	VM3534	121	CM3534	$ 123	K	413M	22	E
1/3	1140	56C									VM3535	159			K	513M	24	E
1/2	3450	56C	VL3503	108	CL3503	110	K	416L	21	A	VM3537	113	CM3537	115	K	410M	19	E
1/2	1725	56C	VL3504**	140	CL3504**	142	K	428L	31	A	VM3538	135	CM3538	137	K	416M	22	E
1/2	1140	56C	VL3505	216			K	529L	40	A	VM3539	174	CM3539	176	K	516M	32	E
3/4	3450	56C	VL3505	124	CL3505	126	K	424L	37	B	VM3541	123	CM3541	125	K	413M	22	E
3/4	3450	56C	VL3506A	128			K	516L	36	E								
3/4	1725	56C	VL3507	166	CL3507	170	K	524L	35	A	VM3542	149	CM3542	151	K	420M	26	E
3/4	1140	56C	VL3508**	237			K	529LCI	43	A	VM3543	174	CM3543	176	K	524M	39	E
3/4	1140	143TC									VM3543T	169			L-1	524M	41	E
1	3450	56C	VL3509	141	CL3509	143	K	524L	40	A	VM3545	138	CM3545	140	K	416M	24	E
1	3450	56C	VL3509A	145			K	524L	40	B								
1	1725	56C	VL3510**	184	CL3510**	186	K	535L	41	A	VM3546	151	CM3546	153	K	516M	33	E
1	1725	143TC	VL3510T**	176			L-1	529L	41	A	VM3546T	146	CM3546T	145	L-1	516M	40	E
1	1725	182C									VM3603	200			L-1	614M	50	E
1	1140	56C									VM3556	192			K	524M	40	E
	1140	145TC									VM3556T	185	CM3556T	185	L-1	524M	39	E
1½	3450	56C	VL3513**	179	CL3513**	181	K	535L	46	A	VM3550	165	CM3550	167	K	516M	33	E
1½	3450	143TC	VL3513T**	172			L-1	529L	44	A	VM3550T	157	CM3550T	157	L-1	516M	34	E
1½	1725	56C	VL3514**	228	CL3514**	230	K	535LC	51	A	VM3554**	166	CM3554**	168	K	520M	35	E
1½	1725	145TC	VL3514T**	219			L-1	535LCI	52	A	VM3554T**	158	CM3554T**	158	L-1	520M	36	E
1½	1725	184C	VL3603d	286			L-1	629L	66	A	VM3605	217			L-1	617M	56	E
1½	1140	56C									VM3557**	209			K	528M	44	F
1½	1140	145TC									VM3557T**	198	CM3557T**	198	L-1	528M	43	F
1½	1140	184C									VM3607	222			L-1	623M	58	F
2	3450	56C	VL3515**	217			K	535L	48	A	VM3555**	191			K	524M	38	E
2	3450	145TC	VL3515T**	207	CL3515T**	207	L-1	535L	53	A	VM3555T**	182	CM3555T**	182	L-1	524M	40	E
2	1725	56C									VM3558**	181			K	528M	41	E
2	1725	145TC									VM3558T**	171	CM3558	171	L-1	528M	45	E
2	1725	182TC	VL3605T**	304			L-1	634L	76	A								
2	1725	184C	VL3605**	304			L-1	634L	76	A	VM3609	229			L-1	620M	56	E
2	1725	213C																
2	1140	184C									VM3614	239			L-1	628M	78	F
2	1140	184TC									VM3614T	238	CM3614T	235	L-1	623M	70	F
3	3450	56C									VM3559**	214			K	535M	59	E
3	3450	145TC									VM3559T**	202	CM3559T**	202	L-1	535M	51	E
3	3450	182TC	VL3605T**	392			L-1	634L	80	A	VM3615T	223	CM3615T	223	L-1	620M	60	E
3	3450	184C	VL3605**d	392			L-1	634L	77	A	VM3610	223			L-1	620M	67	E
3	1725	182TC									VM3611T**	229	CM3611T**	229	L-1	623M	66	E
3	1725	184C									VM3611**	229			L-1	623M	63	E
3	1725	184TC	VL3609T	404			L-1	646LC	100	A								
3	1725	213C									VM3703	299			L-1	717M	90	E
3	1140	213TC									VM3704T	301	CM3704T	301	L-1	726M	112	F
3	1140	215C									VM3704	301			L-1	726M	112	F
5	3450	184C									VM3613**◇	285			L-1	634M	69	E
5	3450	184TC									VM3613T**◇	285	CM3613T	285	L-1	634M	73	E
5	3450	213C									VM3709d	328			L-1	717M	99	E
5	1725	184C									VM3615T◇	256			L-1	634M	75	E
5	1725	184TC									VM3615T1◇	255	CM3615T1◇	255	L-1	634M	79	E
5	1725	215C									VM3707	321			L-1	726M	105	E
5	1140	215TC									VM3707T**◇	322	CM3707T	322	L-1	726M	148	F

Voltage Codes:
A 115/208-230 E 200-208/460

NOTE: STYLE R IS NEMA C FACE LESS BASE, NO DRIP COVER
STYLE V IS NEMA C FACE LESS BASE, NO DRIP COVER

THREE PHASE — PERFORMANCE DATA

Totally-Enclosed, Fan-Cooled • NEMA 48 thru 445T

1/6 Thru 200 H.P.

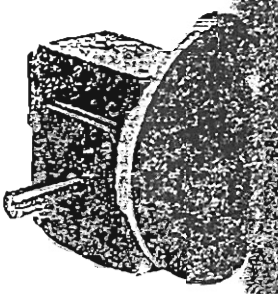
H.P.	Full Load R.P.M.	NEMA Frame	Catalog Number	Type	Winding Number	Amperes-460• Idle	Amperes-460• Full Load	Amperes-460• Locked	Torque—Pound Feet Full Load	Torque—Pound Feet Brk. Dwn.	Torque—Pound Feet Locked	% Effy Full Load	% Power Factor Full Load	Conn't. Diagram Number
1/12	850	42	M3351	310M	33-424	.6	.6	1.2	.25	1.3	1.2	54	62	10275
1/8	1140	42	M3352	310M	33-930	-	-	-	-	-	-	55	70	10275
1/8	1725	42	M3353	313M	33-515	.6	.6	1.6	.38	1.8	1.8	44	42	CD0005
1/8	3450	42	M3354	313M	33-674	.3	.4	2.1	.25	1.0	1.0	58	75	10275
1/8	1725	42	M3355	316M	33-423	-	-	-	-	-	-	54	-	10285
1/4	1155	48	M3452	413M	34-315	.5	.6	2.4	.75	2.7	2.3	58	50	10275
1/4	3450	42	M3358	-	-	-	-	-	-	-	-	-	-	10275
1/4	1730	48	M3454	410M	34-895	.5	.65	2.9	.75	3.4	2.6	63	56	10275
1/4	1150	48	M3455	416M	34-241	.6	.7	3	1.125	5	4	60	48	10275
1/4	1150	56	M3531	513M	35-88	.55	.7	3.3	1.13	4.75	3.5	65	52	10275
1/4	860	56	M3532	516M	35-91	.75	.8	3	1.5	5.3	3.9	57	51	10275
1/3	3475	48	M3457	410M	34-157	.55	.7	3.5	.5	3	2.9	63	70	10275
1/3	1730	48	M3458	413M	34-884	.5	.7	3.8	1	4.7	3.7	67	57	10275
1/3	1730	56	M3534	413M	34-884	.5	.7	3.8	1	4.7	3.7	67	57	10275
1/3	1140	48	M3459	420M	34-186	.9	1	3.6	1.5	4.7	4.5	65	47	10275
1/3	1140	56	M3535	513M	35-89	.7	.8	3.9	1.5	5.5	4.25	67	57	10275
1/3	865	56	M3536	520M	35-92	1	1.2	4	2	8	6.8	60	49	10275
1/2	3440	48	M3460	410M	34-232	.9	1.0	6	.75	3.4	3.0	67	63	10275
1/2	3440	56	M3537	410M	34-232	.9	1.1	6	.75	3.4	3.0	67	63	10275
1/2	1730	48	M3461	416M	34-872	.8	1.0	5.5	1.5	7	5.3	74	63	10275
1/2	1730	56	M3538	416M	34-872	.8	1.0	5.5	1.5	7	5.3	74	63	10275
1/2	1140	48	M3462	428M	34-286	1.1	1.4	5.5	2.25	7.3	6.6	68	51	10275
1/2	1150	56	M3539	516M	35-90	1.1	1.2	6	2.25	9.2	7.4	71	58	10275
1/2	865	56	M3560	528M	35-5351	1.5	1.7	6	3	11	10	65	40	10275
1/2	855	182	M3600	614M	36-111	1.2	1.3	4.9	3	9.2	5.9	69	57	10275
3/4	3450	48	M3463	413M	34-255	.8	1.3	8	1.125	4.8	3.9	75	80	10275
3/4	3485	56	M3541	413M	34-255	.9	1.3	7.6	1.13	4.5	4.0	75	73	10275
3/4	1730	48	M3464	420M	34-893	1.2	1.5	8.5	2.25	10	6.8	74	60	10275
3/4	1725	56	M3542	420M	34-883	1.2	1.5	10.5	2.25	9.75	9.5	74	60	10275
3/4	1130	56	M3549	524M	35-736	1.2	1.4	8.4	3.38	13.4	9.8	72	70	10275
3/4	1130	143T	M3543T	524M	35-736	1.2	1.4	8.4	3.38	13.4	9.8	72	70	10275
3/4	1150	182	M3601	614M	36-108	1.2	1.5	7.5	3.38	12	8.3	75	63	10275
3/4	860	184	M3602	620M	36-112	1.5	1.8	6.75	4.5	12.3	8.9	72	59	10275
1	3435	56	M3545	416M	34-282	1.1	1.5	1.0	1.5	6.5	5.5	75	76	10275
1	1735	56	M3546	428M	34-3254	1.3	1.8	13.5	3	13.7	11.5	75	64	10275
1	1735	143T	M3546T	428M	34-3253	1.3	1.8	13.5	3	13.7	11.5	75	64	10275
1	1730	182	M3603	614M	36-101	1.0	1.6	10.5	3	11	8.6	76	74	10275
1	1150	56	M3556	524M	35-1272	1.4	1.9	8	4.5	12	10.2	77	69	10275
1	1150	145T	M3556T	524M	35-1272	1.4	1.9	8	4.5	12	10.2	77	69	10275
1	1150	184	M3604	617M	36-109	1.4	1.9	10.5	4.5	15.2	12.2	81	65	10275
1	850	182T	M3617T**	623M	36-1162	1.6	2.1	9	6	13	12	66	65	10275
1	860	213	M3700	717M	37-81	1.8	2.3	9.5	6	16.4	11	70	59	10275
1½	3440	56	M3550	516M	35-82	1.4	2.3	16	2.25	9	8	74	80	10275
1½	3440	143T	M3550T	516M	35-82	1.4	2.3	16	2.25	9	8	74	80	10275
1½	3460	182	M3605	614M	36-103	1.0	2.3	16.5	2.25	8.5	7.2	72	87	10275
1½	1735	56	M3554	520M	35W206	1.7	2.4	17	4.5	18	14.4	78	67	10275
1½	1735	145T	M3554T	520M	35W206	1.7	2.4	17	4.5	18	14.4	78	67	10275
1½	1720	184	M3606	617M	36-93	1.2	2.4	14.5	4.5	15	12.2	84	77	10275
1½	1125	56	M3557**	528M	35-1273	1.8	2.5	10.6	6.75	18.6	17.6	78	66	10275
1½	1125	145T	M3557T**	528M	35-1273	1.8	2.5	10.6	6.75	18.6	17.6	78	66	10275
1½	1145	182T	M3607T	623M	36-110	1.8	2.4	14.25	6.75	21.2	16.2	84	73	10275
1½	1145	184	M3607	623M	36-110	1.9	2.4	14.25	6.75	21.2	16.2	84	73	10275
1½	850	184T	M3618T†	628M	36-3066	2.5	3.3	13	9	25	19	74	65	10275
1½	840	213	M3701	720M	37-82	2.65	3.4	14.3	9	26	17.8	71	62	10275
2	3440	56	M3555**	524M	35-672	1.1	2.7	17.5	3	8.6	5.2	76	89	10275
2	3440	145T	M3555T**	524M	35-672	1.1	2.7	17.5	3	8.6	8.2	76	89	10275
2	3440	184	M3608	617M	36-104	1.0	2.7	18.5	3	11.2	9.1	75	90	10275
2	1730	56	M3560**	528M	35-872	1.8	3.05	21	6	23	19.4	80	74	10275
2	1730	145T	M3560T**	528M	35-872	1.8	3.05	21	6	23	19.4	80	74	10275
2	1730	184	M3609	620M	36-94	1.5	3	20	6	22	15.8	85	80	10275
2	1140	184T	M3614T	625M	36-197	1.9	3.1	19	9	26.6	23.8	84	68	10275
2	1140	213	M3712	717M	37-79	2.2	3.4	17.5	9	28	22	78	70	10275
2	850	213T	M3702T	726M	37-83	3.0	4	18.5	12	35.4	22.6	75	66	10275
2	850	215	M3702	726M	37-83	3.0	4	18.5	12	35.4	22.6	75	66	10275

• For Low Voltage Ampere Value, Double the High Voltage Value.
** Class B Continuous Duty.
† Class F Continuous Duty.

SERIES 130 WORM GEAR REDUCE
MODEL 134

- "C" flange reducer — C-flange design permits motor shaft to be plugged directly into quill-type input shaft permitting installation in the smallest possible space.
- Input quill is Parco-Lubrited and coated with Molybdenum Disulfide lubricant to provide protection against fretting corrosion.
- Taper roller bearings on low speed shaft. Double row ball bearings on high speed shaft.
- Hub City Adjustable Base Kit featuring elongated slots for mounting bolts and adjusting screws for ease of positioning. (Refer to page 24.)

  Universal Base Kits to interchange with Boston, Browning, Perfection, Ohio, Morse, and Winsmith. (Refer to page 25.)
- Side Mounting Kits for side wall and ceiling mounting. (Refer to page 26.)
- Hub City Lubricant recommended. (Refer to page 326.)



1.33" CENTER DISTANCE

RATING TABLE

RATIO	Output R.P.M.	MECHANICAL RATING SERVICE FACTOR 1.00 Input H.P.	1.00 Output Torque	1.25 Input H.P.	1.25 Output Torque	1.50 Input H.P.	1.50 Output Torque	1.75 Input H.P.	1.75 Output Torque	Efficiency %	THERMAL RATING DESIGN OPTION Basic Unit Input H.P.	Basic Unit Output Torque	With Synthetic Lu... Input H.P.	
1750 RPM INPUT SPEED (HIGH SPEED SHAFT)														
5	350.0	1.10	181	.880	145	.751	124	.629	103	91.4	1.01	166		
10	175.0	.751	235	.577	181	.501	157	.412	129	87.0	.629	197		
15	116.6	.562	251	.450	201	.375	167	.334	149	82.7	.471	210	THERMAL	
20	87.5	.460	267	.368	214	.307	178	.263	153	80.6	.420	244	RATING	
30	58.3	.337	259	.270	207	.225	173	.193	145	71.1	.292	224	EQUALS	
40	43.8	.268	263	.214	210	.179	175	.153	150	68.1	.263	258	MECHANI	
50	35.0	.224	250	.179	200	.149	167	.128	142	62.0	.224	250	RATING	
60	29.2	.183	224	.146	179	.122	149	.105	128	56.7	.183	224		
1150 RPM INPUT SPEED (HIGH SPEED SHAFT)														
5	230.0	.845	212	.676	170	.563	141	.507	127	91.6				
10	115.0	.553	261	.442	209	.369	174	.334	157	86.1				
15	76.8	.430	288	.344	230	.287	192	.250	168	81.5				
20	57.5	.349	303	.279	242	.233	202	.199	173	79.2			THERMAL RATING EQUAL	
30	38.3	.260	297	.208	236	.173	198	.149	170	69.5			MECHANICAL RATING	
40	28.8	.207	298	.167	239	.138	199	.118	170	65.7				
50	23.0	.174	284	.139	227	.116	189	.099	162	59.6				
60	19.1	.140	253	.112	202	.093	169	.080	145	55.0				
850 RPM INPUT SPEED (HIGH SPEED SHAFT)														
5	170.0	.677	228	.542	182	.451	152	.381	130	90.8				
10	85.0	.440	279	.352	223	.293	186	.251	159	85.5				
15	56.6	.344	307	.275	246	.229	205	.197	175	80.2				
20	42.5	.290	322	.224	258	.187	215	.167	192	77.6			THERMAL RATING EQUAL	
30	28.3	.210	318	.168	253	.140	211	.120	181	67.7			MECHANICAL RATING	
40	21.2	.167	316	.134	253	.111	211	.095	181	63.8				
50	17.0	.142	303	.114	242	.095	202	.081	173	57.6				
60	14.1	.108	253	.086	202	.072	169	.062	145	52.7				
690 RPM INPUT SPEED (HIGH SPEED SHAFT)														
5	138.0	.575	237	.460	190	.383	158	.334	138	90.3				
10	69.0	.376	285	.301	231	.251	193	.215	165	84.2				
15	46.0	.294	318	.235	254	.196	212	.168	182	79.0				
20	34.5	.251	348	.192	266	.167	232	.137	190	76.0			THERMAL RATING EQUALS	
30	23.0	.183	328	.146	262	.122	219	.105	187	69.4			MECHANICAL RATING.	
40	17.2	.146	327	.117	262	.097	218	.083	187	61.3				
50	13.8	.124	312	.099	250	.083	208	.071	178	55.1				
60	11.5	.092	253	.074	202	.061	169	.053	145	50.2				
100 RPM INPUT SPEED (HIGH SPEED SHAFT)														
5	20.0	.109	273	.087	218	.073	182	.062	156	79.5				
10	10.0	.075	328	.060	262	.050	219	.043	187	69.4				
15	6.6	.062	359	.050	287	.041	239	.035	205	61.2				
20	5.0	.051	372	.041	298	.034	248	.029	213	57.9			THERMAL RATING EQUALS	
30	3.3	.043	370	.034	296	.029	247	.025	211	45.5			MECHANICAL RATING.	
40	2.5	.036	365	.029	292	.024	243	.021	209	40.2				
50	2.0	.029	312	.023	250	.019	208	.017	178	34.1				
60	1.6	.022	253	.018	202	.015	169	.013	145	30.4				

OVERHUNG LOAD-LOW SPEED SHAFT — 225 LBS AT CENTER POINT OF SHAFT EXTENSION

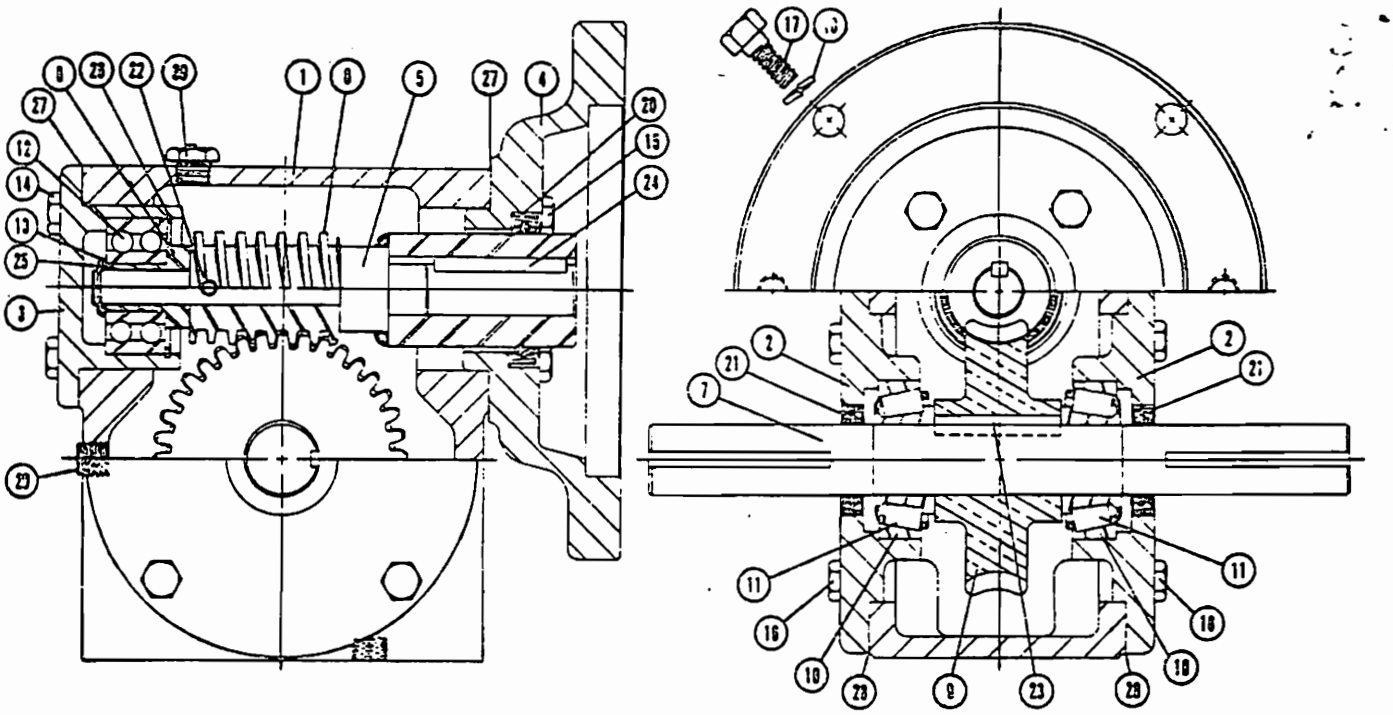
Hub City

WORM GEAR SPEED REDUCER

PARTS LIST

SERIES 130
MODEL 134

NEMA "C" FLANGE
SOLID OUTPUT SHAFT



REF. NO.	PART NUMBER	DESCRIPTION	NO. REQ.
1	02-23-01701-130	Housing	1
2		Cap, Output	2
	02-23-01697-130	Open (Style A requires 2) (Style B or C requires 1)	
	02-23-02230-130	Closed (Style B or C requires 1)	
3	02-23-02509-180	Cap, Closed Input	1
4	02-23-02508-180	Flange, Motor (56C)	1
5	02-23-02522-130	Shaft, Input (⅜" Diameter Quill)	1
6	02-23-02510-180	Bushing, Input Bearing	1
7		Shaft, Output	1
	02-23-01695-130	Style A (Double Extension)	
	02-23-02019-130	Style B or C (Single Extension)	

CAUTION — Hub City recommends that both the worm and worm gear be replaced to obtain maximum life from the repaired unit. Replacement of only one member will result in an unsatisfactory life.

REF. NO.	PART NUMBER	DESCRIPTION	NO. REQ.
8		Worm	1
	02-23-01672-130	5:1 Ratio	
	02-23-01674-130	10:1 Ratio	
	02-23-01676-130	15:1 Ratio	
	02-23-01678-130	20:1 Ratio	
	02-23-01682-130	30:1 Ratio	
8		Worm (Continued)	
	02-23-01684-130	40:1 Ratio	
	02-23-01686-130	50:1 Ratio	
	02-23-01688-130	60:1 Ratio	
9		Gear, Worm	1
	02-23-02984-130	5:1 Ratio	
	02-23-02985-130	10:1 Ratio	
	02-23-02986-130	15:1 Ratio	
	02-23-02987-130	20:1 Ratio	
	02-23-02989-130	30:1 Ratio	
	02-23-02990-130	40:1 Ratio	
	02-23-02991-130	50:1 Ratio	
	02-23-02992-130	60:1 Ratio	
10	8-32-20-58-028	Cup, Bearing (Timken 05185)	2
11	8-32-20-68-028	Cone, Bearing (Timken 05062)	2
12	8-32-11-25-009	Bearing, Ball (5202K)	1
13	02-23-02959-180	Washer	1
14	8-47-14-04-078	Screw, Hex Cap (¼ NC x ⅜)	4
15	8-47-14-04-022	Screw, Hex Cap (¼ NC x ¾)	4
16	8-47-14-04-015	Screw, Hex Cap (¼ NC x ½)	8
17	8-47-14-04-033	Screw, Hex Cap (⅜ NC x 1)	4
18	8-47-16-11-003	Washer, Locking (⅜" Diameter)	4
19	02-23-02687-130	KIT, REPAIR (INCLUDES ITEMS 20-30) THESE ITEMS ARE AVAILABLE IN REPAIR KIT ONLY	
20	8-74-21-25-018	Seal, Input Shaft (C/R 9838)	1
21	8-74-21-25-012	Seal, Output Shaft (C/R 6204) (Style A requires 2) (Style B or C requires 1)	
22	8-47-17-16-004	Pin, Spring (⅜ x ⅝)	1
23	8-47-17-05-022	Key, P G W (⅜ sq. x 1)	1
24	8-47-17-05-030	Key, P G W (⅜ sq. x 1⅜)	1
25		Ring, Retaining (Truarc 5160-42)	1
26	8-47-17-86-008	Ring, Retaining (Truarc N5000-137)	1
27	02-23-01539-180	Gasket, Input Cap	10
28	02-23-01698-130	Gasket, Output Cap	10
29	8-68-12-61-024	Plug, Pipe, Socket (⅛ NPT)	4
30	8-62-12-71-001	Plug, Vented (⅛ NPT)	1

PARTS ORDERING INFORMATION

When ordering replacement or spare parts, check metal tag on the gear case of your unit and furnish ALL of the following information:

GENERAL

- ssembly Number
- Model Number
3. Ratio
4. Style
5. Shipping Code

SPECIFIC

6. Part Number
7. Complete Description
8. Quantity Desired
9. Your Name, Address, Zip Code, and Phone Number

PHONE OR WRITE

Your nearest Hub City Sales Office or Industrial Power Transmission Distributor listed in the Yellow Pages, or the Factory Sales Office.

NOTE — When more than one part number is listed after a reference number, examine each description carefully to determine which parts fit your need. Parts will be shipped "best way" unless specified.

TAB D

Standard Duty Ball Bearing Units
Series 3-200, 200

Pillow Blocks, Cast Iron

P3-U200H, P200, PL3-U200H, PH3-U200H, PL3-Y200N, P3-Y200N

Alignable pillow blocks for shaft sizes ½" through 4" *(17-100 mm)*. Open or closed end, and standard, high or low backing dimension. Available with type H, type N, type E3, or felt contact housing seals for grease lubrication.

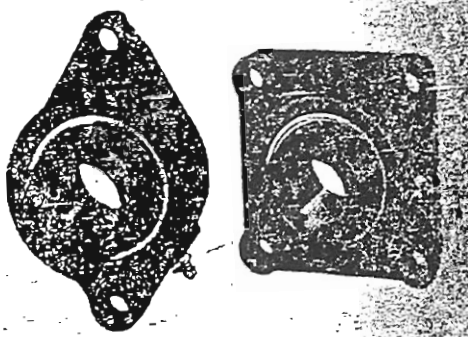
Load ratings on pages I-7 and I-8.
Dimensions on pages I-9 through I-14.
Additional information on page I-36.

Flanged Units, 2 and 4-bolt

FX3-U200H, FX3-Y200N, F3-U200H, F200, F3-Y200N

Alignable 2-bolt units for shaft sizes ½" through 2³⁄₁₆" *(17-55 mm)*; 4-bolt units for shaft sizes ½" through 3½" *(17-85 mm)*. Open or closed end, drilled bolt holes, and machined mounting surfaces. Furnished with eccentric cam or spring collar. Available with type H, type N or type E3, or housing seals for grease lubrication.

Load ratings on pages I-7 and I-8.
Dimensions on pages I-15 through I-19.
Additional information on page I-36.



Flanged Cartridge Units

FC3-Y200N, FC3-U200H, FC200

Alignable units for shaft sizes ⅞" through 4" *(25-100 mm)*. Open or closed end, drilled bolt holes, and machined mounting surfaces. Available with type H, type N, type E3 or felt contact housing seals for grease lubrication.

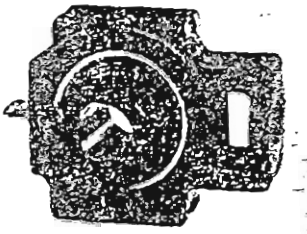
Load ratings on pages I-7 and I-8.
Dimensions on pages I-20 through I-22.
Additional information on page I-36.

Takeup Units

T3-U200N, TH3-Y200N

Alignable units for takeup applications with shaft sizes ½" through 2³⁄₁₆" *(17-55 mm)* with narrow or wide slots. Open or closed end and without frames, guides, or adjusting screws. Furnished with type N seals for grease lubrication.

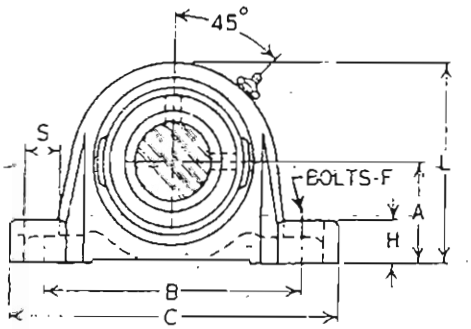
Load ratings on pages I-7 and I-8.
Dimensions on pages I-23 and I-24.
Additional information on page I-36.

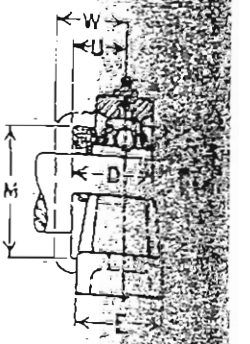


Standard Duty Ball Bearing Pillow Blocks

P3-U200N

Cast Iron Housing
Standard Backing Height
Alignable
Spring Locking Collar
Relubricatable
Wide Inner Ring





Dimensions (inches/*mm*)

Shaft diameter		Pillow block number◘	A †	B	C	D	E	F Bolts	H	L	M	S	U	
mm	in.	Lip seals												
	½	P3-U2B08N												
	⅝	P3-U210N	1 3/16	3½	4⅝	1 7/32	1½	⅜	½	2 11/32	1 5/16	¾	41/64	1
	11/16	P3-U211N												
17		*P3-U2M17N*	*30.16*	*88.9*	*117.5*	*27.78*	*38.1*	*10*	*12.7*	*59.5*	*33.3*	*19.0*	*16.3*	*30.0*
	¾	P3-U212N	1 5/16	3⅞	5⅛	1 9/32	1½	⅜	½	2 19/32	1½	11/16	¾	1
20		*P3-U2M20N*	*33.34*	*98.4*	*130.2*	*32.54*	*38.1*	*10*	*12.7*	*65.9*	*38.1*	*17.5*	*19.0*	*33.3*
	⅞	P3-U214NΔ												
	15/16	P3-U215NΔ	1 7/16	4	5 3/16	1 29/64	1⅝	⅜	9/16	2⅞	1¾	11/16	51/64	1
	1	P3-U216NΔ												
25		*P3-U2M25NΔ*	*36.51*	*101.6*	*135.5*	*34.53*	*41.3*	*10*	*14.3*	*73.0*	*44.4*	*17.5*	*20.2*	*33.3*
	1 1/16	P3-U217N												
	1⅛	P3-U218N	1 11/16	4⅝	6 9/16	1 13/16	1¾	½	11/16	3 5/16	2 3/32	15/16	61/64	1
	1 3/16	P3-U219N												
	1¼	P3-U220N												
30		*P3-U2M30N*	*42.86*	*117.5*	*160.3*	*39.69*	*44.4*	*12*	*17.5*	*84.1*	*53.2*	*23.8*	*24.2*	*38.1*
	1¼	P3-U220NΔ												
	1 5/16	P3-U221NΔ	1 7/8	4 15/16	6⅞	1 49/64	1⅞	½	13/16	3 11/16	2 7/16	13/16	1 7/64	1 1/16
	1⅜	P3-U222NΔ												
	1 7/16	P3-U223NΔ												
35		*P3-U2M35NΔ*	*47.62*	*125.4*	*161.9*	*44.85*	*47.6*	*12*	*20.6*	*93.7*	*61.9*	*20.6*	*28.2*	*42.9*
	1½	P3-U224NΔ	2	5 3/8	7 1/16	1 29/32	1⅞	½	13/16	4	2 11/16	15/16	1 11/64	1 5/8
40		*P3-U2M40NΔ*	*50.80*	*136.5*	*179.4*	*48.42*	*47.6*	*12*	*20.6*	*101.6*	*68.3*	*23.8*	*29.8*	*41.7*
	1⅝	P3-U226NΔ												
	1 11/16	P3-U227NΔ	2 1/8	5⅜	7¼	2 1/32	2	½	13/16	4 5/16	2⅞	⅞	1 15/64	1 5/8
	1¾	P3-U228NΔ												
45		*P3-U2M45NΔ*	*53.98*	*142.9*	*184.2*	*51.59*	*50.8*	*12*	*20.6*	*109.5*	*73.0*	*22.2*	*31.4*	*42.1*
	1⅞	P3-U230NΔ												
	1 15/16	P3-U231NΔ	2 1/4	6 1/8	7⅞	2 5/32	2⅛	½	⅞	4½	3⅛	1	1 7/64	1 5/8
	2	P3-U232NΔ												
50		*P3-U2M50NΔ*	*57.15*	*155.6*	*200.0*	*53.18*	*54.0*	*12*	*22.2*	*114.3*	*79.4*	*22.2*	*32.1*	*46.4*
	2	P3-U234NΔ												
	2 1/16	P3-U235NΔ	2 7/16	6 3/4	9 1/16	2 7/16	2 3/8	⅝	1 1/16	5	3 5/8	1 1/16	1 3/8	2 1/8
55		*P3-U2M55NΔ*	*63.50*	*171.4*	*230.2*	*57.15*	*60.3*	*16*	*25.4*	*127.0*	*83.9*	*33.3*	*35.7*	*54.0*
	2¼	P3-U236N												
	2⅜	P3-U238N	2 11/16	7½	9½	2½	2½	⅝	1⅛	5⅜	3 25/32	1 1/16	1 3/16	2 1/8
	2 7/16	P3-U239N												
60		*P3-U2M60N*	*68.26*	*190.5*	*241.3*	*63.50*	*63.5*	*16*	*28.6*	*136.5*	*96.0*	*27.0*	*39.7*	*53.6*

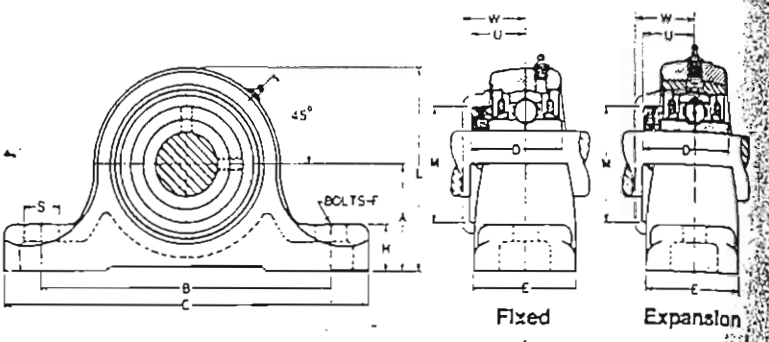
Bold face items are normally available from stock; please consult for availability of non-stock items.
Lubrication fitting tap size: for 1¼" *(17 mm)* and smaller shafts, ¼"-28 UNF; for all other shafts, ⅛" PT.
◘ N lip seals standard. H labyrinth seals available.
† Tolerance, +.000" −.010" *(+0.00 mm −0.25 mm)*.
Δ Available with E3 triple lip seals.
◇ Width dimension for closed end unit.

Selection guide, pages I-5, I-6.
Load ratings, pages I-7, I-8.
Additional information, page I-36.

Heavy Duty Ball Bearing Pillow Blocks

P 300, PE 300

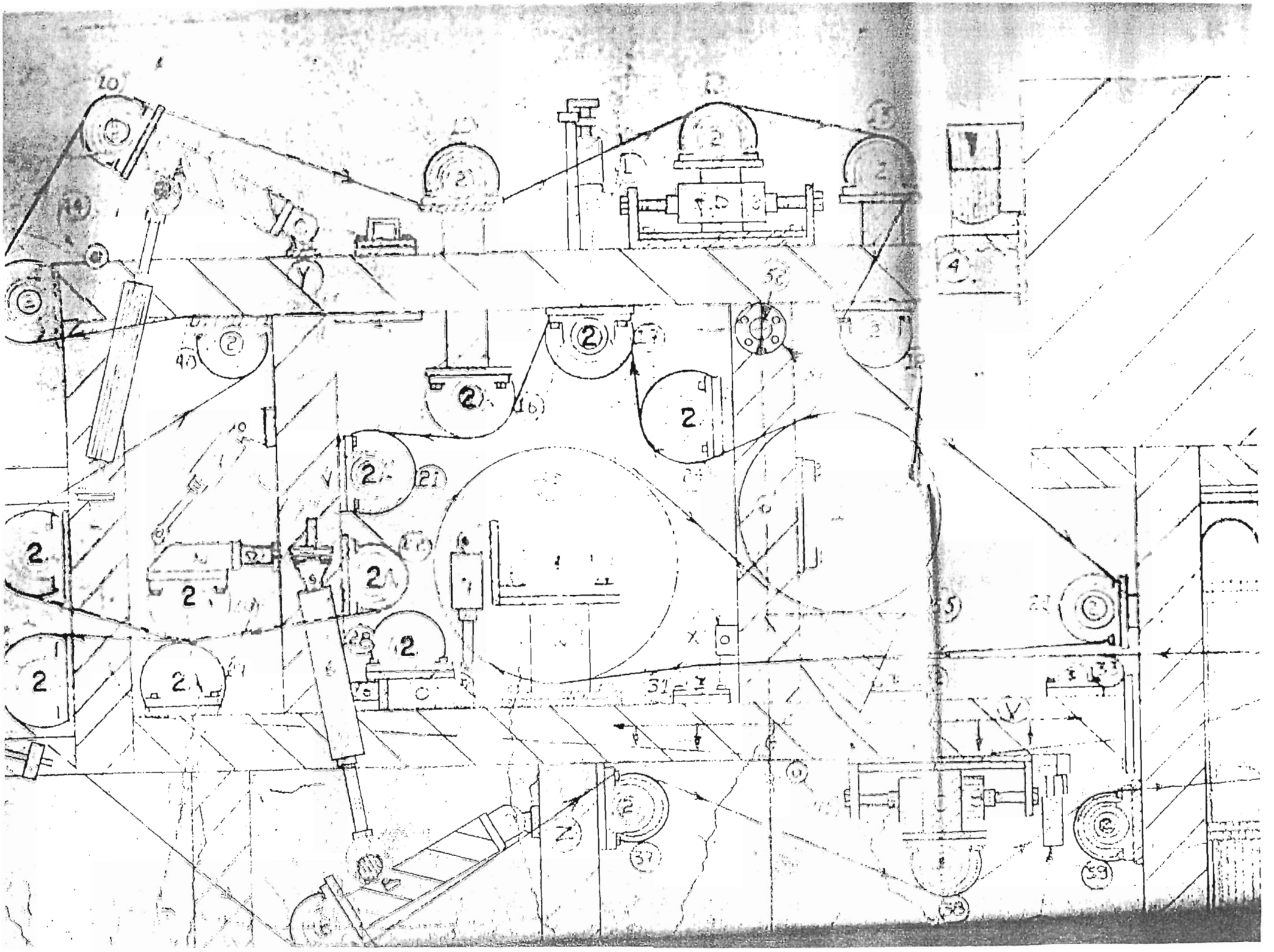
Cast Iron Housing
Standard Backing Height
Fixed or Expansion
Alignable
Spring Locking Collar
Relubricatable



Dimension (inches/*mm*)

Shaft diameter	Pillow block number		A	B	C	D	E	F	H	L		M	S	U	W	Total axial expansion
Inches	Fixed	Expansion	+.000" −.010" +0.00 −0.25 mm					Bolts		Fixed	Expansion				◆	
¾	P 312	PE 312	1⅝ *41.28*	5 *127.0*	6½ *165.1*	1¹⁵⁄₃₂ *37.31*	1¾ *44.4*	½ *12*	¹³⁄₁₆ *20.6*	3¹⁄₁₆ *77.8*	3³⁄₁₆ *81.0*	1⅝ *41.3*	⅞ *22.2*	²⁷⁄₃₂ *21.4*	1⁷⁄₆₄ *26.6*	⅛ *3.2*
⅞ ¹Ⅾ₁₆ 1	P 314 P 315 P 316	PE 314 PE 315 PE 316	1⅞ *47.62*	5½ *139.7*	7 *177.8*	1⁴³⁄₆₄ *42.46*	2 *50.8*	½ *12*	⅞ *22.2*	3⁹⁄₁₆ *90.5*	3²³⁄₃₂ *94.4*	2 *50.8*	⅞ *22.2*	⁶³⁄₆₄ *25.0*	1¹⅝₆₄ *31.4*	⅛ *3.2*
1⅛ 1³⁄₁₆	P 318 P 319	PE 318 PE 319	2⅛ *53.98*	6⁷⁄₁₆ *163.5*	8¼ *209.6*	1⁵⁹⁄₆₄ *48.82*	2¼ *57.2*	½ *12*	¹Ⅾ₁₆ *23.8*	4¹⁄₁₆ *103.2*	4¼ *108.0*	2⅝₁₆ *58.7*	1¹⁄₁₆ *27.0*	1⁹⁄₆₄ *29.0*	1¹³⁄₃₂ *35.7*	⅛ *3.2*
1¼ 1Ⅾ₁₆ 1⅜ 1⁷⁄₁₆	P 320 P 321 P 322 P 323	PE 320 PE 321 PE 322 PE 323	2⅜ *60.32*	7⅜ *187.3*	9¼ *235.0*	2³⁄₃₂ *53.18*	2½ *63.5*	⅝ *16*	1 *25.4*	4½ *114.3*	4²³⁄₃₂ *119.8*	2⁹⁄₁₆ *65.1*	1⅛ *28.6*	1¼ *31.8*	1½ *38.1*	³⁄₁₆ *4.8*
1½	P 324	PE 324	2⅝ *66.68*	8 *203.2*	10⅛ *257.2*	2⁵⁄₁₆ *58.74*	2¹³⁄₁₆ *71.4*	⅝ *16*	1¼ *31.8*	5¹⁄₁₆ *128.6*	5²⁄₃₂ *132.6*	3¹⁄₁₆ *77.8*	1¼ *31.8*	1²⁵⁄₆₄ *35.3*	1³⁹⁄₆₄ *40.9*	³⁄₁₆ *4.8*
1⅝ 1¹¹⁄₁₆ 1¾	P 326 P 327 P 328	PE 326 PE 327 PE 328	2⅞ *73.02*	8¼ *209.6*	10¼ *260.4*	2¹⁹⁄₃₂ *65.88*	3 *76.2*	⅝ *16*	1Ⅾ₁₆ *33.3*	5½ *139.7*	5¹¹⁄₁₆ *144.5*	3¼ *82.6*	1⅛ *28.6*	1³⁵⁄₆₄ *39.3*	1²⁷⁄₃₂ *46.8*	³⁄₁₆ *4.8*
1¹Ⅾ₁₆	P 331	PE 331	3⅛ *79.38*	8⅞ *225.4*	11⅛ *282.6*	2¹³⁄₁₆ *71.44*	3⅛ *79.4*	⅝ *16*	1⅜ *34.9*	6 *152.4*	6³⁄₁₆ *157.2*	3⁷⁄₁₆ *87.3*	1⅛ *28.6*	1⁴³⁄₆₄ *42.5*	1³¹⁄₃₂ *50.0*	³⁄₁₆ *4.8*
2 2⅛ 2³⁄₁₆	P 332 P 334 P 335	PE 332 PE 334 PE 335	3½ *88.90*	10¼ *260.4*	12⅝ *320.7*	3¹⁄₁₆ *77.79*	3⅜ *85.7*	¾ *20*	1½ *38.1*	6⅝ *168.3*	6¹³⁄₁₆ *173.0*	3¹⁵⁄₁₆ *100.0*	1¼ *31.8*	1²⁷⁄₃₂ *46.8*	2³⁄₁₆ *55.6*	³⁄₁₆ *4.8*
2¼ 2⁷⁄₁₆	P 336 P 339	PE 336 PE 339	3⅝ *92.08*	11¼ *285.8*	13¾ *349.2*	3⁹⁄₁₆ *84.14*	3¾ *95.2*	¾ *20*	1⅜ *41.3*	7 *177.8*	7³⁄₁₆ *182.6*	4³⁄₁₆ *106.4*	1⅜ *34.9*	1¹⁵⁄₁₆ *49.2*	2⁷⁄₁₆ *61.9*	³⁄₁₆ *4.8*
2¹¹⁄₁₆ 2¾	P 343 P 344	PE 343 PE 344	4 *101.60*	11¹³⁄₁₆ *300.0*	14⅝ *371.5*	3¹³⁄₁₆ *96.84*	4¼ *108.0*	⅞ *24*	1⅝ *41.3*	7⅞ *200.0*	8¹⁄₃₂ *204.0*	4¾ *120.6*	1⁹⁄₁₆ *39.7*	2¼ *57.2*	2⅝ *66.7*	¼ *6.4*
2¹Ⅾ₁₆	P 347	PE 347	4¼ *107.95*	12 *304.8*	15⅛ *384.2*	4³⁄₃₂ *103.98*	4½ *114.3*	⅞ *24*	1¾ *44.4*	8⅜ *212.7*	8¹⁷⁄₃₂ *216.7*	4¹Ⅾ₁₆ *125.4*	1⅝ *41.3*	2⅜ *60.3*	2¾ *69.8*	¼ *6.4*
3 3³⁄₁₆	P 348 P 351	PE 348 PE 351	4⁹⁄₁₆ *115.89*	12¼ *311.2*	15⅜ *390.5*	4¹³⁄₃₂ *111.92*	4⅝ *117.5*	⅞ *24*	1¹Ⅾ₁₆ *49.2*	8⅞ *225.4*	9⁷⁄₃₂ *234.2*	5¹¹⁄₁₆ *144.5*	1⅝ *41.3*	2¹⁹⁄₃₂ *65.9*	3 *76.2*	⅜ *9.5*
3⁷⁄₁₆ 3½	P 355 P 356	PE 355 PE 356	5⅛ *130.18*	12⅞ *327.0*	16⅛ *409.6*	4¹Ⅾ₁₆ *125.41*	5 *127.0*	1 *24*	2¼ *57.2*	9⅞ *250.8*	10¼ *260.4*	6 *152.4*	1⅝ *41.3*	2²⁹⁄₃₂ *73.8*	3⁹⁄₃₂ *83.3*	⅜ *9.5*
3¹Ⅾ₁₆	P 363	PE 363	5¹¹⁄₁₆ *144.46*	14½ *368.3*	17⅜ *439.7*	5⅝ *141.29*	5½ *139.7*	1 *24*	2⁹⁄₁₆ *65.1*	11¹⁄₁₆ *281.0*	11⅓₁₆ *287.3*	7 *177.8*	1½ *38.1*	3⁹⁄₃₂ *83.3*	3¹¹⁄₁₆ *93.7*	⅜ *9.5*

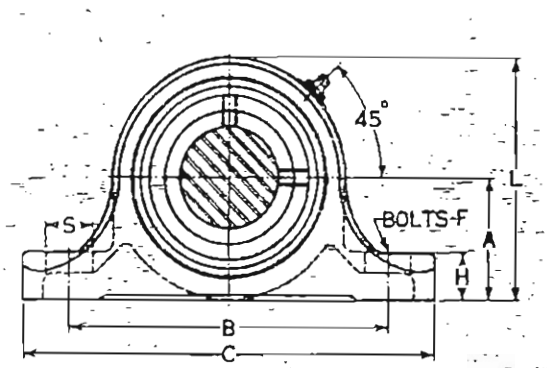
Bold face items are normally available from stock; please consult for availability of non-stock items.
Lubrication fitting tap size: for all expansion units with 2⁷⁄₁₆" and smaller shafts, ¼"-28 UNF; for other expansion units and all fixed units, ⅛" PT.
◆ Width dimension for closed end unit.
Selection guide, pages I-93, I-94.
Load ratings, pages I-95, I-96.
Additional information, page I-105.

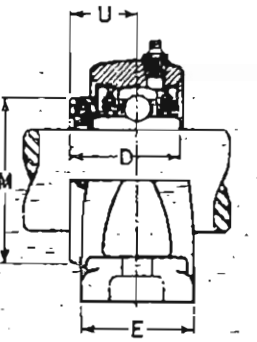


Standard Duty Ball Bearing Pillow Blocks

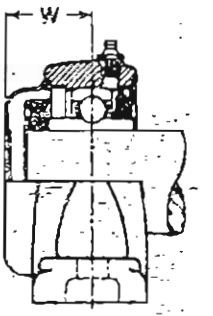
P-200

Cast Iron Housing
Alignable
Housing Type Seals
Spring Locking Collar
Relubricatable
Wide Inner Ring





Open end



Closed end

Dimensions (inches/*mm*)

Shaft diameter		Pillow block number	A †	B	C	D	E	F Bolts	H	L	M	S	U	W ◆
mm	In.	Felt seals												
	2 1/4	P 240	3	8 1/8	10 1/2	2 11/16	2 7/8	3/4	1 5/16	6	4 3/16	1 3/16	1 11/16	2 1/16
	2 7/16	P 243												
65		*P 2M65*	*76.20*	*206.4*	*266.7*	*68.28*	*73.0*	*20*	*33.3*	*152.4*	*106.4*	*30.2*	*42.9*	*52.4*
	2 7/8	P 244	3 1/4	8 7/8	11 1/8	2 7/8	3 1/4	3/4	1 5/8	6 1/2	4 5/8	1 5/16	1 11/16	2 1/16
	2 15/16	P 247												
	3	P 2E48												
75		*P 2M75*	*82.55*	*225.4*	*298.4*	*73.02*	*82.6*	*20*	*34.9*	*165.1*	*117.5*	*33.3*	*46.0*	*56.4*
	3 7/16	P 253	3 1/4	10	13	3 5/16	3 1/4	7/8	1 5/8	7 1/2	5 5/16	1 5/8	2 1/8	2 1/2
	3 1/2	P 2E56												
85		*P 2M85*	*95.25*	*254.0*	*330.2*	*90.49*	*95.2*	*24*	*41.3*	*190.5*	*131.8*	*41.3*	*54.0*	*63.5*
	3 15/16	P 263	4 7/16	11 7/8	15 1/4	4 1/4	4 5/8	7/8	1 13/16	8 15/16	5 15/16	1 7/8	2 29/64	3 1/64
	4	P 2E64												
100		*P 2M100*	*112.71*	*301.6*	*387.4*	*107.95*	*111.1*	*24*	*46.0*	*227.0*	*150.8*	*47.6*	*65.5*	*76.6*

Bold face items are normally available from stock; please consult for availability of non-stock items.
Lubrication fitting tap size, 1/8" PT.
Tolerance, +.000" — .010" (+0.00 mm — 0.25 mm).
◆ Width dimension for closed end unit.
Selection guide, pages I-5, I-6.
Load ratings, pages I-7, I-8.
Additional information, page I-36.

Series 3-U200, 3-Y200, 200

Standard Duty Ball Bearing Units

Additional Features:

All 3-200 mounted units can be purchased with formed steel closed end caps on the collar side which cover all rotating elements. Two bearing seals are provided with all open or closed end units on series 3-U200 and 3-Y200. Closed end units require specially counter bored housings on these series. On series 200 closed end units one housing seal is replaced with the closed end cap. Closed end units are designated with the suffix C (i.e. P 3-U231HC). Shafting should not extend beyond the bearing inner ring more than 1/8" *(3.2 mm)* when end caps are to be used.

Series 3-200 and 200 mounted units have drilled or cored mounting bolt holes suitable for the inch or metric bolts listed. Drilled holes will be 1/32" *(0.8 mm)* larger than the largest inch shown.

Sealed bearings can be replaced in series 3-200 mounted units. It is normally recommended, however, that complete units be replaced to assure a good fit between the bearing O.D. and the housing bore. The same is true of series 200 mounted units with housing seals.

Service instructions for mounting are included with each replacement bearing and should be carefully followed. Series 200 replacement bearings are not prelubricated but are coated with a mineral base preservative and should be further protected from moisture and dirt, especially during installation.

Operation:

Series 3-200 and 200 mounted units are prelubricated with a good quality petroleum grease of No. 2 consistency which has been tested for operational characteristics and stability for long shelf life. The service instructions packed with each unit provide guidelines for relubrication intervals and recommended greases. The lubricant furnished is generally limited to an operating temperature range of −20°F to 200°F *(−29°C to 93°C)*. The lip seals N and E3 should be limited to a temperature less than 225°F *(107°C)*.

Where significant thrust loads are applied to Standard Duty Ball Bearing Units, thrust collars, spacers, shaft shoulders etc. should be utilized to support the thrust so that it is not transmitted through the locking collars.

Imposed radial loads should not exceed 25% of bearing basic load rating; where high speeds, thrust loads, or vibratory loads are unavoidable, consult PT Components, Inc.

Takeups:

The mounting of 3-200 and 200 pillow blocks on universal takeup frames is illustrated on pages I-29 and I-30. For replacement bearing units in takeups, specify takeup part number without prefix S and adjustment (i.e. TA3-U215N, NT3-U215N). Frames for takeup units must be securely fastened to their supports.

Mountings:

Two-bolt FX housings have fully machined mounting surfaces; for maximum stability, radial load should be along center line of bolts.

Recommended Shaft Tolerances

Shaft Diameter	Tolerance
½"-2"	Nominal to −.0005"
2 1/16"-4"	Nominal to −.0010"
17 mm-50 mm	Nominal to −0.013 mm
55 mm-100 mm	Nominal to −0.025 mm

CAUTION The above shaft tolerances are suitable for loads up to .18C and L_{10} life greater than 20,000 hours. For more severe conditions, consult PT Components, Inc.

The service life of a collar mounted bearing is largely dependent on shaft fit, and may be expected to approach theoretical L_{10} life only if the bearing is press fitted to a shaft. A slip fit mounting in accordance with the shaft tolerances shown in table will provide generally acceptable service life on normal applications under light to moderate load and speed conditions. A shaft tolerance resulting in looser fits (such as with commercial shafting) may be expected to have greatly reduced reliability and increasing problems of shaft fret wear, bearing inner ring fracture and shaft slippage. In general, looser fits than recommended are feasible only for very light loading and lower speeds. Prototype or field testing is strongly recommended if looser fits must be considered.

Shafting should be designed for adequate strength and stiffness for the intended application. It should be round, straight, free of nicks and burrs and of correct size.

Warning:

The correct selection of bearings or mounted units requires that the magnitude and nature of all loads, speeds, alignment, mounting, operating requirements, and maintenance be adequately considered. The selection of materials for and design of housings, shafting, fasteners, seals and accessories, as well as provisions for installation and maintenance, must follow engineering principles.

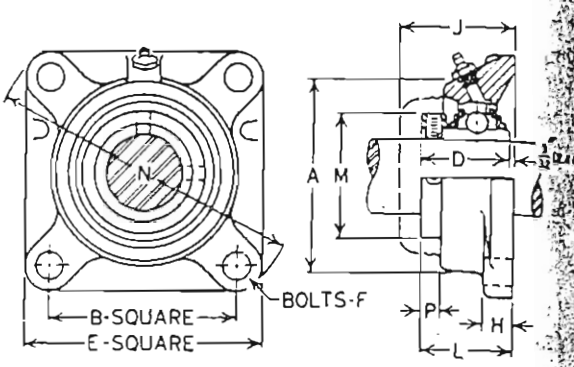
Housings must be selected and installed with regard to the degree and direction of the forces that will occur. Housings should not be used under tension loads except with adequate safety factors. For this reason pillow blocks are best suited to withstand radial loads passing through the base. When heavy loads or shock loads are possible, it is most important to mount a unit so that the unit is directly and substantially supported other than through its mounting bolts. Where the line of force falls outside the base, such as with horizontal or uplift loads on pillow blocks, serious housing and fastener deflection or failure may occur. These conditions may require designs using different materials, fasteners, mounting design, stop bars, etc., together with proper safety factors. When these conditions are unavoidable, the PT Components, Inc., Link-Belt Bearings Division should be consulted.

Service instructions are provided with shipments of bearings and are available on request. These instructions provide detailed information to aid in the proper installation, operation, and maintenance, and should be carefully read and followed. Failure to do so may result in unsatisfactory service as well as serious personal injury or property damage.

Standard Duty Ball Bearing Flanged Units

F3-U200N

Cast Iron Housing
4-bolt Mounting
Alignable
Spring Locking Collar
Relubricatable
Wide Inner Ring



Dimensions (inches/*mm*)

Shaft diameter		Flanged unit number◘	A	B	D	E	F Bolts	H	J ◆	L	M	N	P
mm	inches	Lip seals											
	½	F3-U2B08N	2⅛	2⅛	1³⁄₃₂	3	⅜	⁷⁄₁₆	1²³⁄₃₂	1³⁄₁₆	1⁵⁄₁₆	3⅞	¼
	⅝	**F3-U210N**											
	¹¹⁄₁₆	F3-U211N											
17		*F3-U2M17N*	*54.0*	*53.98*	*27.78*	*76.2*	*10*	*11.1*	*43.6*	*30.2*	*33.3*	*98.4*	*6.4*
	¾	**F3-U212N**	2⁷⁄₁₆	2½	1⁹⁄₃₂	3⅜	⅜	⁷⁄₁₆	1⁵⁹⁄₆₄	1⅜	1½	4¹³⁄₃₂	⁹⁄₃₂
20		*F3-U2M20N*	*61.9*	*63.50*	*32.54*	*85.87*	*10*	*11.1*	*48.8*	*34.9*	*38.1*	*111.9*	*7.1*
	⅞	F3-U214N△	2¹¹⁄₁₆	2¾	1²³⁄₆₄	3¾	⁷⁄₁₆	½	1¹⁵⁄₁₆	1²⁹⁄₆₄	1¾	4²⁹⁄₃₂	¹⁹⁄₆₄
	¹⁵⁄₁₆	F3-U215N△											
	1	**F3-U216N△**											
25		*F3-U2M25N△*	*68.3*	*69.85*	*34.53*	*95.2*	*10*	*12.7*	*49.2*	*36.9*	*44.4*	*124.6*	*7.5*
	1¹⁄₁₆	F3-U217N	3³⁄₁₆	3¼	1⁹⁄₁₆	4¼	⁷⁄₁₆	½	2³⁄₃₂	1²¹⁄₃₂	2³⁄₃₂	5¹⁹⁄₃₂	⁷⁄₁₆
	1⅛	F3-U218N											
	1³⁄₁₆	**F3-U219N**											
	1¼	**F3-U2E20N**											
30		*F3-U2M30N*	*81.0*	*82.55*	*39.69*	*108.0*	*10*	*12.7*	*54.8*	*42.1*	*53.2*	*142.1*	*11.1*
	1¼	**F3-U220N△**	3⅜	3⅜	1⁴⁹⁄₆₄	4⅜	½	⁹⁄₁₆	2¹⁹⁄₆₄	1⁵³⁄₆₄	2⁷⁄₁₆	6⅛	³³⁄₆₄
	1⁵⁄₁₆	F3-U221N△											
	1⅜	F3-U222N△											
	1⁷⁄₁₆	**F3-U223N△**											
35		*F3-U2M35N△*	*92.1*	*92.08*	*44.85*	*117.5*	*12*	*14.3*	*58.3*	*47.2*	*61.9*	*155.6*	*13.1*
	1½	**F3-U224N△**	4	4	1²⁹⁄₃₂	5⅛	½	⁹⁄₁₆	2¹⁵⁄₃₂	2	2¹¹⁄₁₆	6²⁵⁄₃₂	½
40		*F3-U2M40N△*	*101.6*	*101.60*	*48.42*	*130.2*	*12*	*14.3*	*62.7*	*50.8*	*68.3*	*172.2*	*12.7*
	1⅝	F3-U226N△	4¼	4⅛	2¹⁄₃₂	5⅜	½	⅝	2³⁵⁄₆₄	2⅛	2⅞	7³⁄₃₂	³⁵⁄₆₄
	1¹¹⁄₁₆	F3-U227N△											
	1¾	F3-U228N△											
45		*F3-U2M45N△*	*108.0*	*104.78*	*51.59*	*136.5*	*12*	*15.9*	*64.7*	*54.0*	*73.0*	*180.2*	*13.9*
	1⅞	F3-U230N△	4½	4⅜	2³⁄₃₂	5⅝	½	⅝	2¾	2³⁄₁₆	3⅛	7⁷⁄₁₆	⁹⁄₁₆
	1¹⁵⁄₁₆	**F3-U231N△**											
	2	F3-U2E32N△											
50		*F3-U2M50N△*	*114.3*	*111.12*	*53.18*	*142.9*	*12*	*15.9*	*69.8*	*55.6*	*79.4*	*188.9*	*14.3*
	2	**F3-U232N△**	4¹⁵⁄₁₆	5⅛	2¼	6⅜	⅝	¹¹⁄₁₆	2⁶¹⁄₆₄	2¹¹⁄₃₂	3½	8½	⅔
	2³⁄₁₆	**F3-U235N△**											
55		*F3-U2M55N△*	*125.4*	*130.18*	*57.15*	*161.9*	*16*	*17.5*	*75.0*	*59.5*	*88.9*	*215.9*	*15.9*
	¼	*F3-U236N*	5⅜	5⅝	2½	6⅞	⅝	¹¹⁄₁₆	3³⁄₆₄	2¹⁹⁄₃₂	3²⁵⁄₃₂	9⁷⁄₃₂	⁴¹⁄₆₄
	2⅜	*F3-U238N*											
	2⁷⁄₁₆	F3-U239N											
60		*F3-U2M60N*	*136.5*	*142.88*	*63.50*	*174.6*	*16*	*17.5*	*79.8*	*65.9*	*96.0*	*234.2*	*16.3*

Bold face items are normally available from stock; please consult for availability of non-stock items.
Lubrication fitting tap size: for 1¹⁄₁₆" *(17 mm)* and smaller shafts, ¼"-28 UNF; for all other shafts, ⅛" PT.
◘ N lip seals standard. H labyrinth seals available.
△ Available with E3 triple lip seals.
◆ Width dimension for closed end unit.

tion guide, pages I-5, I-6.
. ratings, pages I-7, I-8.
Additional Information, page I-36.

TAB E

Dial-Air™ PRESSURE REGULATORS

Dial-Air™ Regulators are piston operated, internally pilot controlled, use Belleville springs instead of the standard coil type, and are fast relieving. Units have balanced valves for superior regulation, unusually large valves and valve seats, and precisely positioned aspirator tubes which allow high airflow with steady pressure control and minimal secondary-pressure drop. The carefully calculated relationships of piston area, valve area, and valve travel assure minimal fluctuations in secondary pressures regardless of fluctuations in airflow. The Dial-Air™ Regulator's easy-turning, nonrising, polycarbonate plastic adjustment knob allows quick adjustments from minimum to maximum pressure settings in less than one full turn. A lock knob is provided to prevent the adjustment knob from creeping or vibrating off the setting. Units also have field-adjustable "stops" that per presetting of desired minimum or maximum pressures. The d is calibrated in 5-psi (0.35-bar) pressure increments and alsc as a gauge while air pressure is on the system, eliminating t and installation of separate air-pressure gauges. Pressure s on the dial will be accurate to the same degree as a norma air-pressure gauge. If gauges are desired, ¼"-NPT gauge po provided for this purpose on both front and back of the un either port also may be used as an additional regulated outlet lower airflows are required. When units are mounted, di assembly can be turned easily to read from any direction.

Dial-Air™ REGULATOR SERIES R21, R31, AND R41

Formerly 2302 Series

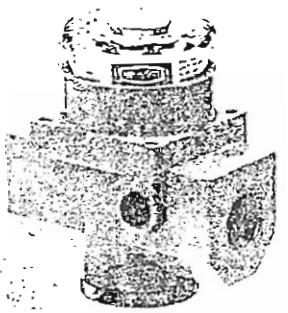
STANDARD Dial-Air™ REGULATOR MODEL R21

Dial-Air™ Regulator Model R21 is available in four pipe sizes. These models have secondary pressure ranges of 2 to 160 psig (0.14 to 11 bar) and are self-relieving. This unit is standard equipped with four panel mounting holes, ⅞" in diameter (.219"; 6 mm). It may be mounted on panels up to 1¼" (32 mm) thick. This unit normally is used when maximum airflows are less than 200 scfm (340 Nm³/h; based on 100-psig [7-bar] primary and 80-psig [5.5-bar] secondary pressures). Maximum inlet operating pressure and temperature ratings are 300 psig (21 bar) and 175°F (79°C).

MODEL NO.	PIPE SIZE	PRESSURE RANGE
R21-02-000	¼" NPT	5–160 psig (0.4–11 bar)
R21-03-000	⅜" NPT	5–160 psig (0.4–11 bar)
R21-04-000	½" NPT	5–160 psig (0.4–11 bar)
R21-06-000	¾" NPT	5–160 psig (0.4–11 bar)

Low-Pressure Range (2–40 psig, 0.2–3 bar) L
Tamper-Resistant Kit. Order part number RRP-95-585.

See suffix designations below.
See pages 22 and 23 for more information on accessories.



Formerly 2303 Series

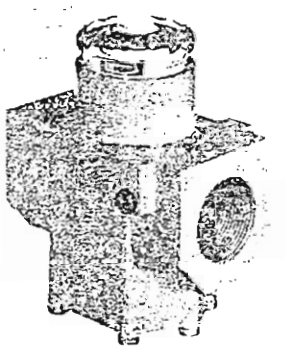
JUMBO Dial-Air™ REGULATOR MODEL R31

Dial-Air™ Regulator Model R31 is available in three pipe sizes with a secondary pressure range of 2 to 160 psig (0.14 to 11 bar) and is self-relieving. It is standard equipped with four panel mounting holes, .200" (5 mm) in diameter, and may be mounted on panels 1¼" (32 mm) thick. The ¾" (19 mm) models are normally used when maximum airflows are less than 400 scfm (680 Nm³/h); the 1" (25 mm) models for airflows up to 600 scfm (1020 Nm³/h); and the 1¼" (32 mm) models for airflows up to 700 scfm (1190 Nm³/h; based on 100-psig [7-bar] primary and 80-psig [5.5-bar] secondary pressures). Maximum inlet operating pressure and temperature ratings are 300 psig (21 bar) and 175°F (79°C).

MODEL NO.	PIPE SIZE	PRESSURE RANGE
R31-06-000	¾" NPT	5–160 psig (0.4–11 bar)
R31-08-000	1" NPT	5–160 psig (0.4–11 bar)
R31-0A-000	1¼" NPT	5–160 psig (0.4–11 bar)

Low-Pressure Range (2–40 psig, 0.2–3 bar) L
Tamper-Resistant Kit. Order part number RRP-95-585.

See suffix designations below.
See pages 22 and 23 for more information on accessories.



Formerly 2304 Series

HIGH-FLOW Dial-Air™ REGULATOR MODEL R41

Dial-Air™ Regulator Model R41 is available in two pipe sizes. These models have secondary pressure ranges of 2 to 160 psig (0.14 to 11 bar) and are self-relieving. The 1½" models are normally used when maximum airflow is less than 1200 scfm (2040 Nm³/h), and the 2" models are up to 1600 scfm airflow (2720 Nm³/h, based on 100-psig [7 bar] primary and 80-psig [5.5-bar] secondary pressures). Maximum inlet operating pressure and temperature ratings are 300 psig (21 bar) and 175°F (79°C).

MODEL NO.	PIPE SIZE	PRESSURE RANGE
R41-08-000	1½" NPT	8–160 psig (0.6 to 11 bar)
R41-0C-000	2" NPT	8–160 psig (0.6 to 11 bar)

Low-Pressure Range (2–40 psig, 0.2 - 3 bar) L
Tamper-Resistant Kit. Order part number RRP-95-585.

See suffix designations below.
See pages 22 and 23 for more information on accessories.

FOR FLOW CHARACTERISTIC CHARTS, SEE PAGES 28 AND 29.

SUFFIX DESIGNATIONS. To order accessories or variations installed or supplied with unit, add appropriate coded suffix letter in position 6 of model number (e.g. R21-02-L00). For more information see pages 22 and 23. To order BSP, PL pipe threads, add "C" in position 4 of model number (e.g. R21-C2-000). See page 1 for model numbering system.

DIMENSIONS. See page 33.

lanual Operated Selector Valves
Position Maintained Contact (Detented)

nual selector valves use electrical type actuator
standard enclosures. All selector valves are
echanically detented.

2 position selectors are used to select between 2 function modes of operation ie. on-off, run-jog, automatic-manual, -down, etc.

2 position detented selector valves are available in 3-way port) and 4-way (5 port) versions.

These high flow valves can be used to directly operate cylinders of up to 2" bore diameter.

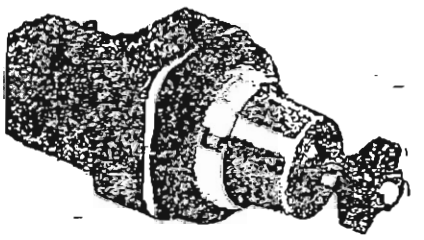
The valves are available with 10-32 or 1/4" push-in buttom ported or 1/8" NPT side ported bases.

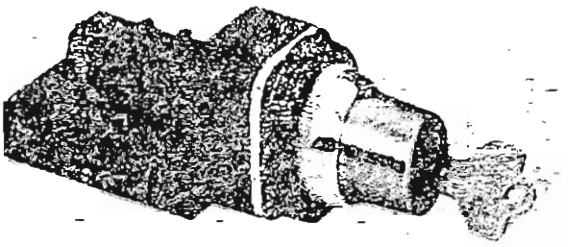
With Standard Bottom Ported Base

With Side-Ported 1/8" NPT Base

V35 Key Operated Selector Valve position detented

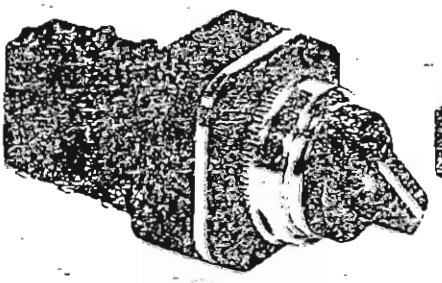
erated by rotating key. Use for urity or safety application. Key is novable in both positions, supplied th 2 keys.

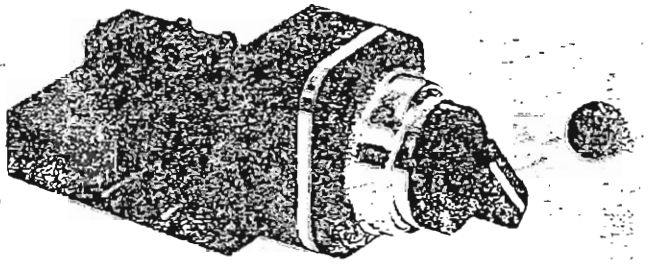




V45 Knob Operated Selector Valve ion Detented

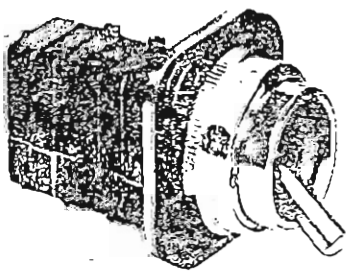
perated by rotating selector knob. se as general purpose selector.

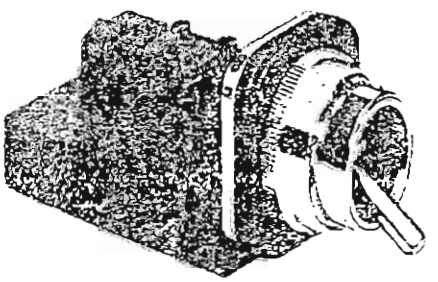




V55 Toggle Operated Selector Valve Position Detented

perated by switching toggle. Toggle an be indexed 90° to provide up-down or de to side actuation.

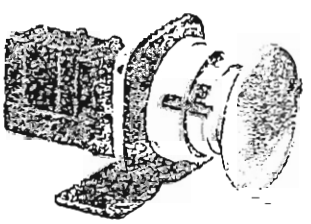




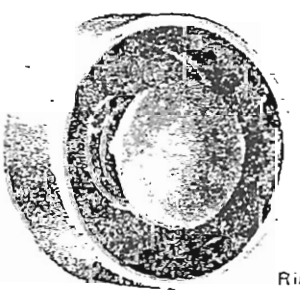
ACCESSORIES

Neck mounted Angle Brackets. Order Part No. A4885.

Ring Guards are available for use with nally operated valves. t No. A4886.



Neck Mounted Angle Bracket



Ring Guard

VALVE SELECTOR CHART

Valve Type	Valve Configuration	Valve Only	Valve with Standard Bottom Ported Base		Valve with Side Ported Base
			10-32 Ports	1/4" Kay Push-in Fittings	1/8" NPT
KV35-Key Operated Selector Valve	3-Way	KV35-3	KV35-3-001	KV35-3-044	KV35-3-122
	4-Way	KV35-5	KV35-5-001	KV35-5-044	KV35-5-122
KV45-Turn Knob Selector Valve	3-Way	KV45-3	KV45-3-001	KV45-3-044	KV45-3-122
	4-Way	KV45-5	KV45-5-001	KV45-5-044	KV45-5-122
KV55-Toggle Switch Selector Valve	3-Way	KV55-3	KV55-3-001	KV55-3-044	KV55-3-122
	4-Way	KV55-5	KV55-5-001	KV55-5-044	KV55-5-122

SPECIFICATIONS

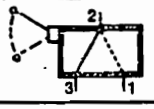
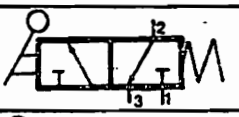
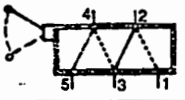
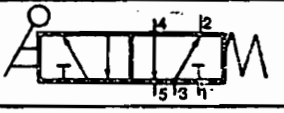
Pressure Range: 0 to 120 psi.
Temperature Range: 32°F to 120°F
Flow Capacity: Cv= .25, 13 CFM @ 80 psi to atmosphere
Operating Media: Air or non-corrosive, non-toxic and non-flamable gasses
Filtration: 50 Micron recommended.
Lubrication: Lubricate for optimum life expectancy. Use Shell Tellus 25, Mobile DTE 25 (light) or equivalent. Do Not Use fire resistant oils, or oils containing phosphate esters, Soap fillers, graphite or silicones.

MOUNTING DIMENSIONS (See page 12 for details)

HOW TO ORDER COMPONENTS

Valves consist of a valve operator, valve capsule and a sub-base. To order any of these parts individually, see page 13 for details.

CIRCUIT SYMBOLS

	KAY Symbols	ANSI
3-Way (3 Port)		
4-Way (5 Port)		

PORT IDENTIFICATION

Bottom view of standard base. Top view of side-ported base.

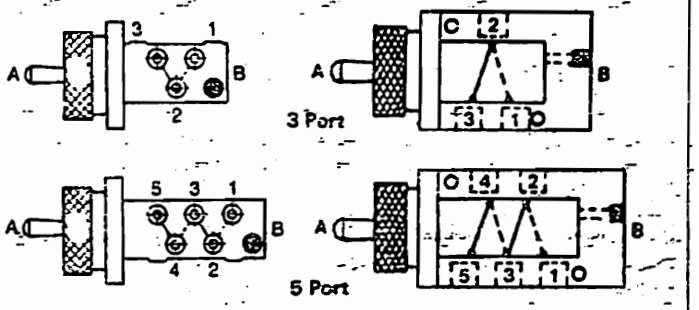


Diagram above shows port configurations and flow conditions with the "B" end in command (valve unactuated). Solid flow path lines between the numbered ports indicate an open passage. Dotted flow path lines indicate a closed passage. All flow conditions are reversed when the "A" end takes command (valve actuated).

Because Kay valves are multi-purpose, they may be piped to obtain several different functions.

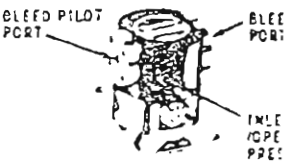
The direct correlation between Kay valve symbols and Kay valve port configurations, permits piping directly from a Kay design schematic, for easy, accurate installation.

KAY® PNEUMATICS

VAP

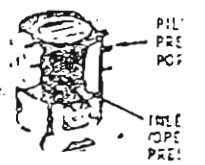
A momentary or maintained pilot pressure applied to one side of the valve will cause it to shift. It will remain in that position until a pilot pressure is applied to the other side, which will cause the valve to return to its original position. If a maintained pilot pressure is employed, it must be released before the other pilot pressure is applied. Pilot pressure must be at least 25% of the operating pressure.

VSA

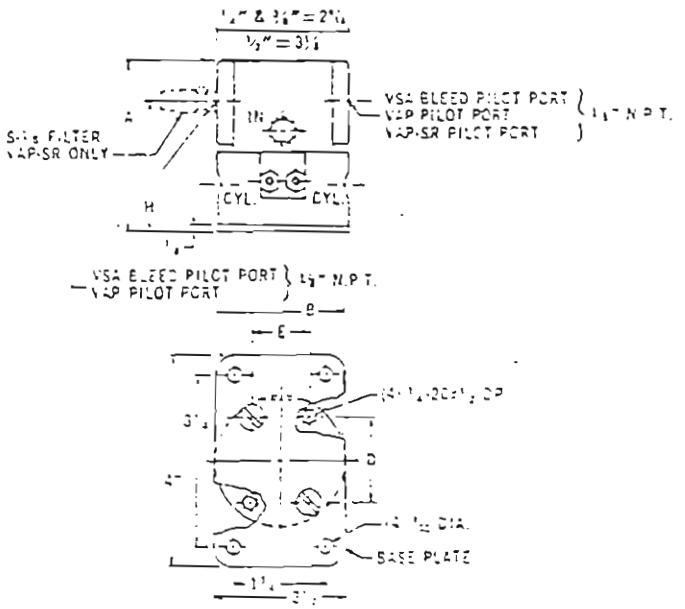


A separate Bleeder Valve, such as the Allenair BV-100 or BV-1-2, must be installed in a line to each spool cap. Depressing one Bleeder Valve momentarily will shift the valve. It will remain in that position until the other Bleeder Valve is depressed, which will cause the valve to shift to its original position.

VAP-SR



A continuous pilot pressure applied to "IN" side of the valve will shift the valve. When the pilot pressure is released the valve will shift to its original position. The pilot pressure must be at least 75% of the operating pressure.



DIM.	PORT SIZES (N.P.T.)		
	1/4"	3/8"	1/2"
A	3 1/4	3 1/4	3 1/8
B	2 1/8	2 1/8	3"
D	1 1/8	1 1/8	1 1/4
E	1 1/8	1 1/4	1 3/8
H	2 1/8	2 1/8	2 1/8
EXH. PORT N.P.T.	1/4"	1/4"	3/4"

NOTES:
1) MODEL VAP & VAP-SR PILOT SIGNAL PRESSURIZES CYLINDER PORT DIRECTLY UNDER THAT PILOT PORT.
2) MODEL VSA BLEED PILOT SIGNAL PRESSURIZES CYLINDER PORT OPPOSITE THAT BLEED PILOT PORT.
3) EXHAUST PORT IS ISOLATED 18CF FROM SPEED CONTROLS

OPTION

SPECIFY [HTS] FOR HIGH TEMPERATURE SPOOL SEALS

These seals are a fluorocarbon compound (Viton) and have an operating temperature range of +10°F to 350°F. They will function at temperatures up to +400°F with reduced life.

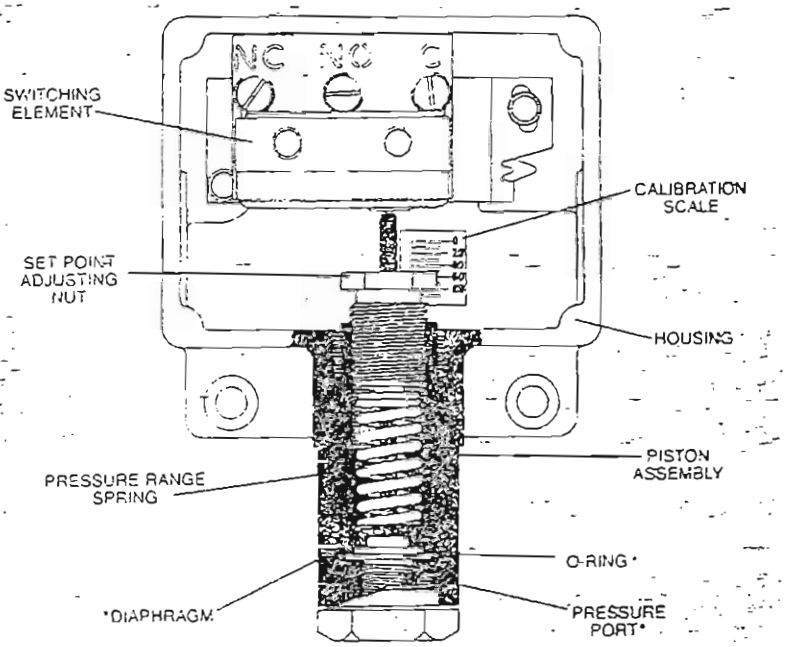
MODEL	SIZE 1/4, 3/8 or 1/2"	OPTION

SOR INC
PRESSURE SWITCH COMPANY
11705 BLACKBOB ROAD, P.O. BOX 591, OLATHE, KANSAS 66061
Telex: 42-6130 PHONE: 913/764-2630

GENERAL INSTRUCTIONS

Static "O" Ring Pressure Switch

INCLUDING WIRING DIAGRAM



CAUTION: The switching element in this switch has been positioned with a dial indicator to a tolerance of ± .002". DO NOT MOVE this switching element! Its position has nothing to do with any set point adjustment. Any movement can either render the switch inoperative or cause the switching element to be damaged with overpressure.

TO ADJUST PRESSURE AT WHICH SWITCH WILL OPERATE, PROCEED AS FOLLOWS:

1. STANDARD UNIT (FIXED DIFFERENTIAL)
   Tighten the hex headed adjusting nut to increase pressure—loosen to reduce pressure. The adjusting nut is the hex headed, threaded bushing through which the shaft that operates the switching element extends.

2. ADJUSTABLE DIFFERENTIAL TYPE (Utilizes "T" –Micro 10BS210– Switch Element)
   Use above procedure to set actuation point on Decreasing Pressure.

   High actuation is adjustable by turning the white plastic knob on the micro-switch. Setting at "A" gives the narrowest differential and at "F" gives the widest differential. Differential settings above "E" are not recommended for maximum repeatability.

Approximate actuation pressure can be determined on most switches by sighting across the top of the hex head to the chart on the bottom of the housing.

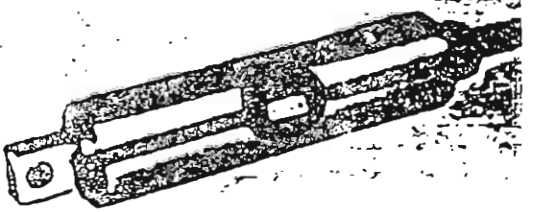
WIRING SUGGESTIONS:

1. Most of the switches are Single Pole, Double Throw and may be connected to either make or break on increasing or decreasing pressure. Terminals or leads are marked NC for Normally Closed, NO for Normally Open, and C for Common or ground.
2. Most switches are Micro Switches with screw type terminals. This is the most convenient wiring arrangement but CARE MUST BE EXERCISED to AVOID DAMAGING the SWITCHING ELEMENT!
3. Some switches are provided with leads rather than the screw terminals. All such leads are marked NC, NO and C for your convenience. Leads to specification, as to length and hook up, are available on request.

RECOMMENDED SPARE PARTS:

Since the Static "O" Ring Pressure Switch is an instrument constructed of close tolerance components and assembled with dial indicators to assure proper location and movement, it is not considered practical to attempt field repairs. Our experience indicates a very low percentage of repair or parts replacement required. We do not recommend changing parts in the field. If spares are essential we recommend spare pressure switches. The defective instruments should be returned to our factory for a complete over-haul. We have, therefore, no recommended spare parts list.

SSA SSE SSAD SSED

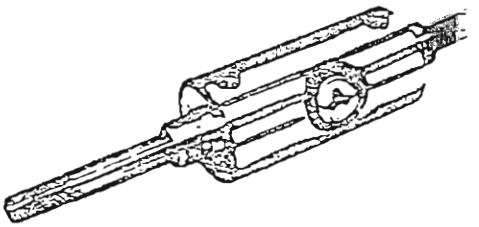


ALL metal parts of these Cylinders are manufactured from type 300 series stainless steel. Otherwise, they are identical in construction to Types "A", "AD", "E" & "ED" Cylinders. These units are particularly recommended for use in the food and dairy industries and in highly corrosive atmospheres, such as found in the chemical field.

Maximum Stroke Available: 72".
Bore Sizes Available: ⅞", 1⅛", 1½", 2", 2½", 3" & 4".
Standard Options: Cushions, Spring Returns, High Temperature Seals, and optional rod material. For other options, please consult factory.

NOTE: MOUNTING NUTS ARE SUPPLIED ONLY UPON REQUEST.

AD CD ED



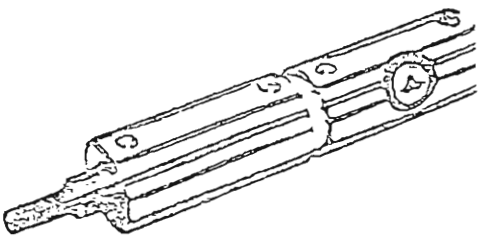
These Cylinders are constructed with a single rod, which protrudes from both ends. As one end retracts, the other extends.

Bore Sizes Available: ⅞", 1⅛", 1½", 2", 2½", 3" & 4".

NOTE: Due to piston construction, 3.32" of stroke is lost on Type AD 1½", 2", 2½" and 3" bore sizes.

FOR DIMENSIONS & MOUNTS SEE PAGES 8 THROUGH 12

ABB CBB EBB

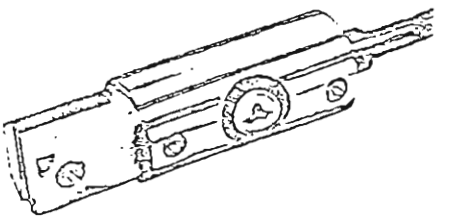


These units consist of two separate single ended Cylinders, joined together by a common rear head. Their strokes can be either identical or different. By fastening one rod end to a fixed object, these units can perform as 3 and 4 position Cylinders.

Bore Sizes Available: ⅞", 1⅛", 1½", 2", 2½", 3" & 4".

FOR DIMENSIONS & MOUNTS SEE PAGES 8 THROUGH 12

AE CE EE

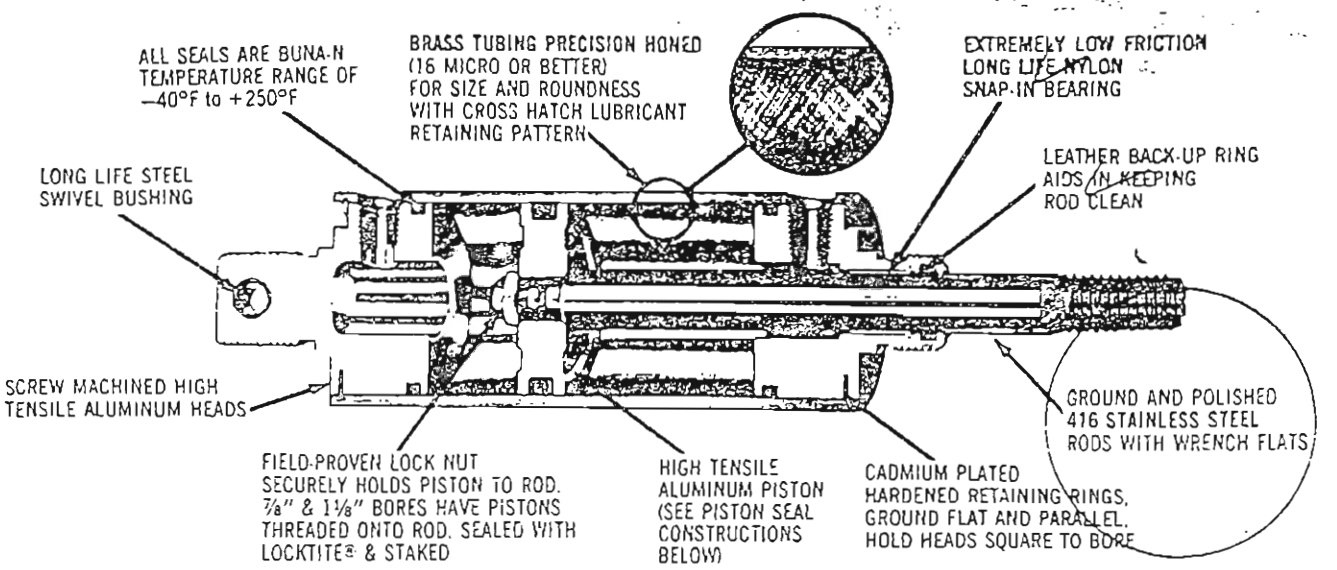


These Cylinders are constructed with a female clevis end.

Bore Sizes Available: ⅞", 1⅛", 1½", 2", 2½", 3" & 4".

FOR DIMENSIONS & MOUNTS SEE PAGES 8 THROUGH 12

DESIGN FEATURES & MATERIALS



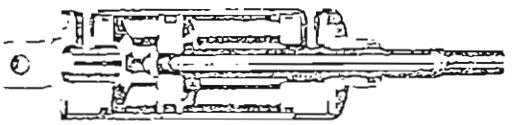
STANDARD STROKE LENGTHS: WHOLE-INCH INCREMENTS FROM 1" THROUGH 20" AND ½", 1½", 2½" & 3½". SPECIAL STROKES AVAILABLE FROM ⅛" TO 144".

BASIC CONSTRUCTION (DOUBLE ACTING)

A

All Type "A" Cylinders, with the exception of the 4" bore, are constructed using "O"-Ring Seals. The 4" bore uses "O"-Ring Rod Seals and "U" Cup Piston Seals. These all-purpose units are used for most pneumatic applications. Optional Double Rod Packings are recommended for heavy duty and hydraulic applications.

Pressure Rating: 150 P.S.I. Pneumatic, 350 P.S.I. Hydraulic.
Breakaway: Approximately 5-8 P.S.I.
Bore Sizes Available: ⅞", 1⅛", 1½", 2", 2½", 3" & 4".

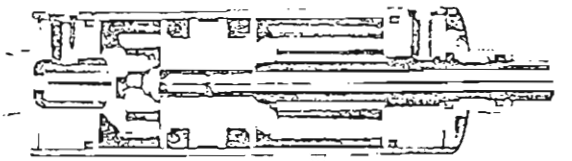


FOR DIMENSIONS & MOUNTS SEE PAGES 8 THROUGH 12

C

Type "C" Cylinders are constructed using low friction "U" Cup Seals and include a wear strip on the piston. These Cylinders are primarily used on low pressure applications and where low minimum breakaway is required.

Pressure Rating: 150 P.S.I. Pneumatic only.
Breakaway: Approximately 2-3 P.S.I.
Bore Sizes Available: ⅞", 1⅛", 1½", 2", 2½", 3" & 4".

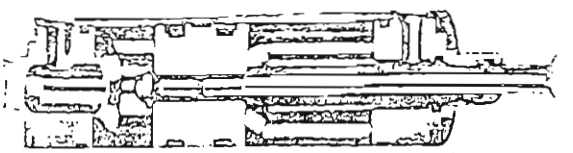


FOR DIMENSIONS & MOUNTS SEE PAGES 8 THROUGH 12

E

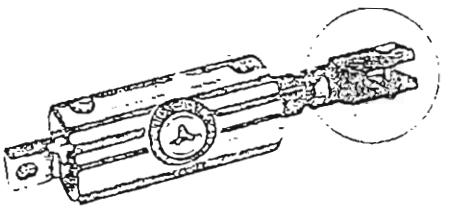
Type "E" Cylinders are constructed using Block-Vee Seals and include double rod seals in the front head. A heavy duty wear strip (bearing) on the piston minimizes friction and piston seal wear, and on side load conditions prevents metal-to-metal contact. These Cylinders are generally used on low pressure hydraulics and where side load conditions are present.

Pressure Rating: 200 P.S.I. Pneumatic, 500 P.S.I. Hydraulic.
Breakaway: Approximately 10-15 P.S.I.
Bore Sizes Available: ⅞", 1⅛", 1½", 2", 2½", 3" & 4".
5" BORE AVAILABLE—Consult Factory for Details.

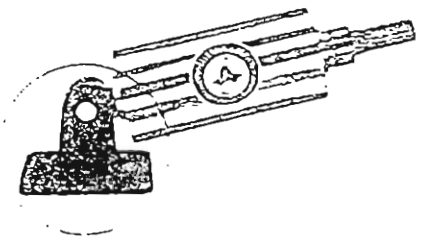


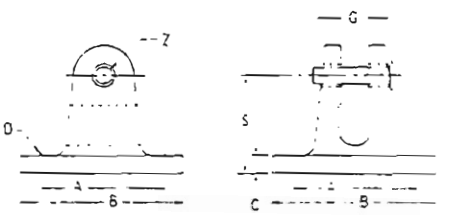
FOR DIMENSIONS & MOUNTS SEE PAGES 8 THROUGH 12

CYLINDERS

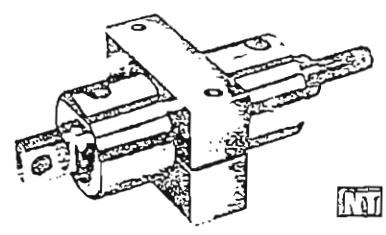


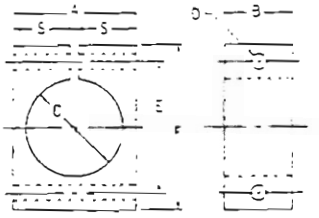
DIM.	PART NUMBERS									
	145		1545		245		345		445	
	STD	OS	STD	OS	STD	OS	STD	OS	STD	OS
A	1 3/32	2 1/4	2 1/4	2 1/4	2 1/4	2 5/8	2 5/8	3 3/8	3 3/4	3 3/4
B	1 3/4	1 3/4	1 3/4	1 3/4	1 3/4	1 13/16	1 13/16	2 5/8	2 1/4	2 1/4
C-C	5/8-16	1/2-13	1/2-13	3/4-11	5/8-11	3/4-10	3/4-10	1"-14	1"-14	1 1/4-12
D	5/16	3/8	3/8	3/8	3/8	1/2	1/2	3/4	3/4	3/4
E	1 1/4	1 3/4	1 3/4	1 3/4	1 3/4	1 3/4	1 5/8	1 15/16	1 15/16	2"
F	3/4	5/8	5/8	5/8	5/8	3/4	3/4	1/2	1/2	3/4
G	3/4	1"	1"	1"	1"	1 1/4	1 1/4	1 1/2	1 1/2	1 3/4
H	5/32	5/16	5/16	3/8	3/8	7/16	7/16	1/2	1/2	5/32





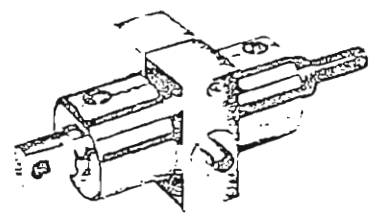
DIM.	PART NUMBERS			
	139	239	339	439
A	1 3/4	2 1/4	3"	3 3/4
B	2 1/4	3"	4"	5"
C	1/2	5/8	3/4	3/4
D	5/32	5/32	13/32	13/32
G	3/8	1/2	3/8	3/4
S	1 5/32	1 3/4	2 3/4	3 3/4
Z	1/4	5/8	3/4	3/4

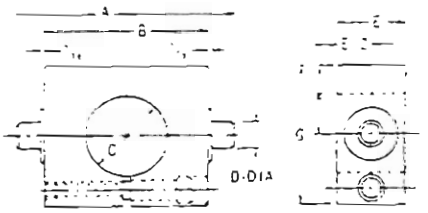




DIM.	PART NUMBERS			
	BM-7/8	BM-1 1/8	BM-1 1/2	BM-2
A	1 1/2	1 3/4	2 1/2	2 3/4
B	1"	1"	1 1/4	1 1/2
C	1 1/4	1 3/4	1 3/4	2 1/4
D	5/32	5/32	5/32	13/32
E	1 5/8	1 7/8	2 3/8	3"
F	2 1/4	2 1/2	3"	3 1/4
S	3/4	3/8	1 1/8	1 3/8

NOT OPTION SUGGESTED





DIM.	PART NUMBERS						
	T-7/8	T-1	T-1.5	T-2	T-2.5	T-3	T-4
A	3 1/4	3 1/4	4"	4"	5 1/2	5 3/4	7"
B	2 1/4	2 1/4	3"	3"	4"	4 1/4	5 1/2
C	1 1/2	1 3/4	1 1/2	2 1/4	2 3/4	3 1/4	4 3/4
D	3/8	3/8	5/8	1/2	3/4	3/4	3/4
E	3/4	3/4	1 1/4	1 1/4	1 1/2	1 1/4	1 1/4
F	3/8	3/4	1 1/8	1 3/8	1 1/2	2 1/8	2 15/16
G	2"	2"	2 1/8	3 1/8	4"	4 1/2	5 1/2

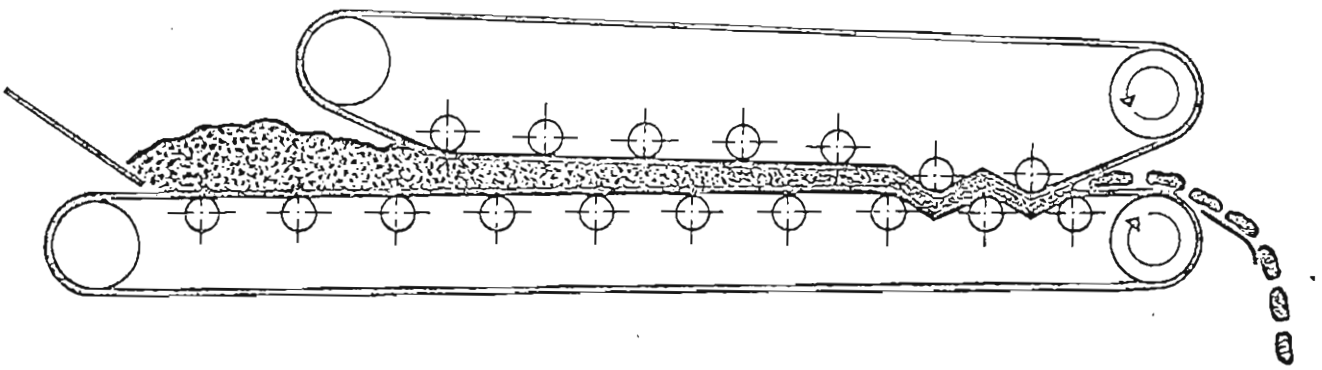
NOT OPTION SUGGESTED

TAB F

IFC

QUALITY TEXTILES FOR INDUSTRY

Bulletin No. 306



DUROTEX™ FILTER BELTS
for Belt Filter Presses

IFC has been a market leader in the design and manufacture of industrial belt fabrics specifically made for belt filter press applications. Through continued research and development, IFC has succeeded in establishing the most complete line of belt fabrics available to meet the needs of dewatering industrial and municipal sludges and product slurries such as pulp, cellulose and coal refuse . . . effectively.

INDUSTRIAL FABRICS CORPORATION
7208 Boone Avenue North · Minneapolis MN 55428
Tel (612) 535-3220 · Telex 29-0157

DUROTEX™ FILTER BELTS for Belt Filter Presses

DUROTEX Filter Belt Qualities

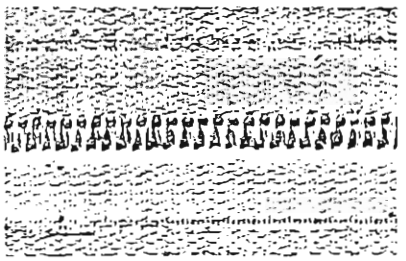
DUROTEX filter belts are constructed with polyester monofilament yarns (and other specialty yarns) and offer long service life due to superior qualities in:

- WEAR RESISTANCE
- MECHANICAL STRENGTH
- TRACKING
- RESISTANCE TO CREASING
- LOW ELONGATION
- CAKE RELEASE

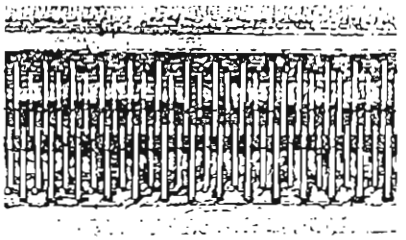
DUROTEX Filter Belt Seams

We have placed considerable emphasis on the development of superior filter belt seams, in order to achieve the greatest possible strength and the longest possible wear.

Seams:



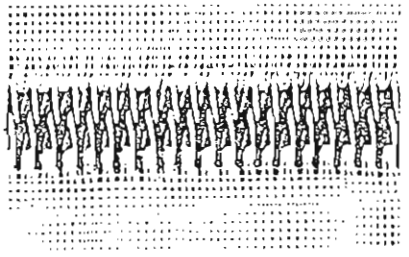
2.15
Sewn-on plastic monofilament seam



2.21
Stainless steel clipper seam, 15 hooks per inch, length .6 inch

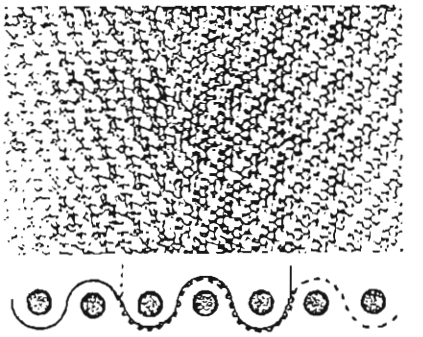
2.22
Stainless steel clipper seam, 8 hooks per inch, length .8 inch

2.26
Stainless steel clipper seam, 10 hooks per inch, length .7 inch

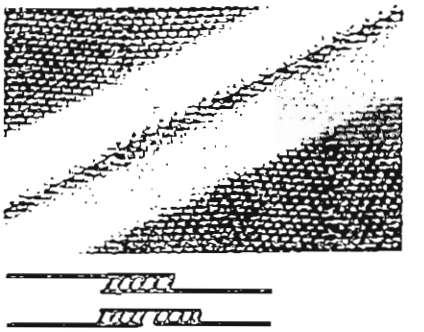


2.42
Plastic spiral seam

For cantilever-design belt filter presses, we recommend belts with handwoven or welded seams.



1.21
Handwoven seam



1.31
Welded seam

QUALITY TEXTILES FOR INDUSTRY

Edges:

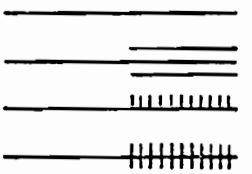
Heat sealing and plastic reinforcement of belt edges increases the wear resistance and overall stability. For equipment with mechanically-activated belt-tracing systems, heavy-duty plastic reinforcement can be applied.

4.11 Heat sealed edges only.

4.25 Heat sealed with plastic welded reinforcement.

4.41 Heat sealed with plastic-coated reinforcement, top only.

4.44 Heat sealed with plastic-coated reinforcement, top and bottom.



DUROTEX Filter Belt Fabrication

The IFC DUROTEX filter belt fabrication department can manufacture belts suitable for any make of equipment. We meet your specific dimensions. Our large inventory enables us to produce belts with the shortest delivery time possible. IFC capabilities also include **belt repair.**

Physical Properties of Polyester Fiber

Specific Gravity	Moisture regain 65% r.h. 68°F/20°C. %	Moisture regain Water retention power %	Tensile strength cN/dtex	Tensile strength wet in % of dry	Elongation at break %	Elongation at break wet in % of dry	(UV) Light resistance	Resistance to fungus, rot, mildew	Resistance to dry heat continuous F.	Resistance to dry heat continuous C.	Resistance to dry heat Short time exposure F.	Resistance to dry heat Short time exposure C.
1.38	0.4	3-5	7-9.5	95-100	10-20	100-105	+	+	302	150	392	200

+ Recommended

Chemical Resistances of Polyester Fiber

Acids	Acetic acid conc.	Sulphuric acid 20%	Nitric acid 10%	Hydrochloric acid 25%	Alkalies	Sat. Sodium carbonate	Chlorine bleach conc.
o	+	+	o	o	o	+	+

Caustic soda 25%	Ammonia conc.	Potassium permang. 50%	Formaldehyde conc.	Chlorinated hydrocarbons	Benzene	Phenol	Ketones, Acetone
–	–	+	+	+	+	o	+

+ Recommended o Conditional – Unsatisfactory

DUROTEX FILTER BELTS Technical Specifications

STYLE NO.	FIBER	YARN	WEAVE	WEIGHT oz/yd²	FABRIC THICKNESS inches	TENSILE STRENGTH warp lb/in	MESH COUNT per inch warp x weft	MESH OPENING microns warp x weft	AIR PERM. cfm	OPEN AREA %
6119	PES	MONO	PLAIN	19.9	.0394	780	38 x 25.4	160 x 500	350	12
6461	PES	MONO	MOD. SATIN	38.3	.0748	1560	63.5 x 30.5	0 x 350	310	15
6623	PES	MONO	MOD. SATIN	19.2	.0394	585	58 x 45.7	90 x 200	450	11
9661	PES	MONO	PLAIN	15.3	.0394	390	20 x 20	850 x 1000	*	42
6715	PES	MONO	MOD. SATIN	43.1	.0866	1560	63.5 x 25.4	0 x 300	200	13
6718	PES	MONO	PLAIN	35.4	.0630	890	20 x 17.8	450 x 600	220	16
6762	PES	MONO	MOD. TWILL	39.8	.0787	1115	35.5 x 17.8	200 x 600	280	18
6838	PES	MONO	PLAIN	26.5	.0551	780	20 x 18	550 x 750	460	23
6869	PES	MONO	MOD. TWILL	18.6	.0393	557	76 x 33	30 x 250	225	17
9877	PES	MONO	PLAIN	8.3	.0276	250	23 x 25	700 x 650	*	43
6912	PES	MONO	MOD. TWILL	29.5	.0669	666	73.6 x 20.3	0 x 550	300	20
6913	PES	MONO	MOD. TWILL	36.9	.0787	645	73.6 x 15.3	0 x 650	270	17
6927	PES	MONO	MOD. SATIN	50.1	.0906	1560	63.5 x 20.3	0 x 250	330	8
725570	PES	MONO	PLAIN	18.9	.0450	445	16 x 15	850 x 1100	*	36
737090	PES	MONO	TWILL	28.0	.0670	615	16 x 16	630 x 750	*	21
1035570	PES	MONO	TWILL	26.2	.0540	670	23 x 23	410 x 560	415	28

* Air Permeability in excess of 762 cfm.

INDUSTRIAL FABRICS CORPORATION
7208 Boone Avenue North · Minneapolis MN 55428
Tel (612) 535-3220 · Telex 29-0157

Bulletin No. 308 — Printed in U.S.A.

BULLETIN
E-17134

DU PONT
INDUSTRIAL SALES

IMRON®
POLYURETHANE ENAMEL

USE: A high gloss extremely durable, chemical and solvent resistant, air dry or low bake material for use on locomotives, cabooses, motorcycles, and other steel and plastic parts where high quality appearance and durability are required or where severe exposure conditions exist.

DESCRIPTION: A multi-component product consisting of a pigmented base and activator. An optional Dry Time Accelerator is also available.

% SOLIDS BY WEIGHT: 47% as mixed. (This is an average value which will vary with color selected.)

% SOLIDS BY VOLUME: 34% as mixed. (This is an average value which will vary with color selected.)

CURE: Air Dry—Tape Free: @ 77°F. 50% Rel. Humidity. 6-10 hours without accelerator. 2-4 hours with accelerator. Bake—15 minutes at 200°F. or 20 minutes at 150°F. NOTE: Since IMRON is a 2 component system, proper ratios and mixing are essential to achieve optimum cure. To test for proper cure: after 24 hours air dry or one hour after bake, rub with a cloth saturated with xylol, toluol or lacquer thinner. Paint should not dissolve and only slight color should be evident on cloth.

THEORETICAL COVERAGE: 544 sq. ft. @ 1.0 mil. (This is an average value that will vary with the color selected.)

COLORS: Full range of solid and metallic colors.

RECOMMENDED FILM THICKNESS: 1.0 to 2.0 mils depending on performance requirements.

POT LIFE: 8 hours minimum @ 70-75°F.

FLASH POINT: Below 73°F. (Closed Cup).

DIELECTRIC STRENGTH: Approximately 2 kilovolts per mil over steel, 8 kilovolts per mil over fiberglass for solid color. Metallics have much lower values.

REDUCTION RATIO: Mix three parts IMRON Polyurethane Enamel with 1 part VG-Y-259 (192S). Four ounces of VH-Y-260 (189S) Accelerator per mixed gallon can be added to increase drying rate. Material should then be thinned as required for application with T-Y-9003 Thinner to 20-22 seconds in a #2 Zahn Cup for spray application.

APPLICATION:

1. IMRON can be applied over properly primed metals or over aged paint films in good condition without sealers or intermediate coats. See your Du Pont representative for recommendations on the proper primer and/or sealer coats required. NOTE: Base coat must be clean, dry and free from dirt or chemical contamination.
2. IMRON may be applied by air or airless spray. There are also suitable modifications for brush or roller application.
3. IMRON should be reduced to application viscosity with T-Y-9003 Thinner (20 to 22 seconds in #2 Zahn Cup for spray application).
4. Clean spray equipment containing mixed material promptly with T-Y-9003. Do not leave mixed material in equipment.

RECOMMENDED SPRAY EQUIP.:

Type	Brand	Model #	Fluid & Air Nozzles	Needle	Retaining Ring
Siphon	Binks DeVilbiss	#7* MSC510*	36 × 36 SD 30	33 EX	
Pressure	Binks DeVilbiss	#7* MBC510*	33B × 33P 704	33 FX	54-704 MBC368
Airless	Nordsen	Versagun*		06C11 (.015 Restrictor)	

*or equivalent

(over)

BELT DEWATERING PRESS
MANUFACTURING COMPANY, INC

IMRON

1-Surface prep over steel
Sand blasted - SSPC-SP5-63 NACEI CSa3 White metal blast.

2-Wipe down with 3812s Enamel reducer.

3-Wipe down with 5717s metal conditioner-1 part 5717s to 2 parts water, thoroughly clean then wipe dry, let dry 10 min.

4-Wipe down with 224s without dillution, rub in for 2-5 minutes, flush off woth water, let dry.

5-Prime with color gray or red Corlar Epoxy Primer - 4 mills thickness, 2 parts primer, 1 part Activator - let stand 2 hours before priming.

6-Sand

7-Wipe with 3812s Enamel reducer.

8-Topcoat with IMRON - 4 mills thickness - 3 parts paint to 1 part Activator.

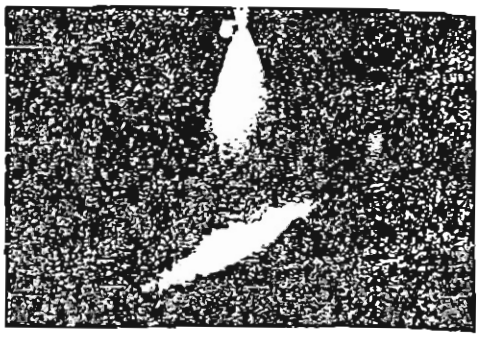
*Recommended to add 4 oz of 189s Accelerator.

Veejet. NOZZLES type H-VV

Spray Characteristics—Flat spray pattern with uniform distribution . . . tapered edges to provide pattern uniformity when adjacent sprays overlap in nozzle manifold installations.

Construction—H⅛VV and H¼VV nozzles are one-piece construction. Types H⅛VVL and H¼VVL are equipped with strainers.

Materials—Nozzles available from stock in brass or type 303 stainless steel. Strainers available in brass with Monel screen or type 303 stainless steel with type 304 stainless steel screen. See page 3 for list of other materials.



Type H⅛VV

Type H¼VV

Type H¼VVL nozzle with strainer. Also supplied as H⅛VVL nozzle with strainer

No. 12686 Strainer for H⅛VVL

No. 12687 Strainer for H¼VVL (screen and strainer body may be ordered separately). See page 40.

Veejet Nozzles are also available with female pipe connections as Type H-DT.

Type H⅛DT or Type H¼DT

HOW TO ORDER: Specify Nozzle No., Material. Example: H¼VV9502 303 Stainless Steel.

Spray Angle at 40 p.s.i.	Nozzle No. Male Pipe Connection ⅛" NPT	Nozzle No. Male Pipe Connection ¼" NPT	Equiv. Orifice Diam. Inches	CAPACITY GPM (gallons per minute) at p.s.i. (pounds per square inch) 5 p.s.i.	10 p.s.i.	20 p.s.i.	30 p.s.i.	40 p.s.i.	60 p.s.i.	80 p.s.i.	100 p.s.i.	200 p.s.i.	300 p.s.i.	500 p.s.i.	SPRAY ANGLE* 20 p.s.i.	40 p.s.i.	80 p.s.i.	200 p.s.i.
110°	H⅛VV11001	H¼VV11001	.026	.03	.05	.07	.09	.10	.12	.14	.16	.22	.27	.35	94°	110°	121°	124°
	H⅛VV110015		.031	.05	.07	.11	.13	.15	.18	.21	.24	.34	.41	.53	97°	110°	121°	124°
	H⅛VV11002	H¼VV11002	.036	.07	.10	.14	.17	.20	.25	.23	.32	.45	.55	.71	98°	110°	120°	123°
	H⅛VV11003	H¼VV11003	.043	.11	.15	.21	.26	.30	.37	.42	.47	.67	.82	1.1	99°	110°	120°	123°
	H⅛VV11004	H¼VV11004	.052	.14	.20	.28	.35	.40	.49	.57	.63	.89	1.1	1.4	100°	110°	119°	122°
		H¼VV11005	.062	.21	.30	.42	.52	.60	.73	.85	.95	1.3	1.6	2.1	101°	110°	117°	122°
		H¼VV11006	.072	.28	.40	.56	.69	.80	.98	1.1	1.3	1.8	2.2	2.8	102°	110°	117°	121°
		H¼VV11010	.078	.35	.50	.71	.86	1.0	1.2	1.4	1.6	2.2	2.7	3.5	103°	110°	117°	119°
	H⅛VV11015	H¼VV11015	.093	.53	.75	1.1	1.3	1.5	1.8	2.1	2.4	3.4	4.1	5.3	104°	110°	117°	118°
95°	H¼VV950050		.018			.035	.043	.050	.06	.07	.08	.11	.14	.18	81°	95°	105°	113°
		H¼VV9501	.026	.03	.05	.07	.09	.10	.12	.14	.16	.22	.27	.35	81°	95°	105°	113°
		H¼VV9502	.035	.07	.10	.14	.17	.20	.25	.28	.32	.45	.55	.71	82°	95°	105°	113°
		H¼VV9503	.043	.11	.15	.21	.26	.30	.37	.42	.47	.67	.82	1.1	83°	95°	104°	111°
	H⅛VV9504	H¼VV9504	.052	.14	.20	.28	.35	.40	.49	.57	.63	.89	1.1	1.4	84°	95°	103°	108°
	H⅛VV9506	H¼VV9506	.062	.21	.30	.42	.52	.60	.73	.85	.95	1.3	1.6	2.1	85°	95°	101°	105°
	H⅛VV9508	H¼VV9508	.072	.28	.40	.56	.69	.80	.98	1.1	1.3	1.8	2.2	2.8	87°	95°	100°	105°
80°	H⅛VV8000050	H¼VV8000050	.018			.035	.043	.050	.06	.07	.08	.11	.14	.18	61°	80°	95°	101°
		H¼VV8000067	.021		.03	.05	.06	.067	.08	.09	.11	.15	.18	.24	67°	80°	94°	99°
	H⅛VV8001	H¼VV8001	.026		.05	.07	.09	.10	.12	.14	.16	.22	.27	.35	68°	80°	89°	92°
	H⅛VV80015	H¼VV80015	.031		.07	.11	.13	.15	.18	.21	.24	.34	.41	.53	68°	80°	89°	92°
	H⅛VV8002	H¼VV8002	.036	.07	.10	.14	.17	.20	.25	.28	.32	.45	.55	.71	69°	80°	88°	91°
	H⅛VV8003	H¼VV8003	.043	.11	.15	.21	.26	.30	.37	.42	.47	.67	.82	1.1	70°	80°	87°	90°
	H⅛VV8004	H¼VV8004	.052	.14	.20	.28	.35	.40	.49	.57	.63	.89	1.1	1.4	71°	80°	86°	89°
	H⅛VV8005	H¼VV8005	.057	.18	.25	.35	.43	.50	.61	.71	.79	1.1	1.4	1.8	71°	80°	86°	89°
	H⅛VV8006	H¼VV8006	.062	.21	.30	.42	.52	.60	.73	.85	.95	1.3	1.6	2.1	72°	80°	85°	88°
	H⅛VV8008	H¼VV8008	.072	.28	.40	.56	.69	.80	.98	1.1	1.3	1.8	2.2	2.8	72°	80°	84°	87°
73°	H⅛VV730077	H¼VV730077	.022		.04	.06	.07	.077	.09	.11	.12	.17	.21	.27	53°	72°	86°	92°
	H⅛VV730154	H¼VV730154	.032	.05	.08	.11	.13	.154	.19	.22	.24	.34	.42	.54	55°	73°	84°	88°
		H¼VV730231	.040	.08	.12	.16	.20	.231	.28	.33	.37	.52	.63	.82	56°	73°	83°	87°
	H⅛VV730308	H¼VV730308	.045	.11	.15	.22	.27	.308	.38	.44	.49	.69	.84	1.1	58°	73°	82°	86°
		H¼VV730462	.056	.16	.23	.33	.40	.462	.57	.65	.73	1.0	1.3	1.6	60°	73°	80°	84°
	H⅛VV730770		.072	.27	.38	.54	.67	.770	.94	1.1	1.2	1.7	2.1	2.7	64°	73°	77°	82°
65°	H¼VV650057	H¼VV650057	.021		.03	.05	.06	.057	.08	.09	.11	.15	.18	.24	50°	65°	75°	81°
	H⅛VV6501	H¼VV6501	.026		.05	.07	.09	.10	.12	.14	.16	.22	.27	.35	51°	65°	74°	80°
	H⅛VV65015	H¼VV65015	.031		.07	.11	.13	.15	.18	.21	.24	.34	.41	.53	51°	65°	74°	80°
	H⅛VV6502	H¼VV6502	.036	.07	.10	.14	.17	.20	.25	.28	.32	.45	.55	.71	52°	65°	73°	79°
	H⅛VV65025		.040	.09	.13	.18	.22	.25	.31	.35	.40	.56	.68	.88	52°	65°	73°	79°
	H⅛VV6503	H¼VV6503	.043	.11	.15	.21	.26	.30	.37	.42	.47	.67	.82	1.1	53°	65°	72°	78°
	H⅛VV6504	H¼VV6504	.052	.14	.20	.28	.35	.40	.49	.57	.63	.89	1.1	1.4	53°	65°	72°	76°
	H⅛VV6505	H¼VV6505	.057	.18	.25	.35	.43	.50	.61	.71	.79	1.1	1.4	1.8	53°	65°	72°	76°
	H⅛VV6506	H¼VV6506	.062	.21	.30	.42	.52	.60	.73	.85	.95	1.3	1.6	2.1	54°	65°	72°	75°
	H⅛VV6508	H¼VV6508	.072	.28	.40	.56	.69	.80	.98	1.1	1.3	1.8	2.2	2.8	55°	65°	71°	74°
50°	H¼VV5002	H¼VV5002	.036		.10	.14	.17	.20	.25	.28	.32	.45	.55	.71	39°	50°	57°	63°
	H¼VV5003		.043	.11	.15	.21	.26	.30	.37	.42	.47	.67	.82	1.1	40°	50°	56°	62°
	H¼VV5004	H¼VV5004	.052	.14	.20	.28	.35	.40	.49	.57	.63	.89	1.1	1.4	42°	50°	56°	61°
		H¼VV5005	.057	.18	.25	.35	.43	.50	.61	.71	.79	1.1	1.4	1.8	44°	50°	56°	61°
	H⅛VV5006	H¼VV5006	.062	.21	.30	.42	.52	.60	.73	.85	.95	1.3	1.6	2.1	45°	50°	55°	60°
	H⅛VV5008	H¼VV5008	.072	.28	.40	.56	.69	.80	.98	1.1	1.3	1.8	2.2	2.8	45°	50°	56°	60°
40°	H⅛VV40015		.031			.11	.13	.15	.18	.21	.24	.34	.41	.53	27°	40°	52°	59°
	H¼VV4002	H¼VV4002	.036		.10	.14	.17	.20	.25	.28	.32	.45	.55	.71	29°	40°	51°	58°
	H⅛VV4003	H¼VV4003	.043		.15	.21	.26	.30	.37	.42	.47	.67	.82	1.1	30°	40°	50°	57°
	H⅛VV4004	H¼VV4004	.052		.20	.28	.35	.40	.49	.57	.63	.89	1.1	1.4	30°	40°	50°	56°
	H⅛VV4005	H¼VV4005	.057		.25	.35	.43	.50	.61	.71	.79	1.1	1.4	1.8	31°	40°	49°	55°
	H⅛VV4006	H¼VV4006	.062		.30	.42	.52	.60	.73	.85	.95	1.3	1.6	2.1	31°	40°	49°	55°
	H⅛VV4008	H¼VV4008	.072	.28	.40	.56	.69	.80	.98	1.1	1.3	1.8	2.2	2.8	31°	40°	47°	53°
25°	H⅛VV2501		.026			.07	.09	.10	.12	.14	.16	.22	.27	.35	14°	25°	34°	42°
	H⅛VV2502	H¼VV2502	.036			.14	.17	.20	.25	.28	.32	.45	.55	.71	15°	25°	33°	40°
	H⅛VV2503	H¼VV2503	.043			.21	.26	.30	.37	.42	.47	.67	.82	1.1	15°	25°	33°	40°
	H⅛VV2504	H¼VV2504	.052		.20	.28	.35	.40	.49	.57	.63	.89	1.1	1.4	16°	25°	32°	39°
	H⅛VV2505		.057		.25	.35	.43	.50	.61	.71	.79	1.1	1.4	1.8	16°	25°	32°	39°
	H⅛VV2506	H¼VV2506	.062		.30	.42	.52	.60	.73	.85	.95	1.3	1.6	2.1	17°	25°	31°	38°
		H¼VV2508	.072		.40	.56	.69	.80	.98	1.1	1.3	1.8	2.2	2.8	17°	25°	31°	38°
15°	H⅛VV1502		.035			.14	.17	.20	.25	.28	.32	.45	.55	.71	6°	15°	22°	27°
		H¼VV1503	.043			.21	.25	.30	.37	.42	.47	.67	.82	1.1	6°	15°	22°	27°
	H⅛VV1504	H¼VV1504	.052			.20	.35	.40	.49	.57	.63	.89	1.1	1.4	7°	15°	21°	26°
	H⅛VV1505		.057			.35	.43	.50	.61	.71	.79	1.1	1.4	1.8	7°	15°	21°	26°
	H⅛VV1506	H¼VV1506	.062			.42	.52	.60	.73	.85	.95	1.3	1.6	2.1	8°	15°	21°	26°
	H⅛VV1508	H¼VV1508	.072			.56	.69	.80	.98	1.1	1.3	1.8	2.2	2.8	9°	15°	20°	25°

*See page 5 for spray coverage information and page 40 for DIMENSIONS AND WEIGHTS.

TAB G