



## 1984-1985 CATALOG



**We know what you want. And we've got it.**

## INTRODUCTION

Trico Industries, Inc. is engaged primarily in the manufacture, marketing, and servicing of products for the petroleum industry. The products include oil well completion equipment, bolted steel tanks, subsurface sucker rod pumps and accessories, production tools, oil well servicing tools, pump shop equipment, and pumping units.

Trico products are sold through a network of over 90 field warehouses located in most petroleum-producing areas of the United States and Canada. Parts are distributed to field stores from central warehouses in Tulsa, Oklahoma, in Gardena and Cudahy, California, and in Kansas City, Kansas, to assure their availability to oil operators when needed.

Trico also has a force of qualified engineers and sales and service representatives based throughout its manufacturing and warehouse network to provide the proper products and the expert advice and service required to meet the ever changing needs and challenges of the industry.

### TRICO

Trico is one of the largest manufacturers of subsurface sucker rod pumps in the world. With the knowledge that 85% of the wells in the United States today are equipped with sucker rod pumps, Trico continues to meet the challenge of increasing demands for new pumps and for exceptional service, parts, and repair.

In addition to Monarch pumps, Trico designs, manufactures, markets, and services a comprehensive line of polished rods, polished rod liners, pony rods, sucker rods, sucker rod couplings, tubing couplings, stuffing boxes, oil well servicing tools, production tools including Page tubing anchors and drains, and crank balanced pumping units.

Trico products are available through service centers located in U.S. oil producing areas and through independent representatives worldwide. After the sale of new equipment, a large staff of trained servicemen is available 24 hours a day, every day, to keep your Trico equipment operating properly and profitably.

Since its beginning over 30 years ago, Trico's philosophy of product excellence through engineering innovation, metallurgical advances, and new manufacturing techniques has benefitted both Trico and the oilpatch. Today, the Company has a reputation for quality unexcelled in the industry.

### B & W Well Completion Equipment

B & W was founded in 1939 as a specialized manufacturer of tools for the cementation of oil well casing. The company was merged into Trico in 1981.

The successful use of their early tools led B & W to the development of

scratchers and turbulators that changed the cementing practices of the entire petroleum industry. Over the intervening years, B & W's product line was expanded to include centralizers, stop devices, floating equipment and other tools necessary for primary cementation and modern well completion operations. Among these, the exclusive B & W Kon-Kave Bow Centralizer has become the leading type in the industry.

Today, B & W's line of well completion tools and equipment includes the industry's widest selection of centralizers, scratchers, cement baskets, stop devices, and a full range of casing, and cementing equipment. Major surface equipment includes precision pipe perforating machines and pipe cleaning equipment.

Each Trico Service Center location across the United States employs a qualified crew of sales/servicemen knowledgeable in well completion technology.

### COLUMBIAN DIVISION

The Columbian Division has been a primary and respected manufacturer of bolted steel storage tanks for the industrial, petroleum, agricultural and water storage industries since 1893. Its enviable reputation has been earned through its excellent engineering and quality control. Erection crews know that when a Columbian tank arrives on site it will go up quickly and precisely.

The tanks feature Trico-Bond 478, a two component, spray-applied, factory-baked epoxy coating that has excellent corrosive resistance to a wide range of hydrocarbons, sour crude oils, brines and alkalis. Columbian is also one of the few companies offering factory-coated bolted steel tanks for dry and liquid storage applications.

The Columbian Division has also established a sales program to market bolted steel tanks in developing countries where large water storage tanks are needed, primarily for major water developments. Where skilled welders are in short supply, bolted steel tanks provide a ready solution to the erection problem. Recently Columbian furnished a number of storage tanks to the government of Abu Dhabi, several of which were designed to hold 1.2 million gallons of water, the largest bolted steel tanks ever erected.

### SUPERIOR DIVISION

The Superior Division is a diversified field construction operation serving the energy and related industries.

The Superior Division offers field construction services, primarily in California, that can provide, from initial location stake to completion, full turnkey installation and construction of a ready-to-operate production facility. Offshore construction and maintenance services are also available.

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# TRICO INDUSTRIES, INC.

Corporate Offices: 15707 South Main Street • Gardena, CA 90248 • (213) 532-9400, Telex: 67-3496

## MANUFACTURING AND MAJOR WAREHOUSES

- 15707 South Main Street, P.O. Box 108, Gardena, CA 90247 (213) 532-9400, Telex: 67-3496
- 57 Holley Avenue, Bradford, PA 16701 (814) 368-6191, Telex: 91-4409
- 5555 South Garnett Road, P.O. Box 45546 Tulsa, OK 74145 (918) 252-3525, Telex: 49-7406
- 8420 South Atlantic Avenue, Cudahy, CA 90201 (213) 773-8611, Telex: 69-1711
- 6325 Trico Lane, P.O. Box 1050, Greenville, TX 75401 (214) 455-4441
- 19706 S. Normandie Ave., Torrance, CA 90510 (213) 515-1990, Telex: 683-1233

### ARKANSAS

Magnolia ..... (501) 234-2652  
Smackover ..... (501) 725-3081

### CALIFORNIA

Bakersfield ..... (805) 327-9737  
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Gardena ..... (213) 532-9400†  
Huntington Beach ... (213) 536-4814  
Oil Center ..... (805) 399-1198  
Santa Fe Springs ... (213) 941-1211  
Santa Maria ..... (805) 925-0985  
Signal Hill ..... (213) 595-7061  
                                  (213) 595-1758  
Taft ..... (805) 763-1591  
Torrance ..... (213) 515-1990  
Ventura ..... (805) 648-1801  
                                  (805) 648-5361

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Olney ..... (618) 395-3873  
Robinson ..... (618) 544-3154†

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Arlington ..... (817) 261-6470†  
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Graham ..... (817) 549-7001  
Greenville ..... (214) 455-4441  
Hamlin ..... (915) 576-3732  
Houston ..... (713) 923-6603\*†‡  
Ira ..... (915) 573-2254  
Iraan ..... (915) 639-2800  
Kilgore ..... (214) 984-6881  
Knox City ..... (817) 658-3821  
La Grange ..... (713) 968-6448  
Luling ..... (512) 875-2435  
McCamey ..... (915) 652-3271  
Midland ..... (915) 699-5128†  
Odessa ..... (915) 332-8206  
Palestine ..... (214) 723-1540  
Pleasanton ..... (512) 569-3851  
Ranger ..... (817) 647-3726  
Sterling City ..... (915) 378-3311  
Sundown ..... (806) 229-5131  
Wichita Falls ..... (817) 767-2081  
Wickett ..... (915) 943-4411

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Cody ..... (307) 587-5563  
Douglas ..... (307) 358-2098  
Gillette ..... (307) 682-8056  
Thermopolis ..... (307) 864-3193

### CANADA

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Edmonton ..... (403) 436-0865  
Lloydminster ..... (403) 875-6284  
Macklin ..... (306) 753-2388  
Wainwright ..... (403) 842-3603

### UNITED KINGDOM

Aberdeen ..... 224-54494  
London ..... 784-51444

### SINGAPORE ..... 734-6577

\* Regional Office and Warehouse.

† Regional Office.

‡ Export Sales Office.

### COLUMBIAN DIVISION

Main Office and Manufacturing  
5400 Kansas Avenue, Kansas City, KS 66110  
(913) 621-3700, Telex: 42-6348

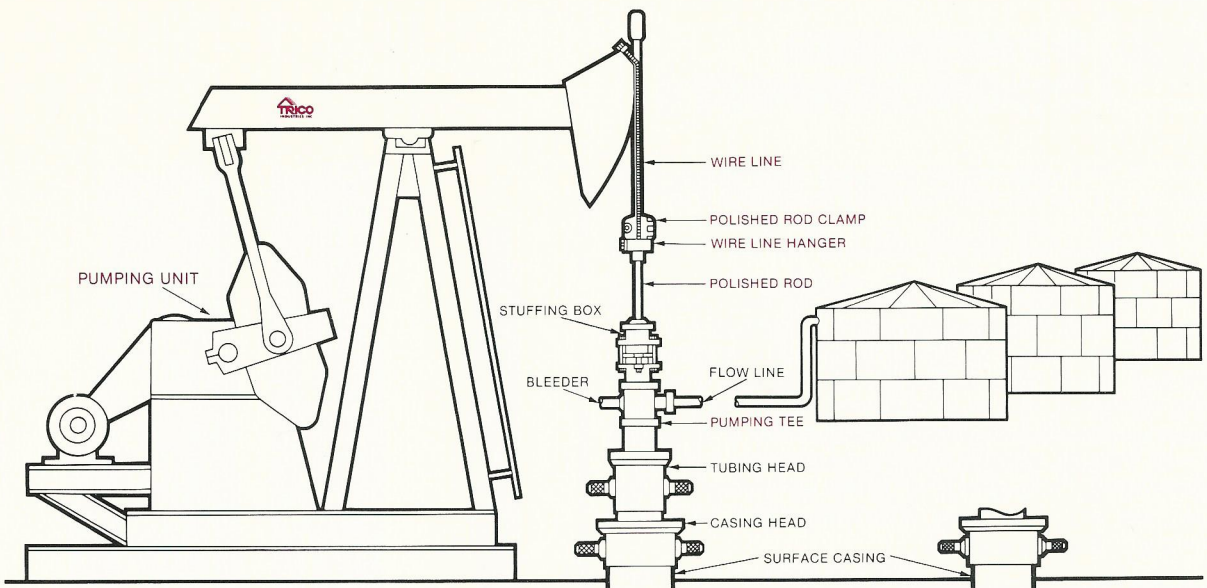
### SUPERIOR DIVISION

Main Office  
3356 Lime Avenue  
Long Beach, CA 90807  
(213) 595-0931

### Sales/Service

#### CALIFORNIA

Bakersfield ..... (805) 327-9737  
Coalinga ..... (209) 935-2340  
Long Beach ..... (213) 595-0931  
San Ardo ..... (408) 627-2408  
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**TRICO PRODUCTS**

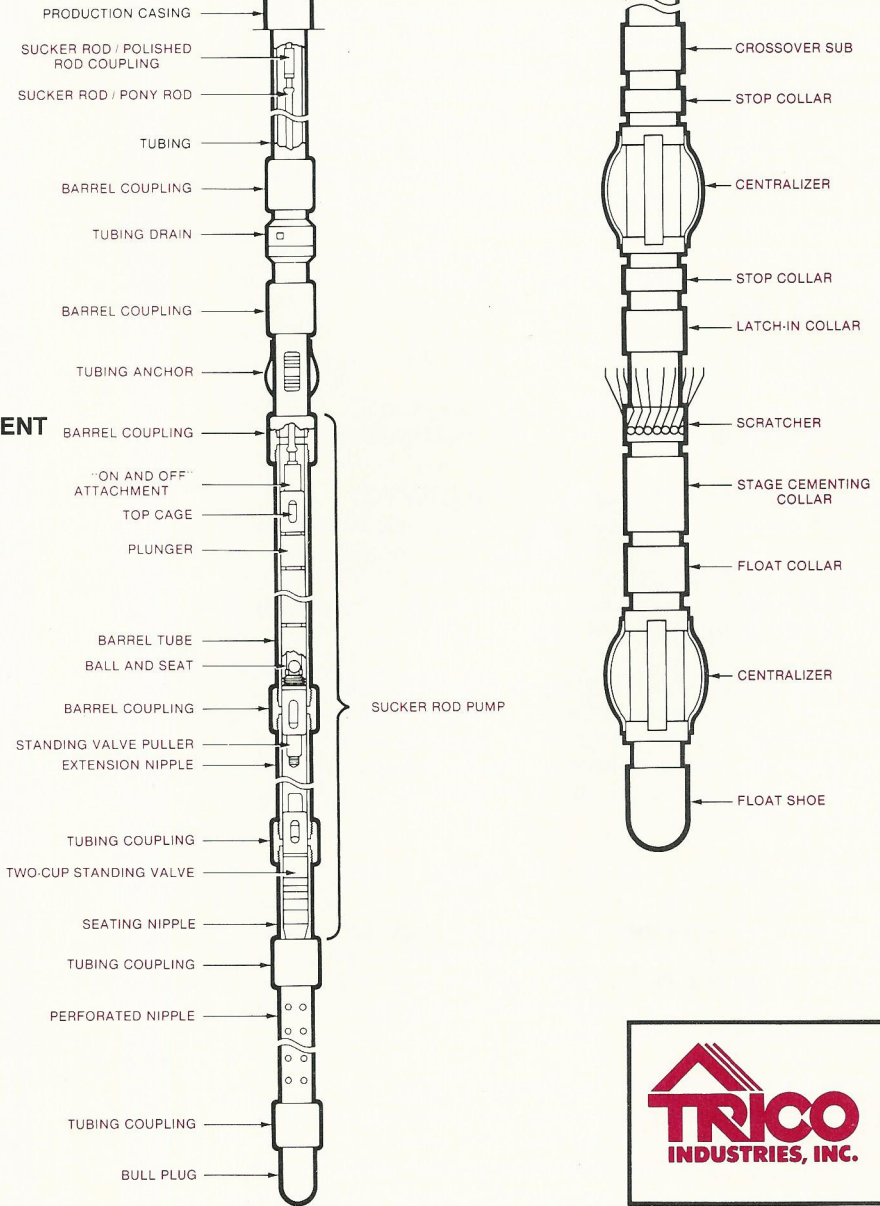
**PRODUCTION EQUIPMENT**

- Sucker rod pumps and parts
- Speciality survey tools
- Production tools
- Sucker rods
- Well service tools
- Pump shop equipment

**WELL COMPLETION EQUIPMENT**

- Centralizers
- Well completion equipment
- Floating equipment
- Tubing spider elevators

**PUMPING UNITS  
BOLTED STEEL TANKS**



15707 SOUTH MAIN STREET  
GARDENA, CALIFORNIA 90248  
(213) 532-9400 • TELEX: 67-3496



## SUCKER ROD PUMPS AND PARTS

Trico designs, manufactures, markets, and services a comprehensive line of subsurface oil well sucker rod pumps and parts, polished rods, polished rod liners, pony rods, sucker rod couplings, tubing couplings, stuffing boxes, oil well servicing tools in all conventional types and sizes, oil well production tools including Page tubing anchors and drains, crank balanced pumping units, and B & W well completion equipment. The company also manufactures pump shop equipment and sucker rod power tongs and markets bolted steel liquid storage tanks.

Trico products are available through the many sales/service/warehouse facilities located in U.S. oil producing areas and through independent representatives worldwide. And after the sale, a large staff of trained servicemen is available 24 hours a day, every day, to keep your Trico equipment operating properly and profitably.

### Subsurface Rod Pumps

Monarch subsurface rod pumps are available in every API size and type and in all materials and finishes, standard and special. As every experienced operator knows, each oil well has its own distinct personality and requires a particular type of pump assembly. Knowing which configuration will do the best job takes years of experience—Trico servicemen average 15 years each. Their ability to match pump and well for peak production equals the enviable reputation of the rugged hardware they sell and service. So no matter what you're dealing with in the way of corrosion, abrasion, gas or whatever, your Trico man will not only tell you how to handle it, he'll deliver the goods to get the job done. Fast. Give him a call.

- 24-hour-a-day service, every day of the year
- Large local inventories
- Pumps for all standard tubing and casing sizes
- Barrels and plungers for all types of well conditions

#### Traveling Thin-Wall Barrel Pump (RWTC)

The RWTC pump is recommended for moderately deep wells because internal and external pressures on the barrel tube reduce the risk of bursting over top anchored pumps. The open-type cage design used on both the traveling and standing valves results in optimum flow rates.

#### Stationary Thin-Wall Barrel Pump (RWAM)

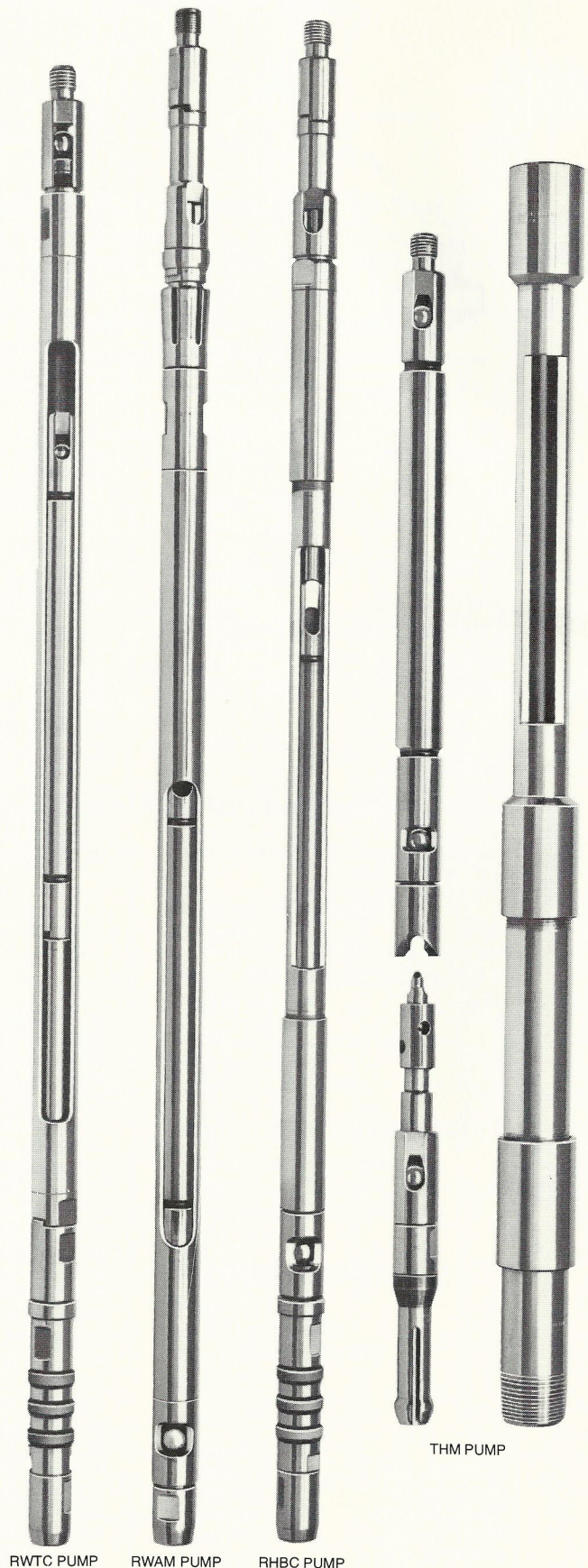
The RWAM pump is recommended for wells with a low fluid level at moderate depths. With the pump anchored and sealed at the top end, sand cannot settle between the pump barrel and tubing. Close internal spacing of the valves minimizes gas locking in gassy or foamy wells.

#### Stationary Heavy-Wall Barrel Pump (RHBC)

The RHBC pump is recommended for rugged service because of the heavy-wall stroke-through construction of the barrel tube. This feature allows even wear along the entire length of the tube. The size and location of the standing valve makes this pump ideal for low-fluid-level wells. Close internal valve spacing also minimizes gas locking problems.

#### Heavy-Wall Tubing Barrel Pump (THM)

The THM pump is recommended for hard-to-pump wells. The heavy-duty stroke-through construction, which allows the plunger to stroke out of each end of the barrel, results in even wear distribution and minimizes the entry of abrasive material between the plunger and barrel. Tubing-type pumps offer the maximum bore-to-tubing ID ratio making them capable of handling more fluid than insert pumps that can be run in the same size tubing.



RWTC PUMP

RWAM PUMP

RHBC PUMP

THM PUMP

# SUCKER ROD PUMPS AND PARTS



## Subsurface Pump Barrels

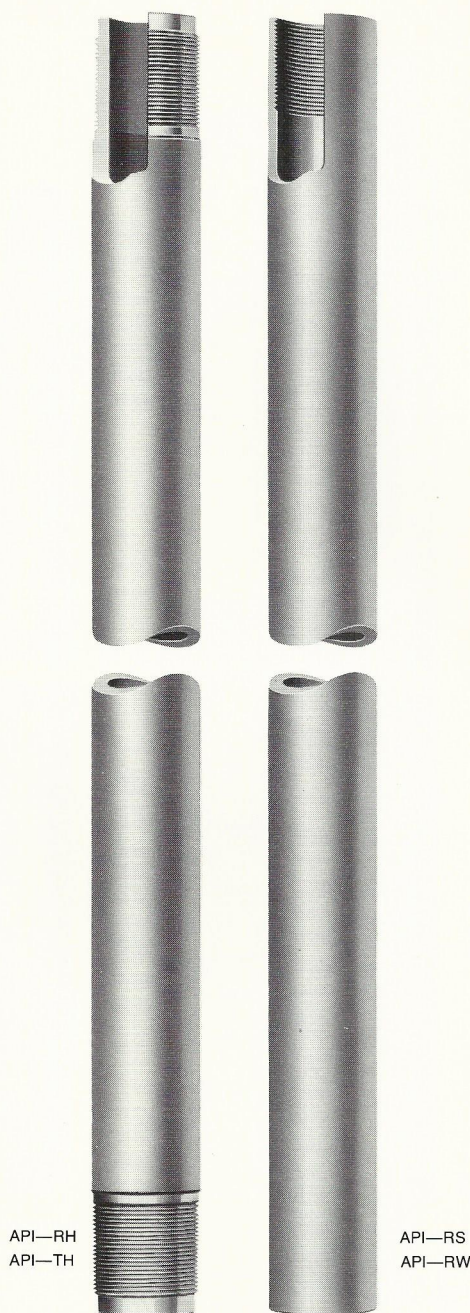
*Advances in metallurgy and manufacturing give you ...*

### Barrels with longer life in every well condition

Our subsurface pump barrels lead the field in the petroleum industry all over the world, for the best reason in the world—they do a better job. Superior control of material quality is half the story. The other half is superior control of straightness and finish. So whatever problems your well presents, you can be sure that a Monarch barrel will deliver the capabilities it promises—giving longer service itself, and promoting durability of other parts of the pump, too.

### Full range of types available

Whether your production is corrosive, abrasive, or both, there's a Monarch barrel to handle it. We make them in five basic materials: regular steel, hardened steel, chrome ID steel, bronze, and chrome ID bronze—plus some specials. They're all precision-honed to a mirror finish, and our chrome plating technique has set the industry standard. And we make them in every standard API configuration.



SUBSURFACE PUMP BARRELS

### CHEMICAL ANALYSIS

Material	% C Max.	% MN Max.	% P Max.	% S Max.	Other
Regular Steel (1030)	0.34	0.90	0.04	0.05	—
Hardened Steel (ATST 1036)	0.33	0.78	0.04	0.01	—
Admiralty Bronze (No. 443)	—	—	—	—	72.0 Cu; 27.0 Zn; 0.07 As

### APPLICATIONS

Material	Service					
	Abrasion				Corrosion	
	Low	Moderate	Severe	None	CO <sub>2</sub>	H <sub>2</sub> S
Regular Steel	X			X	X	
Hardened Steel	X	X		X	X	
Regular Steel (Chromed ID)			X	X	X	
Bronze	X			X		X
Bronze (Chromed ID)		X		X		X
Tricarb			X	X	X	X

### PHYSICAL PROPERTIES

Material	Type	Hardness Range		Tensile Strength (lb)	Yield Strength (lb)	ID Surface Treatment
		Surface	Core			
Regular Steel	1030	20-25 Rc	20-25 Rc	80,000	70,000	Precision Honed
Hardened Steel	1036	52-56 Rc	25 Rc	105,000	78,000	Precision Honed
Regular Steel (Chromed ID)	1030	69-70 Rc	25 Rc	80,000	70,000	Chrome Plated 0.003" (Precision Honed)
Bronze	Admiralty No. 443	95 Rb	95 Rb	65,000	53,000	Precision Honed
Bronze (Chromed ID)	Admiralty No. 443	69-70 Rc	95 Rb	65,000	53,000	Chrome Plated 0.003" (Precision Honed)
Tricarb	1030	72-75 Rc	20-25	80,000	70,000	Tricarb plated (Precision Honed)



## SUCKER ROD PUMPS AND PARTS

### Plungers

Monarch plungers are available in all standard API sizes and types — chrome, Mo-Hard and Mo-Hard with monel pins. The chrome units are the lowest cost plungers with a hard and high quality surface finish. The Mo-Hard, a Thermo Spray unit, is our premium plunger.

#### Series 389 Mo-Hard Plungers

**Plungers last five times longer with unique Mo-Hard finish.**

Monarch Mo-Hard plungers are made of heavy wall seamless alloy tubing, with a special high nickel hard-facing material sprayed on in a molten state. The result is a surface with a hardness of Rockwell Rc 58-60 which is up in the diamond neighborhood. That's why they stand up to abrasion and corrosion five times longer than ordinary plungers.

#### Lower lifting costs

Besides its extreme toughness, the Mo-hard surface also has a very low coefficient of friction against any kind of barrel. There's no galling, barrels last longer, and the pump runs smoother, easier, more efficiently. Pins can be nickel-plated against corrosion.

#### Standard sizes

Standard sizes are available in 1-1/4, 1-1/2, 1-3/4, 1-25/32, 2-1/4, 2-3/4, and 3-1/4 in., ground to many standard fits. Standard lengths are 2 through 6 ft.

#### Series 397 Mo-Hard Plungers with Monel Pins

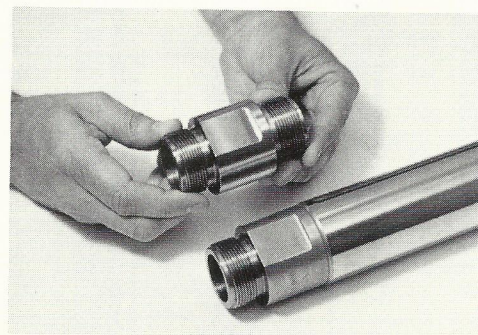
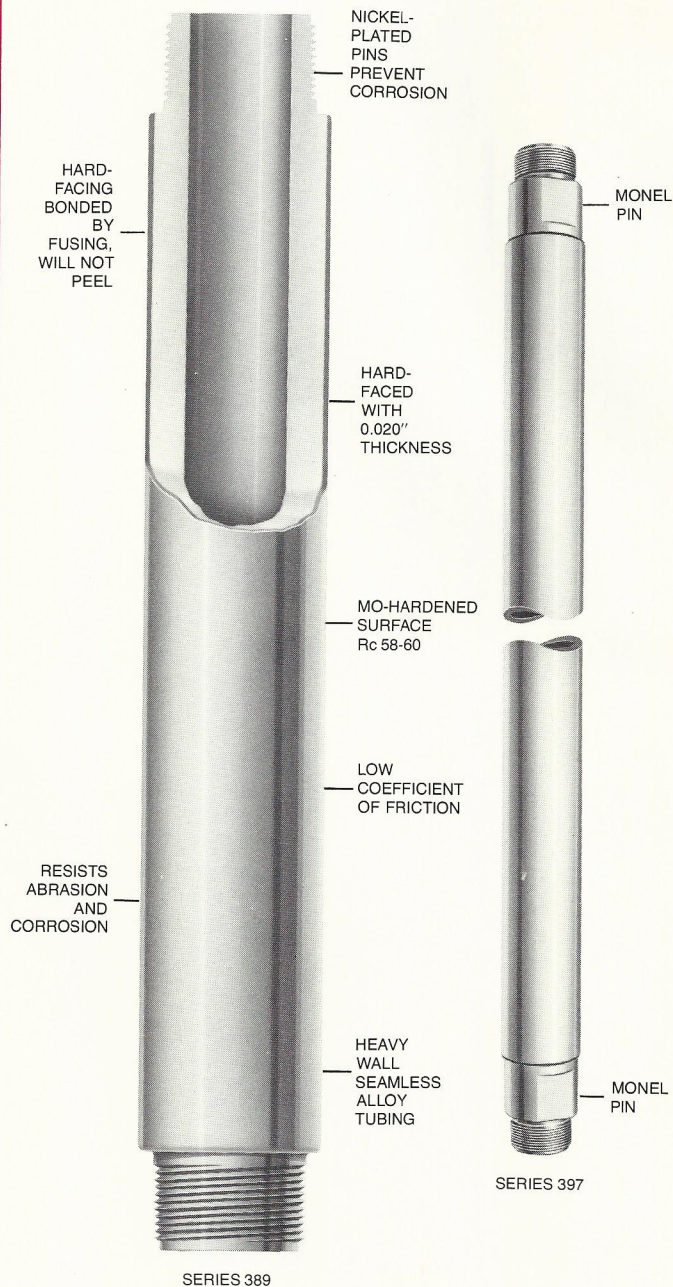
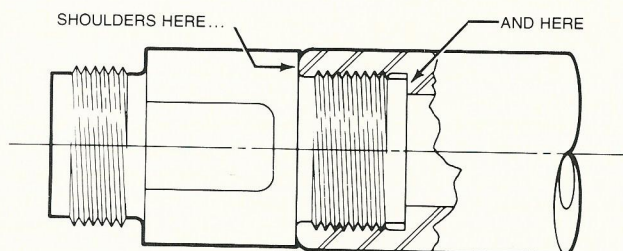
**Monel pins and super-hard finish Mo-Hard plungers give extra long life in the most corrosive wells.**

The plunger area most vulnerable to corrosion is the pin. Without protection, corrosive elements will quickly chew through the thin, threaded wall and destroy pump efficiency.

To help overcome this problem, Trico offers the Series 397 Plunger. Prior to final grind of the plunger, precision machined Monel pins, with their inherent corrosion-resistant properties are threaded into each end of the plunger and secured with a special hard seal epoxy. Box depth and pin length are kept to very close dimensional tolerances to eliminate turbulence-creating voids. This combination results in a super-hard plunger with superior abrasion and corrosion resistance *throughout its full length, including the pin.*

#### Standard sizes

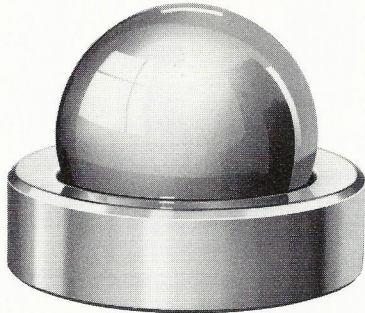
Standard sizes are available in 1-1/4, 1-1/2, 1-3/4 and 2 in. ground to any fit desired. Standard lengths are 2 through 6 ft.



MO-HARD PLUNGERS



# SUCKER ROD PUMPS AND PARTS



FLAT TYPE



RIP TYPE

BALLS AND SEATS

## Balls and Seats

When you have a critical component working thousands of feet downhole, you feel better knowing it's top quality — and when the component is a Monarch ball and seat, your feeling pays off.

### More efficiency, longer service

Our balls and seats are machined to the highest standards in the industry, so you get top performance out of your pump. And our materials and finishes meet or exceed all API requirements, so you get extra long service without problems.

### Types for all conditions

We make balls and seats in five different materials, to handle every degree of abrasion and corrosion. And we make them in a full range of standard sizes.

### Materials

**Chromard** — A relatively low priced, general purpose, ball and seat, made of special 440 stainless steel; for wells with moderate abrasion and of moderate depth.

**Super Alloy** — Superior grade stainless steel, heat treated; for deep wells.

**Hi-Krome** — High grade chromium stainless steel, hardened; non-magnetic, excellent corrosion resistance, adequate hardness. Recommended for corrosive conditions where Monel is too soft.

**Rex-Alloy** — Alloy tungsten, chromium and cobalt for severe corrosive and abrasive conditions. Non-magnetic; hardness of Rc 56-58.

**Carbide** — Tungsten carbide, sintered with cobalt binder. Best known material for extremely severe corrosion and abrasion.

## BALL AND SEAT SPECIFICATIONS

### FLAT TYPE

Seat	Super Alloy		Chromard	Rex-Alloy	Hi-Krome	Carbide	Carbide
	Ball	Stainless	Chromard	Rex-Alloy	Hi-Krome	Carbide	Stainless
1-1/4	11/16		104-D29-111				104-D26-111
1-1/4	3/4		104-D29-112	104-D28-312			104-D26-112
1-1/2	7/8	104-F15-114	104-F29-114	104-F28-314		104-D26-212	
1-1/2	15/16	104-F15-115	104-F29-115	104-F28-315		104-D26-215	104-F26-115
1-3/4	1	104-H15-116	104-H29-116	104-H28-316	104-H31-516		104-H26-116
1-3/4	1-1/8	104-H15-118	104-H29-118	104-H28-318		104-H26-218	104-H26-118
2	1-1/8	104-K15-118	104-K29-118				104-K26-118
2	1-1/4	104-K15-120	104-K29-120	104-K28-320			104-K26-120
2-1/4	1-1/4	104-M15-120	104-M29-120	104-M28-320			104-M26-120
2-1/4	1-3/8	104-M15-122	104-M29-122	104-M28-322	104-M31-522	104-M26-222	104-M26-122
2-3/4	1-1/2	104-P15-124	104-P29-124	104-P28-324			104-P26-124
2-3/4	1-11/16	104-P15-127	104-P29-127	104-P28-327			104-P26-127
3-3/4	2	104-T15-132		104-T28-332			104-P26-127

### RIB TYPE

Seat	Chromard		Rex-Alloy	Hi-Krome	Bronze	Chromard	Chromard
	Ball	Chromard	Rex-Alloy	Hi-Krome	Bronze	Bronze	Hi-Krome
1-1/2	7/8	105-F29-114	105-F28-314				105-F29-514
1-1/2	15/16	105-F29-115	105-F28-315				105-F29-515
1-3/4	1	105-H29-116	105-H28-316	105-H31-516	105-F16-415	105-F29-415	105-F29-516
1-3/4	1-1/8	105-H29-118	105-H28-318	105-H31-518	105-H16-416	105-H29-416	105-H29-516
2-1/4	1-1/4	105-M29-120		105-M31-520	105-H16-418	105-H29-418	105-H29-518
2-1/4	1-3/8	105-M29-122	105-M28-322				
2-3/4	1-1/2	105-P29-124					
2-3/4	1-11/16	105-P29-127					



# SUCKER ROD PUMPS AND PARTS

## Valve Cages

Tough basic materials, together with superior design, ensures long service with Monarch valve cages. Steel, brass and stainless cages, both open and closed, are available.

### Pump Insert Guided Cages

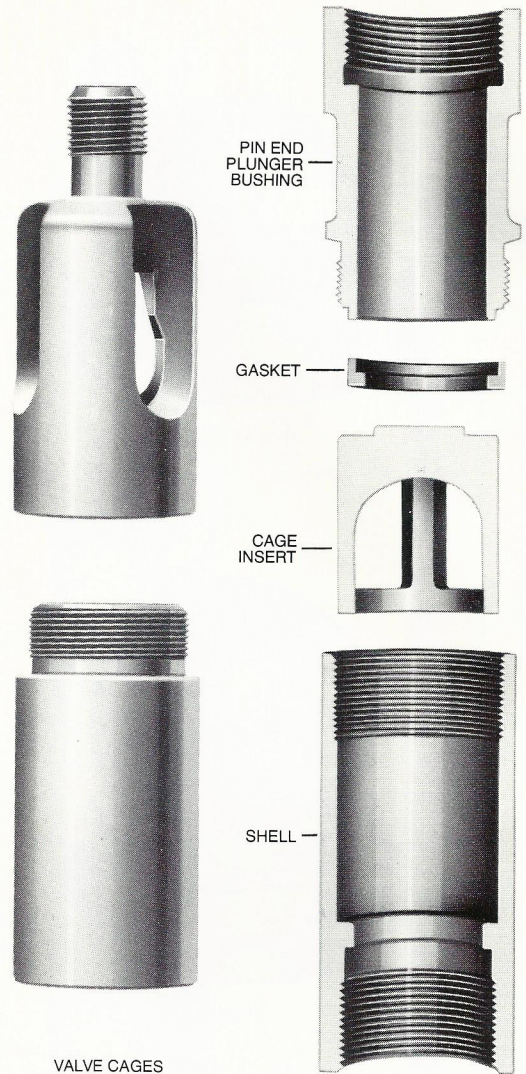
#### The most effective answer to minimize wear of critical pump cage, ball and seat

The Monarch Pump Insert Guided Cage is designed to provide longer life for pump cages and ball and seats than any conventional cage combination. Its self-centering cage insert assures a straight drop for the ball. This reduces "float-flutter" ball action and minimizes friction wear on the ball, seat and cage. Fluid passage has minimum restrictions. A special high-temperature-resistant rubber gasket cushions the insert to soften impact.

The cage insert is cast of a special cobalt alloy which has excellent corrosion and shock resistance. All sizes are designed to receive API balls. The cage shell is machined in a choice of materials—steel for normal or sandy wells and stainless steel for corrosive wells. Available in 1-1/4, 1-1/2, 1-3/4, 2, 2-1/4 and 2-3/4 in. sizes with a full range of top connections. Adaptable for all combinations as shown below.

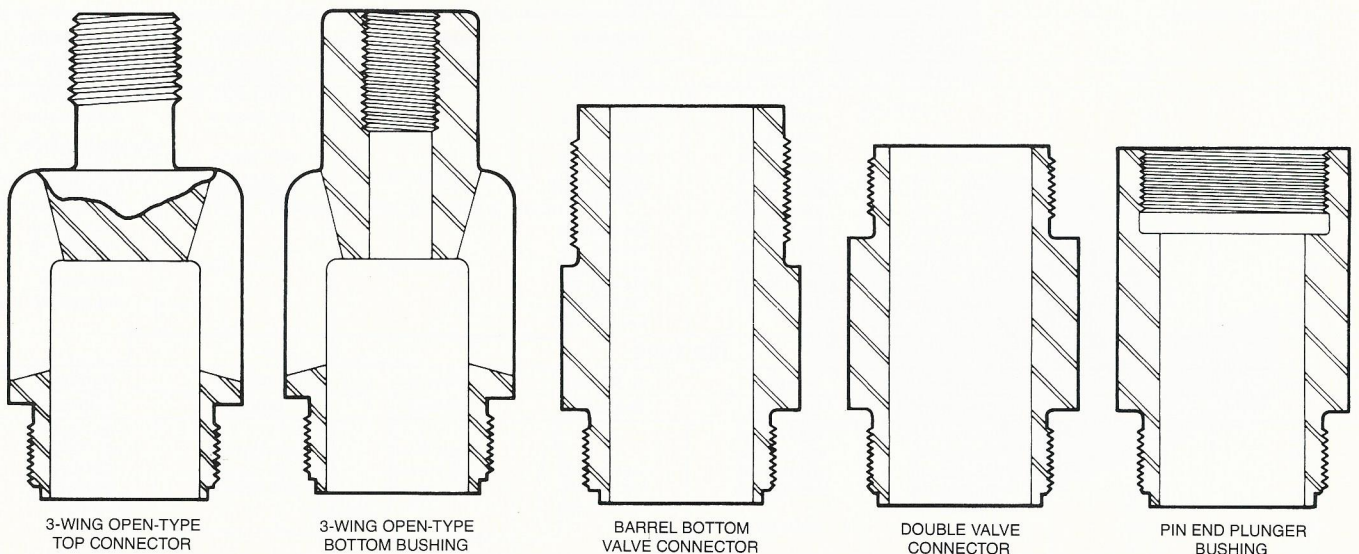
#### Adaptors for various insert cage combinations

- 3-wing open-type top connector
- 3-wing open-type bottom bushing
- Barrel bottom valve connector
- Double valve connector
- Pin end plunger bushing



PUMP INSERT GUIDED CAGE

### ADAPTORS



3-WING OPEN-TYPE TOP CONNECTOR

3-WING OPEN-TYPE BOTTOM BUSHING

BARREL BOTTOM VALVE CONNECTOR

DOUBLE VALVE CONNECTOR

PIN END PLUNGER BUSHING

# SUCKER ROD PUMPS AND PARTS

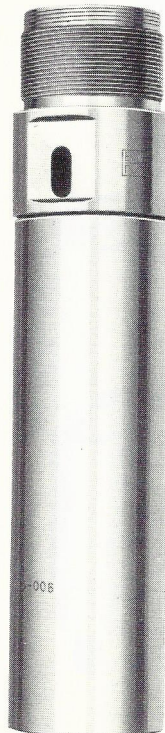


MECHANICAL  
BOTTOM LOCK  
HOLDDOWN

MECHANICAL  
TOP LOCK  
HOLDDOWN

CUP-TYPE  
HOLDDOWN

HOLDDOWNS



BOTTOM  
DISCHARGE  
VALVE

## Holddowns

### Mechanical Bottom Lock Holddown

The Monarch mechanical bottom lock holddown serves as a retrievable-type standing valve in tubing pumps, and as a bottom mechanical anchor for insert pumps. Complete assemblies are held to rigid API specifications. Unit adapts to any API mechanical bottom lock seating nipple.

### Mechanical Top Lock Holddown

The Monarch mechanical top lock holddown anchors and seals insert pumps on top. Recommended for wells with high bottom-hole pressures or high-gravity oil. API specifications are rigidly held to ensure interchangeability with all API mechanical top lock seating nipples.

### Cup-Type Holddown

The Monarch cup-type holddown seals and retains insert pumps on the top or bottom with friction cups. Recommended for wells with low bottom-hole pressures or high-gravity oil. Close component tolerances are maintained to ensure compatibility with all API seating nipples.

## Bottom Discharge Valve

### A necessity for economical pumping in many oil wells.

The Monarch Bottom Discharge Valve is designed to run on any stationary barrel, bottom anchored RWB or RHB pump. By taking approximately 20% of the produced fluid from the pumping chamber and discharging it just above the pump holddown, the bottom discharge valve: (1) eliminates "sanding-in" of the pump, (2) increases net plunger stroke, (3) reduces compression in the sucker rod string on the downstroke thereby retarding rod breaks, (4) eliminates stagnant, corrosive fluids in the "dead" annulus between the pump and tubing, (5) prevents external corrosion damage to the pump barrel and internal corrosion damage to lower portion of the production tubing, and (6) increases the life of the traveling valve cage and the ball and seat.

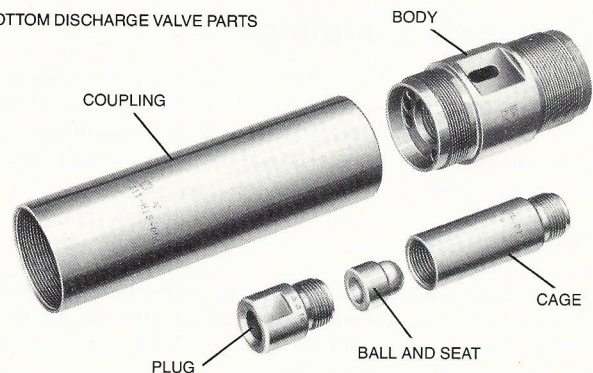
### Helps prevent gas lock

An excessive pressure drop occurs through the traveling valve at high pumping speeds. By installing a Monarch Bottom Discharge Valve, a portion of the fluid is displaced at the bottom, reducing the flow rate and pressure loss through the traveling valve. This keeps the gas in solution and aids in preventing gas lock.

### Features

- Made from stainless steel to API specifications
- Fits all RHB and RWB pumps for 2-3/8 and 2-7/8 in. tubing
- Only one special part required, others standard

### BOTTOM DISCHARGE VALVE PARTS



COUPLING

BODY

CAGE

PLUG

BALL AND SEAT



## SUCKER ROD PUMPS AND PARTS

### “Clutched” Top Seal for Bottom Lock Pumps

The “Clutched” Top Seal was designed to seal off sand, scale, or other undesirable residue which usually forms around the seat of a bottom lock plunger travel pump. By using the “Clutched” Top Seal, a rubber packer isolates that space usually open to receive sand and scale. The “Clutch” allows the make-up or break-out of sucker rods.

The rubber element is bonded onto a steel ring to minimize extrusion, to aid in releasing the rubber from the tubing wall, and to prevent the fluid from washing it away when the tool is released.

#### Positive Seal

The “Clutched” Top Seal provides a positive seal so that no pressure can reach the outside of the pump.

#### Simple Installation

The “Clutched” Top Seal is installed on any conventional bottom lock pump by inserting it between the top insert collar and the rod guide cage. The tool sets by applying the weight of the rods through the tool. To release, merely pick up the rod string and the pump.

#### “Clutched” Top Seals Complete

O.D. Size Tubing Tool Is To Be Installed In.	Pump Plunger Size
2-3/8"	1-1/16", 1-1/4", 1-1/2"
2-7/8"	1-1/2", 1-3/4", 2"
3-1/2"	2", 2-1/4", 2-1/2"

Specify 14 or 16 threads per inch.

### “Fin” Top Seal

This Fin Top Seal's design replaces the conventional Adapter with a cage and provides a larger I.D. to prevent sand, scale, etc., from settling in the tubing annulus around the barrel of the bottom lock pump. The fins on the element are flexible to prevent wear while running in the hole. The Top Seal is threaded to adapt to the Valve Rod Guide and threaded on the bottom to screw into the upper end of the pump.

#### New Fin Top Seal Complete

O.D. Size Tubing Tool Is To Be Installed In.	Pump O.D. of Special Top Seals
2-3/8" (1-1/8" I.D.)	1-1/4" O.D. Pump
2-1/2" (1-1/4" I.D.)	2-1/8" O.D. Pump
2-7/8" (1-1/8" I.D.) for 2" Pump	

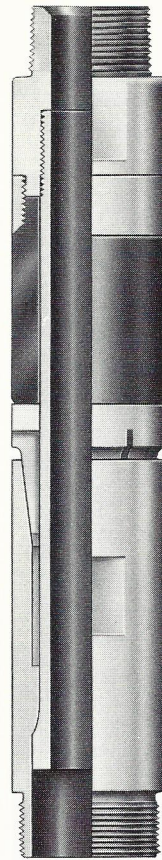
Cage shown for illustration only.  
Specify 14 or 16 threads per inch.

### Spiral Guide Couplings

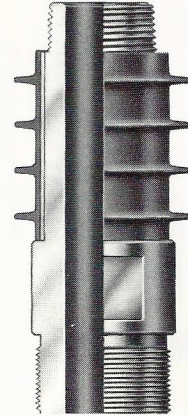
Spiral guide couplings are used to centralize sucker rods inside tubing. They are faced with a special low-friction metal spray which produces an extremely high wear and corrosion resistant surface. Available in three sucker rod thread sizes for use in 2 and 2-1/2 in. tubing.

### Valve Pullers

Trico valve pullers feature simple design, ease of replacement in the field and sure operation even under adverse pumping conditions. Available in 1-3/4, 2-1/4 and 2-3/4 in. sizes, in tap-type or mechanical Sur-Hold models.



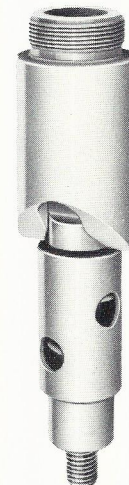
CLUTCHED TOP SEAL



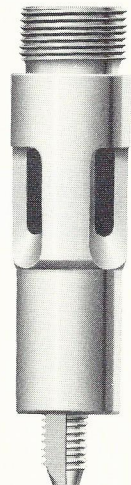
FIN TOP SEAL



SPIRAL GUIDE COUPLING



VALVE PULLERS





## SPECIALTY SURVEY TOOLS

### Crossover Assembly

The Crossover Assembly, or "Y" tool, allows downhole surveys to be taken with wireline equipment while electric submersible pumping equipment is in place and operating in the well. The "Y" tool, called so because of its unique shape, provides a piping arrangement which offsets the pump, allowing survey tools to go straight through to the bottom of the well. Surveys are recorded without disturbing the pumps' original function, even in directional wells drilled up to 75 degrees. The "Y" tool also provides a method of blanking off while the well is in a normal producing mode or while a survey is in process.

The "Y" tool is useful to production operators in a number of monitoring applications, including the location of excessive water or gas entry from undesirable subzone contributors, tracking water and gas cap movement within a production reservoir, and monitoring pressures, temperatures and fluid levels.

The Crossover Assembly has four major components:

#### Crossover

The original crossover assembly is designed to run 8-5/8 in. or larger casing on 2-7/8 in. tubing. Smaller crossover assemblies are available for operation on 7 in. -26 lb casing and 2-3/8 in. tubing. A new 3 in., 9-5/8 in. unit has also been developed to accommodate 5-1/2 in. pumps and motors and the running of 1-11/16 in. survey tools.

The crossover body is streamlined using non-upset tubing and has no internal shoulders where survey tools can hang up. The straight portion is made of heavy seamless tubing to prevent fluid cutout. Each unit, after complete assembly, is hydraulically tested for leaks to above 3000 psi. The tool incorporates a seating nipple that houses a stainless steel seating ring and is capable of accommodating different types of plugs.

#### Blanking Plug

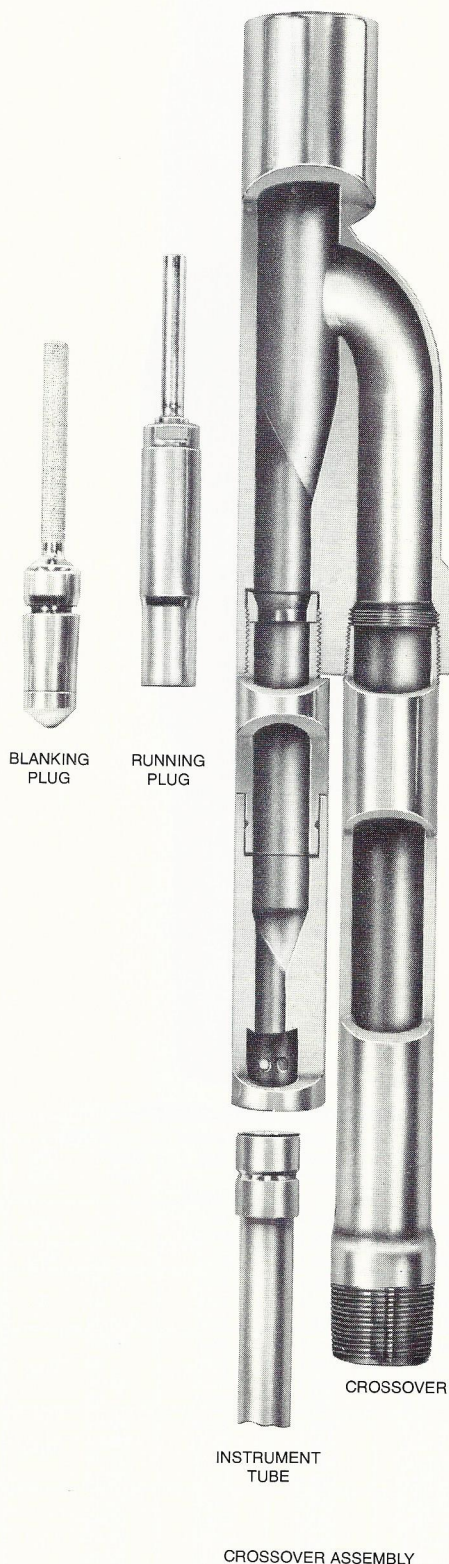
The original blanking plugs are solid and made with API top-lock rod pump parts. A flow-through type blanking plug, advantageous in many cases, is also available, again utilizing API top-lock rod pump components. Each plug assembly has a fishing neck looking up, and when seated on the seating ring, the neck protrudes past the fluid port of the crossover assembly, allowing produced fluid to keep the neck washed free of sand. The function of this plug is to blank off the instrument port section while the well is pumping normally.

#### Running Plug

The running plug is similar to the blanking plug, except that a wire or recording line can be run through it. The lines are normally 3/16 in. or 5/16 in. in size. A brass bushing in the tool functions as a stuffing box or packoff with minimum fluid bypass. To prevent the loss of survey tools should wireline separation occur during retrieving operations, an overshot is provided on the bottom of the running plug containing slips sized to catch the survey tool fishing neck. The survey tool and running plug can then be removed from their seated position by alternate means and the well returned to production after returning the blanking plug to its seated position.

#### Instrument Tube

The instrument tube connects to the crossover assembly providing a passageway for survey tools alongside the submersible pump installation and into the producing zones. There are no internal shoulders present throughout the assembly. The tube is held straight and parallel to the installation by simply clamping it to the submersible unit with steel banding clamps. The bottom of the instrument tube is cut at an angle and hangs at the bottom of the pump installation. Instrument tubes may be joined together to obtain the correct overall length.





## PRODUCTION TOOLS

### Page Mechanical Tubing Anchor/Catcher

The Page Type "B" Mechanical Tubing Anchor/Catcher prevents movement of the tubing during the pumping cycle thereby increasing pump efficiency and decreasing rod, tubing and casing wear. There are two sets of teeth — one facing up and one facing down — on each slip. This double gripping action allows the tool to be set for both anchoring and catching at the time of initial installation. When set at the proper tension, the Type "B" Anchor/Catcher will prevent the tubing and rods from falling if the tubing should part.

#### Features

- Pure mechanical operation. Sets with left-hand rotation and releases with right-hand rotation.
- Holds in tension and compression.
- Stainless steel drag springs minimize corrosion and hydrogen embrittlement problems.
- Setting threads coated for corrosion protection.
- Emergency release possible with straight upward pull.

#### Specifications

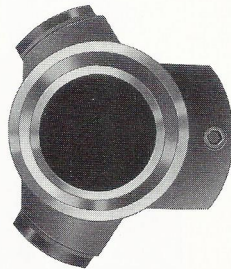
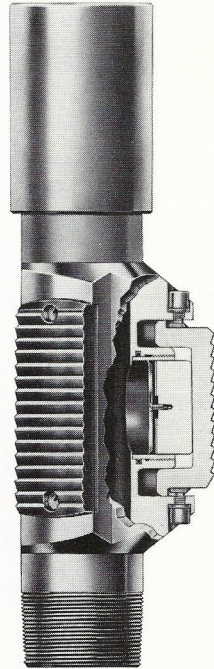
Assembly Number	Casing		Box Up Pin Down	Physical Characteristics			
	O.D. (in.)	T & C wt. (lb.)		O.D.	I.D.	Weight (lb.)	Length (in.)
				(in.)		Approximate	
06-450-05-01	4-1/2	9.5-13.5	2-3/8 EU 8 RD.	3.750	1.938	40	40
06-500-05-02	5	11.5-18	2-3/8 EU 8 RD.	3.750	1.938	40	40
06-550-05-03	5-1/2	13-23	2-3/8 EU 8 RD.	4.500	2.000	65	35
06-550-06-03	5-1/2	13-23	2-7/8 EU 8 RD.	4.500	2.375	65	35
06-600-05-09	6	18-23	2-3/8 EU 8 RD.	5.000	2.000	65	35
06-600-06-09	6	18-23	2-7/8 EU 8 RD.	5.000	2.375	65	35
06-662-05-04	6-5/8	17-32	2-3/8 EU 8 RD.	5.500	2.000	100	35
06-662-06-04	6-5/8	17-32	2-7/8 EU 8 RD.	5.500	2.437	100	30
06-662-07-06	6-5/8	17-32	3-1/2 EU 8 RD.	5.500	3.000	90	39
06-700-05-04	7	20-38	2-3/8 EU 8 RD.	5.500	2.000	100	35
06-700-06-04	7	20-38	2-7/8 EU 8 RD.	5.500	2.437	100	30
06-700-05-05	7	17-20	2-3/8 EU 8 RD.	5.500	2.000	100	35
06-700-06-05	7	17-20	2-7/8 EU 8 RD.	5.500	2.437	100	30
06-700-07-06	7	17-38	3-1/2 EU 8 RD.	5.500	3.000	90	39
06-762-05-05	7-5/8	20-39	2-3/8 EU 8 RD.	6.250	2.000	125	35
06-762-06-05	7-5/8	20-39	2-7/8 EU 8 RD.	6.250	2.437	125	30
06-862-07-07	8-5/8	24-49	3-1/2 EU 8 RD.	7.000	3.000	155	37
06-962-07-08	9-5/8	32.3-47	3-1/2 EU 8 RD.	8.000	3.000	175	37



MECHANICAL TUBING ANCHOR/CATCHER



## PRODUCTION TOOLS



TYPE "R" HYDRAULIC TENSION  
TUBING ANCHOR Top View

### Page Type "R" Hydraulic Tension Tubing Anchor

The Page Type "R" Hydraulic Tension Tubing Anchor is a completely automatic tool which utilizes the weight of the fluid column in the tubing string to power the piston in the anchor. The load reversal from the pump is the dynamic force that moves the anchor into tension.

#### Features/Advantages

- No tubing manipulation required to set anchor.
- May be pulled in activated position without damaging the casing.
- Eliminates tubing coupling and casing wear.
- Minimizes tubing thread leaks.
- Reduces frequency of tubing jobs.
- Maximum pump stroke increases pump efficiency.
- Smoothing out of reversal in pumping cycle reduces sucker rod breakage.

#### Operation

The Page Type "R" Anchor should be located in the tubing string as close to the pump as well conditions permit. Because of the generous bypass area around the anchor, it may be run into the well at any speed without damaging the tool or casing wall.

After the pump is seated and the fluid level in the tubing string becomes higher than the fluid level in the annulus, the tubing will be anchored and the anchor holding power will be proportionate to the differential of the fluid levels in the tubing and the casing annulus.

A single Page Type "R" Tubing Anchor is generally used in the deeper pumping oilwells and where an insert type pump is applied. The Type "R" Anchor is ideally positioned no farther than 60 ft. away from the pump. In shallower wells two "R" anchors may be combined to securely anchor the tubing string.

#### SPECIFICATIONS PHYSICAL CHARACTERISTICS

Assembly Number	Casing		Tubing OD (in.) EU 8RD	O.D. Slips Retracted	I.D. Anchor	Length
	OD (in.)	Weight (lb)				
01-400-05-01	4-1/2	9.5	2-3/8	4.000	1-15/16	17-1/8
01-391-05-01		11.6	2-3/8	3.906	1-15/16	17-1/8
01-391-05-01	4-3/4	16	2-3/8	3.906	1-15/16	17-1/8
01-428-05-01	5	15	2-3/8	4.281	1-15/16	17-3/8
01-419-05-01		18	2-3/8	4.172	1-15/16	17-1/8
01-441-05-01		11.5-13	2-3/8	4.406	1-15/16	17-3/8
01-469-05-01	5-1/2	14-20	2-3/8	4.688	1-15/16	17-3/8
01-463-05-01		23	2-3/8	4.625	1-15/16	17-7/8
01-469-06-01		14-20	2-7/8	4.688	2-7/16	18-1/8
01-463-05-01		23	2-7/8	4.625	2-7/16	18-1/8
01-563-05-01	6-5/8	17-28	2-3/8	5.625	1-15/16	18-7/8
01-563-06-01		17-28	2-7/8	5.625	2-7/16	19-1/4
01-579-07-01		17-24	3-1/2	5.797	2-15/16	20-1/8
01-563-07-01		24-28	3-1/2	5.625	2-15/16	20-1/8
01-606-05-01	7	17-29	2-3/8	6.060	1-15/16	18-5/8
01-588-05-01		29-35	2-3/8	5.875	1-15/16	18-5/8
01-606-06-01		17-29	2-7/8	6.060	2-7/16	18-7/8
01-588-06-01		29-35	2-7/8	5.875	2-7/16	18-7/8
01-606-07-01		20-29	3-1/2	6.060	2-15/16	20-3/8
01-617-07-01		17	3-1/2	6.170	2-15/16	20-3/8
01-577-07-01		29-38	3-1/2	5.770	2-15/16	20-3/8

Assembly Number	Casing		Tubing OD (in.) EU 8RD	O.D. Slips Retracted	I.D. Anchor	Length
	OD (in.)	Weight (lb)				
01-663-06-01	7-5/8	24-33.7	2-7/8	6.625	2-7/16	18-7/8
01-650-06-01		39	2-7/8	6.500	2-7/16	18-7/8
01-641-07-01		24-39	3-1/2	6.410	2-15/16	20-3/8
01-772-06-01	8-5/8	24-32	2-7/8	7.719	2-7/16	21-3/8
01-757-06-01		24-40	2-7/8	7.562	2-7/16	21-3/8
01-738-06-01		44-49	2-7/8	7.375	2-7/16	21-3/8
01-738-07-01		44-49	3-1/2	7.375	2-15/16	21-3/4
01-738-07-02		36-49	3-1/2	7.375	2-15/16	23-7/8
01-775-07-01		24-40	3-1/2	7.750	2-15/16	21-3/4
01-775-07-02		24-36	3-1/2	7.750	2-15/16	23-7/8
01-775-07-05	24-36	3-1/2	7.750	2-15/16	23-7/8	
01-775-09-01	36	4-1/2	7.750	3-15/16	24-1/8	
01-772-06-01	9	40-45	2-7/8	7.719	2-7/16	21-3/8
01-850-06-01	9-5/8	32.3-47	2-7/8	8.500	2-7/16	22-1/8
01-850-07-01		32.3-47	3-1/2	8.500	2-15/16	22-1/2
01-903-06-01	11-3/4	47-71	2-7/8	10.43	2-7/16	22-1/8
01-903-07-01		47-71	3-1/2	10.43	2-15/16	22-1/2



## PRODUCTION TOOLS

### Page Type "B" Hydraulic Tubing Drain

The Page Type "B" Hydraulic Tubing Drain provides a positive means of dumping the fluid in the tubing string without mechanical manipulation of the tubing. Hydraulic tubing anchors should never be run without them. Sound production practices should always include the drain as standard equipment in all pumping wells to eliminate the potential hazards associated with pulling a wet string.

#### Features/Advantages

- Drains tubing above an anchor, packer or submersible pump equipped with a check valve and pumping in a high angle or straight hole.
- Reduces pollution and fire hazard.
- Eliminates expense and wasted time of wet jobs.
- Provides a means to pump down the tubing to kill a gassy well before pulling has begun.
- Full tubing ID.

#### Operation

The Page Type "B" Drain should be installed box up x pin down at the desired depth in the tubing string. For hydrostatic head at the drain, and determination of the proper drain element, multiply .433 psi/ft x drain depth and add a 1,000 psi safety factor. Select calculated drain element or next higher drain element if calculations exceed shear pin values closest to calculated shear unit.

#### Specifications

##### Page Type "B" Hydraulic Tubing Drain

Size (In.)	Weight (lb.)	Maximum Tool OD (In.)
2-3/8	11	3-13/16
2-7/8	19	4-7/16
3-1/2	27	5-3/16
4-1/2	38	6-5/32

Shear Pressures Available (PSI)		
1,200	3,000	4,500
1,500	3,100	5,000
2,000	3,400	5,500
2,100	4,000	6,000
2,500		

### Page Type "S" Hydraulic Tubing Drain

The Page Type "S" Tubing Drain is more specialized than the Type "B" model. Its small OD makes it ideal for use in small casing. The large drain ports permit rapid draining of heavy crude. The Type "S" is furnished with multiple shear pins in order to provide the desired shearing pressure.

#### Features/Advantages

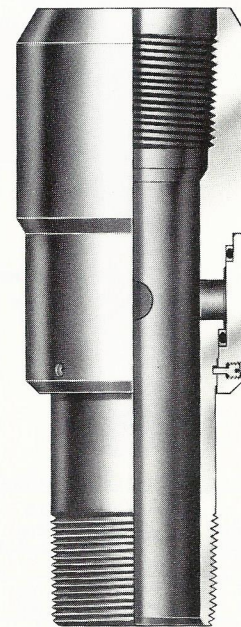
- Large drain ports for increased flow area.
- Small OD for use in small casing

#### Operation

The Page Type "S" Drain should be installed box up x pin down at the desired depth in the tubing string. For hydrostatic head at the drain, and determination of the proper drain element, multiply .433 psi/ft x drain depth and add a 1,000 psi safety factor. The pressure is equal to or should slightly exceed that value when installing shear pins. Only the required number of pins should be used to avoid over-pressuring the tubing.



TYPE "B" HYDRAULIC TUBING DRAIN



TYPE "S" HYDRAULIC TUBING DRAIN

#### Specifications

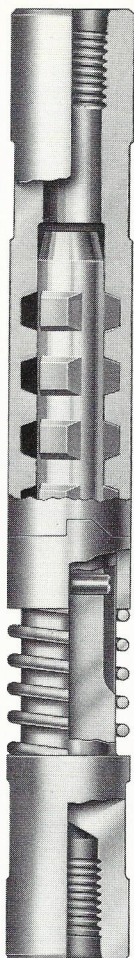
##### Page Type "S" Hydraulic Tubing Drain

Tubing OD (in.)	Tool		Port Flow Area (in. <sup>2</sup> )	Tool Length (in.)	Tool Number	Sheave Valve (p.s.i./DIN)
	OD (in.)	ID (in.)				
2-3/8	3-7/16	1-5/16	1.77	11-3/4	12-05-00-01-0	1,000
2-7/8	3-7/8	1-7/16	2.76	12	12-06-00-01-0	900
3-1/2	4-1/2	2-15/16	3.98	13-5/8	12-07-00-01-0	750





## PRODUCTION TOOLS



"ON AND OFF" ATTACHMENT

### Page "On and Off" Attachment

The Page "On and Off" Attachment is a unique, precision made tool that provides a means of getting on or off a sucker rod string at any point desired in the string. The tool is rugged and simple in design and is assembled from a minimum number of parts to reduce the possibility of failure. It is a must for all wells with tubing pumps and for wells which need frequent maintenance because of paraffin buildup.

Both the mandrel and socket section of the tool are milled with nine extra heavy lugs to help support the load and ensure long life.

#### Features/Advantages

- Fish broken rods without pulling pump.
- Operate paraffin scrapers without having to unseat pump.
- Virtually eliminate stripping jobs.
- Run pumps larger than tubing.

#### Operation

The mandrel part of the Page "On and Off" Attachment is normally run above the pump or plunger. The socket end of the tool is run on the sucker rod string. Engagement is accomplished by lowering the rod string over the mandrel, compressing the spring and then rotating 1/4 turn to lock the two sections together, counterclockwise if the tool is a right-hand release model and clockwise if a left-hand release model. NOTE: In tubing pump installations it is important to have a means of clutching or locking the plunger to permit engagement and disengagement of the tool.

The tool is released by lowering the rods, turning 1/4 turn and picking up.

#### Specifications

##### Page "On and Off" Attachment

Sucker Rod Size (in.)	Sucker Rod Box Size (in.)	Nominal Tubing ID (in.)	Tool OD (in.)
5/8	15/16	1-1/2	1-1/4
		2	1-5/8
3/4	1-1/16	2-1/2	1-13/16
		3	2-3/16
7/5	1-3/16		
3/4	1-1/16		
7/8	1-3/16		
1	1-3/8		

Heavy duty springs available for use in heavy pumping wells.



# PRODUCTION TOOLS

## Polished Rod Clamps

Titan super-grip polished rod clamps are offered in one-, two-, and three-bolt models.

Monarch Titan polished rod clamps are designed for working loads ranging from 10,000 to 40,000 lb. The unique placement of the hinge pin and bolt results in superior gripping capability. The bolts and nuts have smoothed and rounded edges for safety and are easily accessible for tightening.

Each Titan clamp is machine bored and reamed to assure exact polished rod fit with both ends precisely machined 90° to the polished hole. Clamp bodies are made of heat-treated forged steel with cadmium-plated, heat-treated bolt, washer, nut and hinge pin.

### TITAN JUNIOR (Light to Medium Duty)

Rod Size	Single Bolt		Double Bolt		Triple Bolt	
	Recommended Working Load 10,000 lb		Recommended Working Load 18,000 lb		Recommended Working Load 26,000 lb	
	Weight (lb)	Part Number	Weight (lb)	Part Number	Weight (lb)	Part Number
1-1/8	4	194-C12-050	8	194-C12-250	12	194-C12-350
1-1/4	4	194-D12-050	8	194-D12-250	12	194-D12-350
1 (Line Pipe)	4	194-A12-150	—	—	—	—

Component Parts: Bolt, Nut, and Washer—194-A12-050

### TITAN I (Medium Duty)

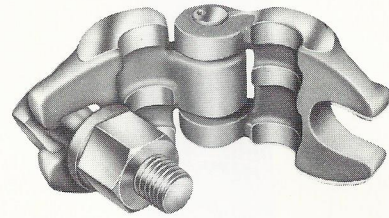
Rod Size	Single Bolt	
	Recommended Working Load 25,000 lb	
	Weight (lb)	Part Number
1-1/8	10	194-C12-100
1-1/4	10	194-D12-100

Component Parts: Bolt, Nut, and Washer—194-A12-100

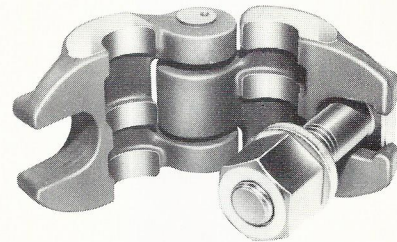
### TITAN II (Heavy Duty)

Rod Size	Double Bolt	
	Recommended Working Load 40,000 lb	
	Weight (lb)	Part Number
1-1/8	24	194-C12-200
1-1/4	24	194-D12-200
1-1/2	24	194-F12-200

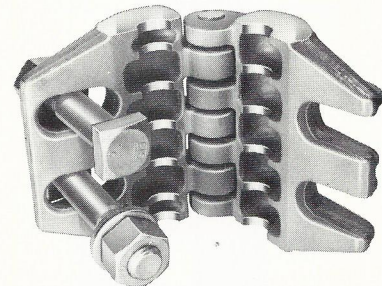
Component Parts: Bolt, Nut, and Washer (two required)—194-A12-200



TITAN JUNIOR  
(Single Bolt)

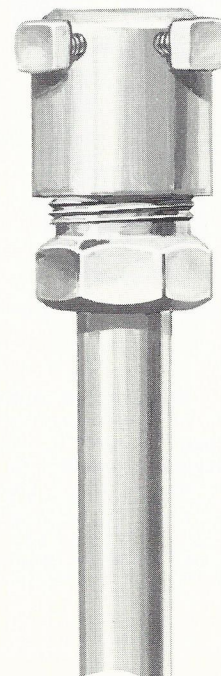


TITAN I



TITAN II

POLISHED ROD CLAMPS



## Polished Rods

The surface of Monarch polished rods is finished by a unique process that enhances a positive seal at the wellhead stuffing box. This quality finish coupled with the finest steels in the industry assures long trouble-free service.

Thermo-Sprayed rods are also available for severe service.

## Polished Rod Liners

Available in bronze and Armorcote versions.

The Monarch one piece polished rod liner eliminates the confusion which is sometimes caused by the great variety of threads found on different liner tubes. The packing head is an integral part of the liner tube. Both the tube and head are replaced as a unit.

Monarch polished rod liners are available in bronze and hard surfaced (Armorcote) versions. Bronze liners are normally supplied in 3', 3'-4'', 3'-6'', 4', 5', 6', 7', 8', 9', and 10' lengths. Armorcote units are supplied in 3', 3'-6'', 4', 5', 6', 7', 8', 9', 10', 12', 14', 16', 18' and 22' lengths.



## PRODUCTION TOOLS

### Trico Stuffing Boxes

The basic design of the Trico Stuffing Box has been proven in thousands of applications throughout the world. It has been the first choice of experienced oilmen for years and has established an enviable reputation for long-term dependable service. The unit is ideally suited for wells that tend to pump off or operate through intermittent producing periods and can be successfully operated at working pressures up to 1,500 psi. It features a free-floating lubricated upper section which assures self alignment and reduces packing burnout. Lower pack-off on the Double-Pac model allows packing changeout while under pressure.

### Vernon Stuffing Box

The Vernon Stuffing Box directs fluid pressure from the well into the molded packing element causing the packing to expand and seal off around the polished rod. This means that the packing is tight against the rod only when there is pressure on the stuffing box. Since the packing is only in tight contact during production, the packing elements last longer. It has been tested for pressures up to 3,000 lb. An oil reservoir in the race follower provides constant lubrication while pumping or heading with gas.

All standard polished rod sizes and thread combinations are available in two models: Standard and Pack-Off.

### API Pony Rods

Monarch API pony rods provide exceptional tensile strength and load factors. Their high performance ratings are the result of the prestressed skin. Control of surface decarburization also adds to their excellent uniform mechanical properties.

All Monarch pony rods are forged from special alloy steel which is normalized and tempered and manufactured to API class D specifications. Shot peening after heat treating increases fatigue strength and contributes to high endurance limits. Fully rolled, cold-formed threads assure a precise, smooth, reinforced thread structure not attainable by normal machine-cut threads.

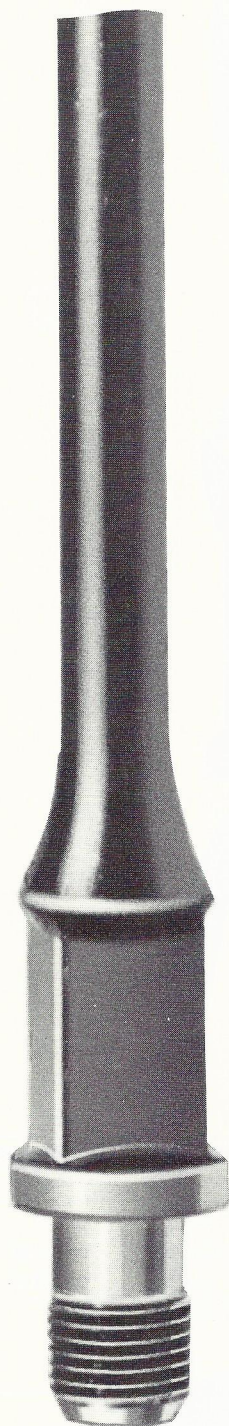
#### MECHANICAL PROPERTIES:

115,000 psi Minimum Tensile Strength

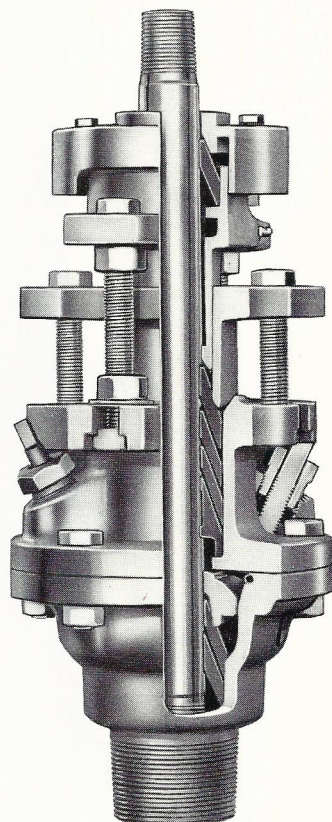
140,000 psi Maximum Tensile Strength

### Sucker Rod Couplings

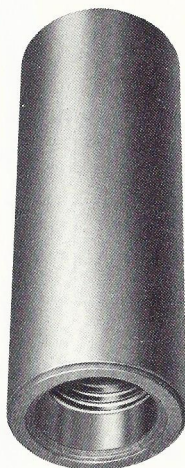
Trico sucker rod, polished rod, and sub-type couplings are available in all sizes. They are manufactured with fully rolled, cold-formed threads. A low friction metal-sprayed version is available which is highly resistant to abrasion and corrosion.



PONY ROD



TRICO DOUBLE-PAC  
STUFFING BOX



SUCKER ROD  
COUPLING



## SUCKER RODS

### Sucker Rods

Trico sucker rods are manufactured in one of the newest, most modern facilities of its type in the industry. They are of a one-piece forged double-pin construction designed to meet or exceed all new API specifications. Trico sucker rods feature fully-rolled, cold-formed threads that ensure a precise, smooth reinforced thread structure not attainable by normal machine-cut threads. Metal is displaced rather than removed and the thread root is strengthened by the resultant cold working. Trico rods are cleaned by shot blasting to remove any scale or oxidation and then liberally coated with rust inhibitors and carefully racked in bundles to ensure safe transport and handling.

#### Trico Grade C11 (API Class C) Sucker Rod

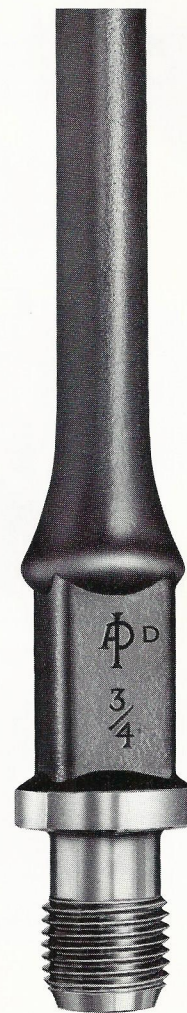
The C11 rod is designed for light to medium load applications in wells not known to be corrosive. It is manufactured to API specifications from high grade carbon-manganese AISI C-1036 steel which is fully-normalized and then shot blasted after heat treating. Available in 25 and 30 ft lengths in 5/8, 3/4, 7/8 and 1 in. sizes. Each rod is furnished with one API Class T Sucker Rod Coupling.

#### Trico Grade D61 (API Class D) Sucker Rod

The D61 is a low alloy carbon-manganese-chromium-molybdenum rod with high tensile strength recommended for heavy load applications in noncorrosive wells. It is manufactured to API specifications from AISI 4142H steel which is fully normalized, tempered and then shot blasted after heat treating. Available in 25 and 30 ft lengths in 5/8, 3/4, 7/8 and 1 in. sizes. Each rod is furnished with one API Class T Sucker Rod Coupling.

#### Trico Grade K65 (API Class K) Sucker Rod

The K65 is a nickel-molybdenum alloy rod recommended for light to medium load applications in mild corrosive or inhibited corrosive environments. It is manufactured to API specifications from AISI A-4621 steel which is fully normalized, tempered and then shot blasted after heat treating. Available in 25 and 30 ft lengths in 5/8, 3/4, 7/8 and 1 in. sizes. Each rod is furnished with one API Class T Sucker Rod Coupling.



SUCKER ROD

#### CHEMICAL ANALYSIS OF SUCKER RODS

Grade	Carbon	Manganese	Phosphorus	Sulphur	Silicon	Nickel	Chromium	Molybdenum
	Percent							
C11	0.30-0.37	1.20-1.50	0.04 Max.	0.05 Max	0.15-0.30	—	—	—
D61	0.39-0.46	0.65-1.10	0.04 Max.	0.04 Max	0.20-0.35	—	0.75-1.20	0.15-0.25
K65	0.18-0.23	0.70-0.90	0.04 Max	0.04 Max	0.20-0.35	1.65-2.00	—	0.20-0.30

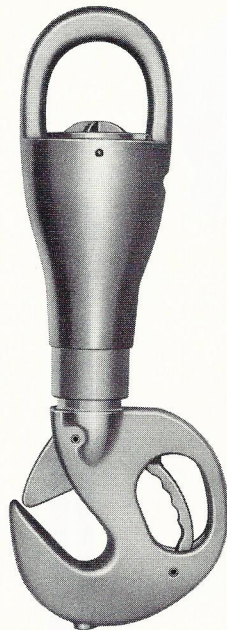
#### MECHANICAL PROPERTIES OF SUCKER RODS

Grade	Yield Strength (1000 psi)	Tensile Strength (1000 psi)	Elongation in 8 inches (%)	Reduction in Area (%)	Izod Impact (ft-lb)	Brinell Hardness	Heat Treatment
C11	60/75	90/105	18-23	50-65	60-90	190-205	Normalized
D61	100/115	115/140	10-15	50-65	45-65	241-280	Normalized & Tempered
K65	68/80	85/100	18-25	60-70	90-105	175-207	Normalized & Tempered



## WELL SERVICE TOOLS

### Rod Hooks



SNAP-IN SPRING LIFT  
ROD HOOK

Monarch rod hooks are designed for operating speed and safety. They feature a special snap-in latch mechanism which permits the elevator bail to enter the hook opening without the latch being released by the operator. When the elevator bail is engaged the hook spring automatically forces the latch to a locked position, holding the elevator secure until released. The latch spring is enclosed in a housing to prevent fouling. Monarch rod hooks are made of forged high-grade steel, heat treated for long life.

Both the short Snap-In Rod Hook (33 lb) and long Snap-In Spring Lift Rod Hook (55 lb) have a safe working capacity of 35,000 lb.

#### Snap-in Spring Lift Rod Hook

The Monarch Snap-In Spring Lift Rod Hook has an extra long shank containing a heavy coil spring which supports the section of rods being pulled. The spring protects the rod threads while the rods are being removed from the tubing. The additional weight of this hook assists in unspooling the line from the pulling unit. Overall length is 23 in. Hook opening is 1-7/8 in. To order this hook, specify Part No. 554-578-800.

#### Snap-in Rod Hook

The Monarch Snap-In Rod Hook has a standard shaft length and an overall length of 18-1/2 in. Hook opening is 1-7/8 in. Order Part No. 554-578-600 for hook, complete.

### Elevators

The Monarch line of elevators is unsurpassed in strength, ease of operation, and safety. Each of the three models feature interchangeable heat treated steel plates which allow quick conversion of the basic elevator bodies to various rod or pipe sizes. Additional savings are realized because worn plates can be replaced instead of replacing the entire elevator.

#### Super Lift-A Rod Elevator

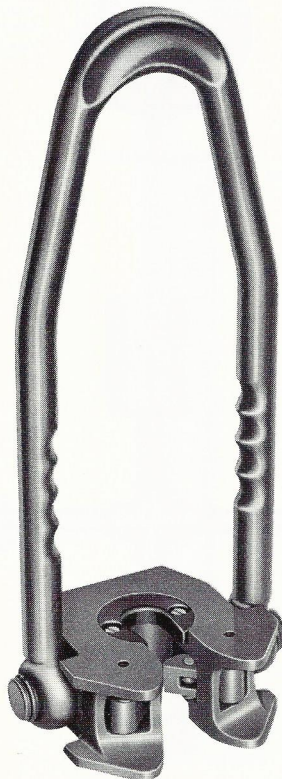
Interchangeable rod plates are of hardened steel and give you the economy of adapting the elevator for 1/2, 5/8 and 3/4, 3/4 and 7/8, and 1 in. rods. All parts are fabricated from high grade steel. The basic elevator design provides excellent balance and non-tilt performance. Large access to the front and rear release levers assures easy, safe latching and unlatching. Long bails (19 in.) provide free action for sub elevators.

#### Super Lift-A Pipe Elevator

A Super Lift-A Pipe Elevator has all the features of the Super Lift-A Rod Elevator plus a special bore and seat to handle 1 in. regular pipe. Furnished with rear release levers only and 19 in. bails. Solid body elevators are available upon request.

#### Bantam-C Rod Elevator

The Bantam model offers the same basic strength, operating ease and safety as the Super Lift-A elevator. Interchangeable plates accommodate 1/2, 5/8, and 5/8 and 3/4 in. rods. Its one piece body with trunnion pins provides good balance under load, minimizing the possibility of kinking or distortion of the rods. Double latches (front and rear) add to safety (each is capable of holding the rods independently). Bail length is 16 in.



SUPER LIFT-A PIPE  
ELEVATOR



## WELL SERVICE TOOLS

### Sucker Rod Wrenches

#### Rod Buster

The Monarch snap-action Rod Buster Sucker Rod Wrench is made of high-grade alloy steel, hardened to resist wear. This lightweight (6 lb) rugged tool is excellent for manual makeup and breakout of sucker rod joints. It features a counterbalanced grip to reduce fatigue. The cross-section of the handle is oval which provides a natural resistance to the wrench spinning when gripped. The head is spring-loaded and a hardened steel bushing is provided between the wrench head and handle. Three sizes are available: Part No. 555-560-000 for 5/8 in. API rods, Part No. 555-560-050 for 3/4 and 7/8 in. API rods, and Part No. 555-560-075 for 1 in. API rods. There is no wear on the rivet during wrench use. Small part repair kits are available for the Rod Buster wrench.

#### Spin Wrench

The Monarch Sucker Rod Spin Wrench is a one piece tool manufactured from high tensile strength alloy steel. The wrench opening fits the square on sucker rods and is accurately machined to exact size. The tool is designed for perfect balance to reduce user fatigue. The spin wrench is available in two sizes: Part No. 555-559-500 is furnished for 5/8 in. API rods and Part No. 555-559-600 is used on 3/4 and 7/8 in. API rods.

#### Paraffin Knife

A proven paraffin-removing feature makes the Monarch paraffin knife a rugged, yet flexible tool. The units are available in the following sizes:

- 1-1/2 in. Paraffin Knife complete with 5/8 in. API pin (Part No. 556-792-400)
- 2 in. Paraffin Knife complete with 5/8 in. API pin (Part No. 556-792-600)
- 2 in. Paraffin Knife complete with 3/4 in. API pin (Part No. 556-793-000)
- 2-1/2 in. Paraffin Knife complete with 3/4 in. API pin (Part No. 556-792-700)

Replaceable scraper disks are also available for 1-1/2, 2-1/16, 2-3/8, and 2-7/8 in. tubing.

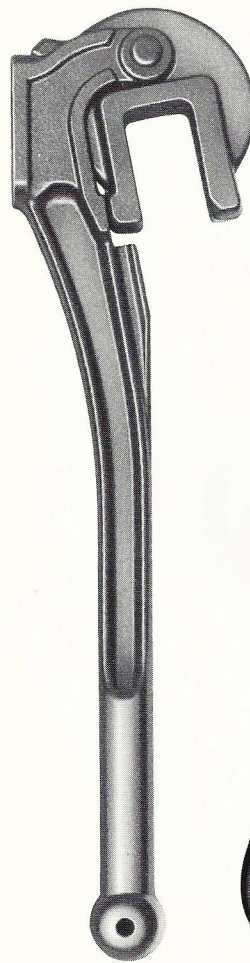
#### Tap and Die Sets

These handy Monarch tools are available in combination or single rod size models and provide an on-the-spot thread chaser for use on all well servicing units. They allow you to repair rod threads and couplings in the field by setting correct factory thread pitch and contact area.

The combination models provide two taps and two dies in one tool. Three models are available: Part No. 556-786-010 for 5/8 and 3/4 in. API threads, Part No. 556-786-020 for 3/4 and 7/8 in. API threads, and Part No. 556-786-030 for 7/8 and 1 in. API threads.

In producing areas where a single sucker rod size is most common, single size tap and die tools are available. These units come in a choice of 5/8, 3/4, 7/8, or 1 in. API.

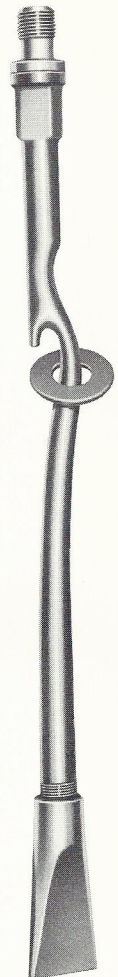
All Monarch tap and die tools are made of high quality hardened steel. They are not designed to cut new threads.



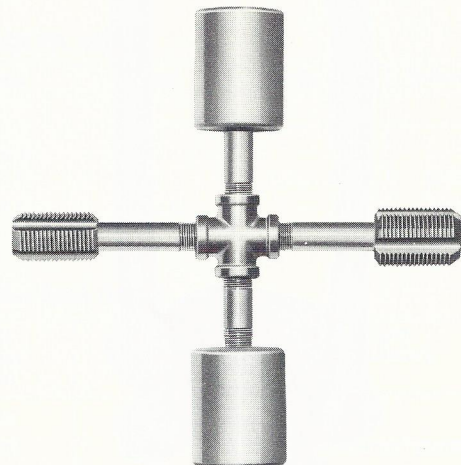
ROD BUSTER  
SUCKER ROD WRENCH



SPIN WRENCH



PARAFFIN KNIFE



COMBINATION TAP  
AND DIE SET



## WELL SERVICE TOOLS

### Sucker Rod Sockets

#### Reversible-Type Sucker Rod Socket

The Monarch Reversible-Type Sucker Rod Socket is a combination slip socket for retrieving sucker rods, polished rods, and sucker rod couplings (except hard surfaced couplings). Each socket is fitted with a reversible slip unit which has reverse wickers in each end. When fishing for couplings, the large ID end of the reversible slip is run in the down position. For fishing rods alone, the slip unit is reversed. The large ID end of the slips will catch two different sizes of boxes, while the other end will catch two different size of rods. The slip units are held in place by control rings. Regular sockets, available to run in either 2 or 2-1/2 in. tubing, are capable of fishing varied rod and coupling sizes. When ordering, specify the rod and coupling sizes to be retrieved.



REVERSIBLE-TYPE SUCKER ROD SOCKET



COMBINATION SLEEVE-TYPE SUCKER ROD SOCKET



COMBINATION SNAPOVER SOCKET

#### Combination Sleeve-Type Sucker Rod Socket

The Combination Sleeve-Type Sucker Rod Socket is designed for fishing rod body breaks and rod couplings. It has an upper bowl fitted with rod slips suitable for catching two different size rods, and a lower bowl fitted with a single end slip unit, designed to engage and catch one size sucker rod coupling.

Regular sockets are available to run in either 2 or 2-1/2 in. tubing. These units are capable of fishing varied rod coupling sizes. When ordering, specify the rod and coupling sizes to be retrieved.

#### Combination Snapover Socket

The patented Monarch Combination Snapover Socket is designed to catch hardened couplings which cannot be engaged with wickered slips. An expansion snap ring, seated on the shoulder within the bowl, is held in place by a combination sleeve and inner bowl. The hardened coupling enters the bowl, and the ring is forced over the coupling and snaps into position beneath the shoulder on the coupling.

The combination sleeve and inner bowl is fitted with a set of wickered rod slips made to catch two different size rods. Expansion snap rings are furnished to fit standard couplings, and are inserted and removed through the top of the bowl. Both regular and oversize sockets are available to run in either 2 or 2-1/2 in. tubing. These units are capable of fishing varied rod and coupling sizes. When ordering, specify the rod and coupling sizes to be retrieved.



## WELL SERVICE TOOLS

### Little Giant Sucker Rod Socket

The Little Giant Sucker Rod Socket is a combination socket for running inside tubing and catching rods (not including boxes). It is also used for running inside a working barrel with corresponding size tubing. Regular sockets are available to run in 2 in. tubing. These units are capable of fishing varied rod sizes. When ordering, specify the rod size to be retrieved.

### Slim Hole Little Giant Sucker Rod Socket

The Slim Hole Little Giant Sucker Rod Socket is fitted with conventional wickered slips for catching rod breaks in 1-1/2 in. tubing, but it will not catch couplings. Socket assembly with 5/8 in. API pin is Part No. 552-568-400. Slips are provided to catch 1/2 or 5/8 in. rods.

### Slim Hole Combination Snapover Socket

The Slim Hole Combination Snapover Socket contains an expansion snap ring for catching hardened couplings (which cannot be engaged with wickers).

The upper portion contains conventional wickered slips for catching rods. Regular sockets are available to run in 2 in. tubing. These units are capable of fishing varied rod and coupling sizes. When ordering, specify the rod and coupling sizes to be retrieved.

### Mousetrap Sucker Rod Socket

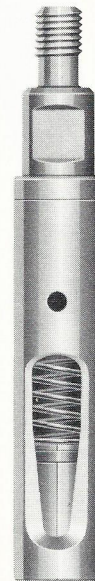
The Mousetrap Sucker Rod Socket is employed when other fishing tools have been unsuccessful. We recommend that it be used to fish no more than 3,000 ft of sucker rods at any one time. The 2 in. socket cannot be used if the rod break is 16 in. or more above the coupling (in the rod string), because it would be impossible for the rod to pass the sucker rod connection on top of the mousetrap.

The regular 2-1/2 in. socket (Part No. 552-520-100) is used to catch 1-3/16 in. OD couplings in 2-1/2 in. tubing.

### Swivel Rope Socket

Swivel Rope Sockets are used to connect the wireline to the sinker bar for swabbing. The swivel permits free turning of the swab under load. Sockets are furnished in two sizes, 1-3/8 in. and 1-3/4 in. OD for wire rope up to 7/8 in. diameter. The 1-3/4 in. OD is available with API sucker rod box sizes for 5/8, 3/4, and 7/8 in. sucker rod pins, 1-3/8 in. OD with 5/8 in. box.

The 1-3/4 in. OD socket is made with a 1-3/8 in. OD x 4 in. long fishing neck on the upper half of the socket. The 1-3/8 in. OD socket has a 1-1/8 in. OD x 1-1/2 in. long fishing neck on the upper half of the socket. The 1-3/8 in. OD socket has a 1-1/8 in. OD x 1-1/2 in. long fishing neck. The 1-3/8 in. socket complete is specified as Part No. 556-578-310. The 1-3/4 in. socket complete is Part No. 556-578-300.



LITTLE GIANT  
SUCKER ROD  
SOCKET



SLIM HOLE  
LITTLE GIANT  
SUCKER ROD  
SOCKET



SLIM HOLE  
COMBINATION  
SNAPOVER  
SOCKET



MOUSETRAP  
SUCKER  
ROD SOCKET



SWIVEL ROPE  
SOCKET





## WELL SERVICE TOOLS

### Super Sucker Rod Power Tong

Specifically designed to rapidly makeup and breakout 5/8 to 1-1/8 in. sucker rods, the SSR Power Tong from Trico features optional operator-controlled torque adjustments at the tool, a direct-reading torque gauge, tandem control locations and a gear-type hydraulic drive.

With the rugged construction you've come to expect from Trico, the SSR Power Tong applies consistent torque to each coupling in the rod string—from the first to the last joint—quickly and easily.

The upper and lower gear cases are constructed of high-strength flat plate with replaceable bearing housings. Frame tie bolts utilize a "thru-bolt" design to eliminate threads in the gear case members and this, combined with the all-spur gear drive mechanism, results in a compact, reliable tool that sets a new standard in sucker rod power tongs.

#### Specifications

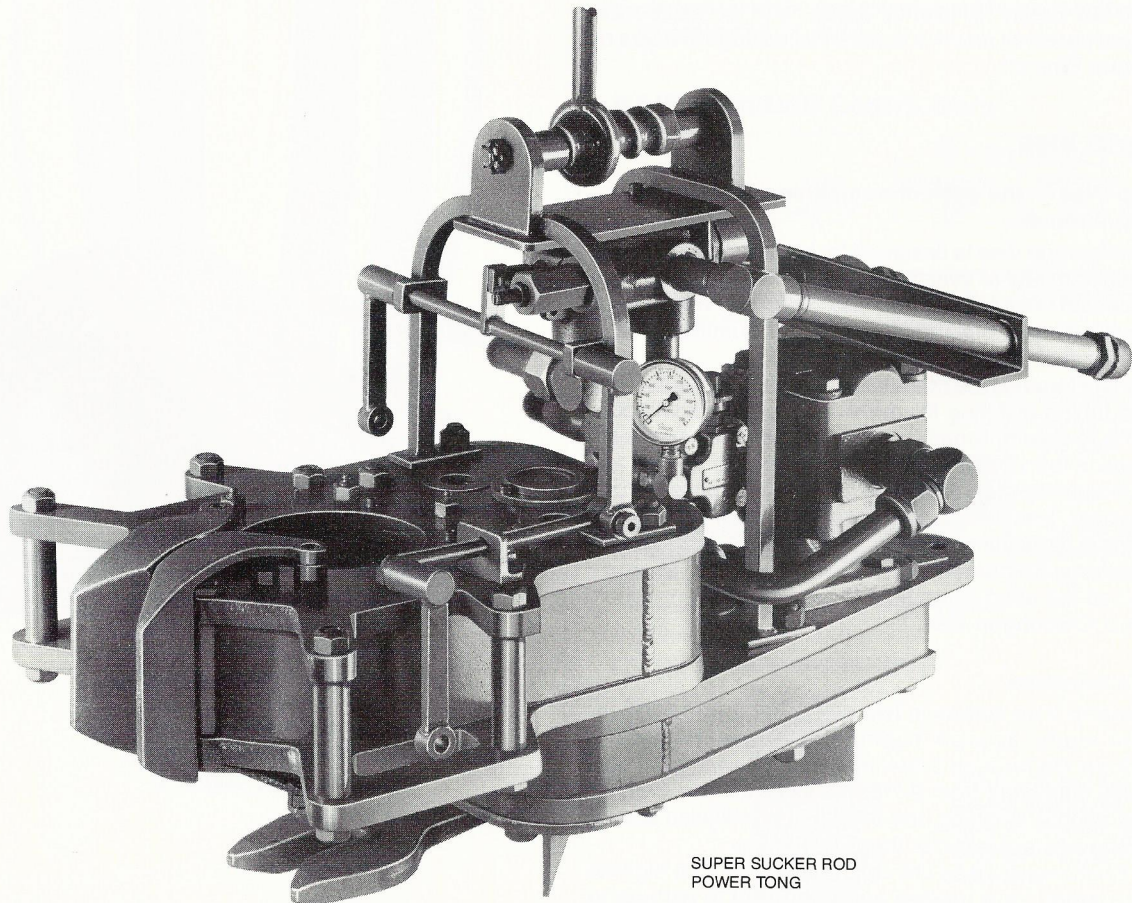
Size Range .....	5/8 to 1-1/8 in.
Length .....	34 in.
Width .....	16 in.
Height .....	27-1/2 in.
Weight .....	350 lb

#### Features

- One year warranty
- Variable speed control
- Torque adjustable at tool
- Direct-reading torque gauge
- Single-lever reversing
- Tandem control locations
- Conversion from makeup to breakout in seconds
- Spring-loaded safety gates
- Spur gear hydraulic drive
- Replaceable steel bearing housings
- Compact, rugged construction
- Easy model conversion

#### Performance Characteristics

Model	Maximum Torque (ft-lb)	Supply Pressure (2000 psi)
		Maximum rpm @ 40 gpm
DASH 1	1210	160
DASH 2	1560	130
DASH 3	1910	100
DASH 4	2240	90



SUPER SUCKER ROD  
POWER TONG



## PUMP SHOP EQUIPMENT

### Pump Shop Equipment

Monarch manufactures a complete line of pump shop equipment including horizontal and vertical storage racks, heavy duty part carts, wash tanks, pump repair stands and benches, bore gauges, and friction wrenches and vises.

#### Frictiongrip Wrench

The Trico Frictiongrip Wrench is designed for use on smooth surfaces of pipe, tubing, piston rods, pump barrels, shafts, fittings, and all cylindrical objects where distortion, teeth marks or scratched surfaces must be avoided. The jaws have smooth surfaces that completely encircle the object they grip preventing crushing or marring of the surface. One jaw is spring-loaded, which provides an instant, non-slip grip and a perfect ratcheting action.

The Frictiongrip Wrench has another important advantage when fittings or threaded connections are made up or broken loose. Because no distortion or crushing occurs between the male and female threads, additional friction is not introduced into the connection. This permits makeup or breakout with minimum effort and allows the user to "feel" when a fitting is made up to the correct torque.

#### Rugged construction

Trico Frictiongrip Wrenches are drop forged from quality alloy steel, hardened and tempered to withstand rugged field service. The I-beam-type handle provides a secure grip with maximum strength and low weight. Efficiency, safety, and the assurance of undamaged parts will result in substantial savings to users of the Frictiongrip Wrench.

#### Frictiongrip Vise

**Frictiongrip Vise ... the perfect companion for Trico's Frictiongrip Wrench.**

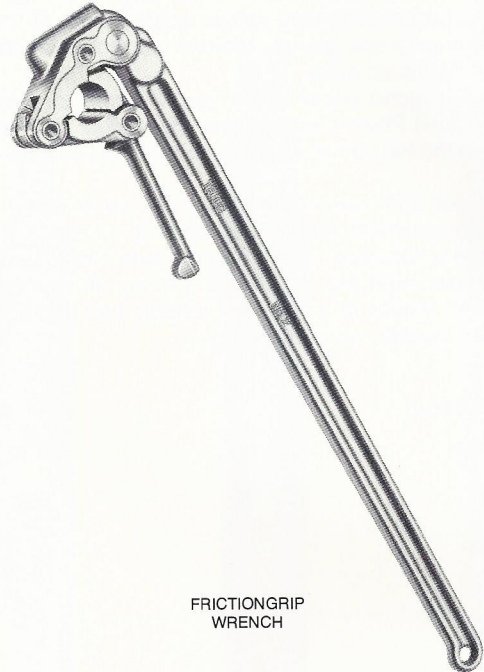
The Trico Frictiongrip Vise is designed for holding tubing, pump barrels, piston rods and all cylindrical objects where the surface must be protected from scoring and distortion. The vise will not crush thin wall tubing or pipe because the soft aluminum bushings completely encircle the object being held.

A light turning force on the crank will apply sufficient clamping force on the tubing or fitting for makeup or breakout without slippage. This is accomplished through an additional mechanical advantage in the vise gained by the over-center or cam action that increases the clamping force as torque is applied to the object being held. This over-center feature also permits "impact action," which is particularly important when breaking out old or rusty connections. Compared to a standard pipe vise, approximately one-half the effort is required to break out a connection with the Trico Frictiongrip Vise.

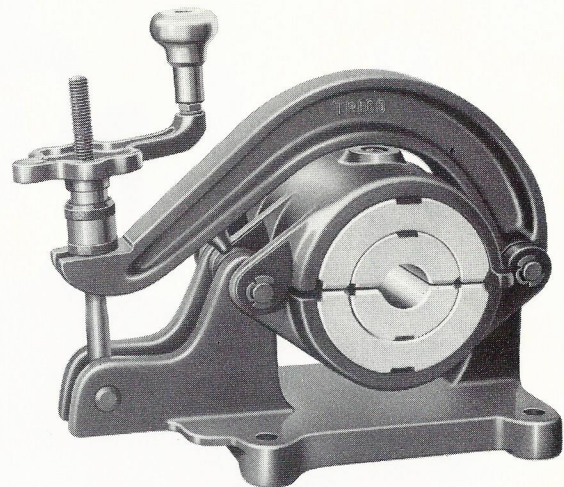
#### Available in two sizes

The Frictiongrip Vise comes in two sizes, 3-1/2 and 5-1/2 in. The smaller model accepts bushing sets that will handle diameters from 7/8 through 2-3/4 in. The 5-1/2 in. model normally handles diameters from 2-7/8 through 5 in. However, by installing an adapter bushing, the 5-1/2 in. unit will also accept all the bushing sets available for the 3-1/2 in. vise.

All Trico Frictiongrip Vises are constructed from the highest quality alloy steel, heat treated and tempered to withstand rugged field service.



FRICIONGRIP  
WRENCH



5-1/2 INCH FRICIONGRIP VISE  
WITH ADAPTER BUSHING SET  
AND 1-1/2 INCH BUSHING  
SET INSTALLED



## CENTRALIZERS

### B & W Centralizer Equipment

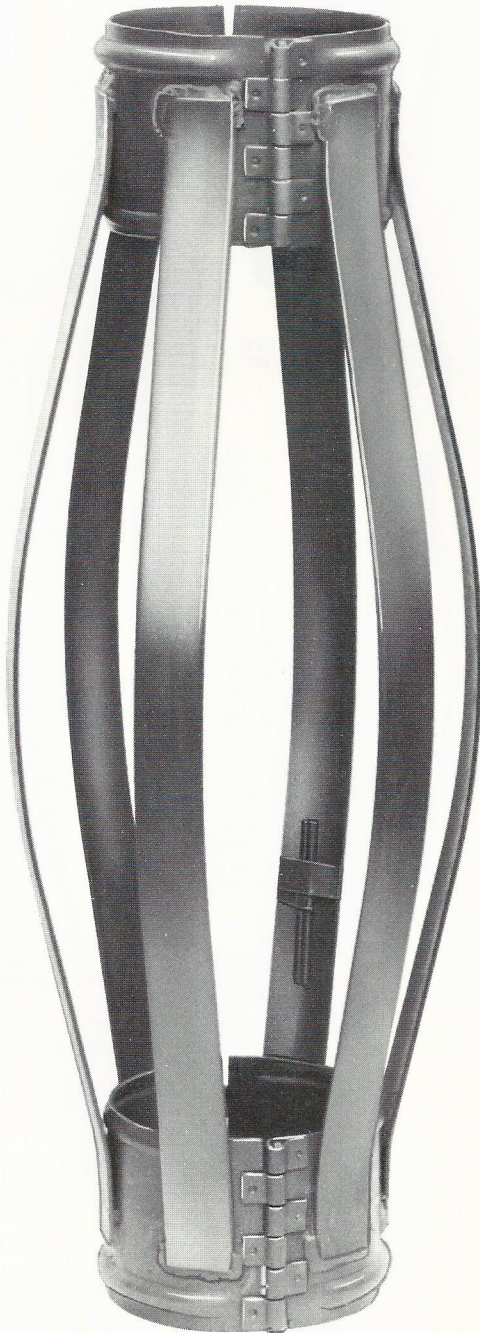
*Featuring the Kon-Kave Bow*

B & W centralizers center the casing in the hole during primary cementing operations to prevent channeling and effect a 360° cement fill. Where scratchers are run, B & W centralizers center the casing to provide uniform scratching over the entire face and height of the cement fill. The "sled" effect facilitates the running of casing regardless of hole direction, hole diameter or irregularities in the formation. Centralizers also agitate drilling fluid and cement slurry in the critical area between casing and formation.

B & W centralizers are placed at preselected points in the well to obtain a more uniform annular cement space. Force and spacing curves are available to help determine spacing recommendations.

B & W centralizer collars are sized to API standards. After assembly, every B & W centralizer is thermally and mechanically stress relieved and fully tested before shipment.

B & W supplies the widest range of centralizers in the industry. There's a B & W centralizer to meet every tubing, liner, or casing-to-hole-size combination per API Std 10D Specification.



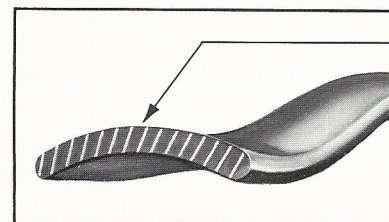
STANDARD CENTRALIZER  
Product No. AA02  
Latch-On-Type

- The arched shape makes it strongest, easiest to run and easiest on the hole
- Rounded profile reduces plow effect, "sleeds" easily
- Exclusive concave cross section increases effective bow strength without increasing bow thickness
- Bows of drop-forged, High-alloy Spring Steel that survive B & W torture test without taking a set
- Stress-relieved in an 800°F oven, compressed repeatedly at a rapid rate and turned on a test mandrel to API specification for collar roundness and alignment

### B&W Standard Centralizers

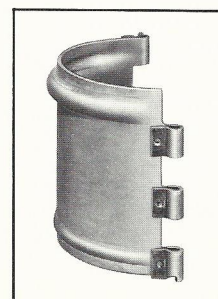
Item	Type	OD = Casing OD +		Length
		Maximum	Minimum	
AA02	Latch-On	4-7/8"	1"	27"

B & W Standard Centralizers provide maximum strength for centering casing and resisting side thrusts. For all normal casing-centering operations, they provide peak performance.



The Arch of the bow conforms to the radius of the hole.

Curved Bow offers greatest resistance to side thrusts.



Integral, forged and welded hinge uses alloy steel pin not soft nails. Strongest hinges in the industry.



## CENTRALIZERS

### B & W Non-Weld Series "N" Centralizers

The B & W Non-Weld Series "N" Centralizer is specifically designed for international markets.

#### Features/Advantages

- **Non-Weld Construction**

Non-Weld construction allows manufacturing in countries where the product is being used.

- **Less shipping and storage space**

The components which are shipped from the U.S. are packaged compactly, requiring up to 75% less storage space than conventional welded centralizers.

- **Designed to exceed A.P.I. Spec 10-D Requirements**

The smooth curvature of the bow springs allows for installation over casing couplings without interference. The bow springs are mechanically locked to the collars, providing the support and flexibility necessary for the most stringent conditions.

- **Durable collar design**

The reinforcing ribs and hinge design provide resistance to deformation under the worst conditions. The alloy steel hinge pins are permanently locked in position and will not work loose.

- **Heat treated premium alloy steel bow springs**

Each bow spring is hardness tested after heat treatment, flattened to its minimum height and then checked for dimensional accuracy and standoff force. B & W's stringent inspection procedures ensure quality, reliability and proper function in the well.

Series	Type	OD=Casing OD +		Length
		Maximum	* Minimum	
NA	Latch-On	2-1/2"	1"	22-1/2"
NB	Latch-On	3"	1-1/8"	22-3/4"
NC	Latch-On	4-3/8"	1-1/4"	25-1/2"
ND	Latch-On	6"	1-1/4"	25-1/4"

\*When centralizer is installed between stop collars or casing collar and stop collar



NON-WELD  
SERIES N  
CENTRALIZER  
Product No. NA  
Latch-On Type

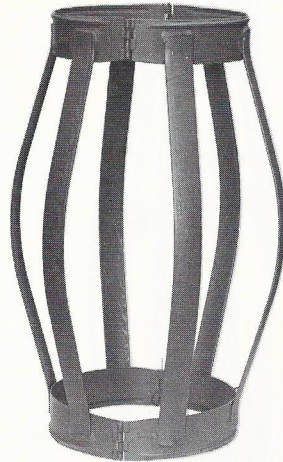
PATENT APPLIED FOR



# CENTRALIZERS



**STANDARD CENTRALIZER**  
Product No. AG02  
Latch-On-Type



**HIGH STRENGTH CENTRALIZER FOR OFFSHORE APPLICATIONS**  
Product No. AC02  
Latch-On-Type



**GP LARGE HOLE CENTRALIZER**  
Product No. AD02  
Latch-On-Type



**GP OVERSIZE HOLE CENTRALIZER**  
Product No. AE02  
Latch-On-Type



**GP OVERSIZE HOLE LINER CENTRALIZER**  
Product No. AE07  
Slip-On-Insert-Type



**GP TELESCOPING RESTRICTED CLEARANCE LINER CENTRALIZER (w/Automatic Stop Collar)**  
Product No. AE09  
Slip-On-Type



**LINER OR SLIM HOLE CENTRALIZER (w/Automatic Stop Collar)**  
Product No. AF22  
Slip-On-Type

## B&W Standard Centralizers

Item	Type	OD = Casing OD +		Length
		Maximum	Minimum	
AG02	Latch-On	3-3/4"	1"	23"

## B&W High Strength Centralizer for Offshore Applications

Item	Type	OD = Casing OD +		Length
		Maximum	Minimum	
AC02	Latch-On	6-1/2"	1"	32"

## B & W GP Centralizers

All GP centralizers are extremely effective in directional hole operations, oversize hole conditions and gravel packing. The long bow design permits travel through restricted casing, yet exerts a strong centering force in enlarged holes.

AD02 GP Large Hole Centralizers are suitable for normal to large hole conditions.

AE02 GP Oversize Hole Centralizers are suitable for normal to oversize hole conditions.

AE07 GP Oversize Hole Liner Centralizers permit running through close-tolerance casing into a large hole below.

AE09 GP Telescoping Restricted-Clearance Liner Centralizers have integral automatic stop collars. They are used where welding is undesirable. The bows are always pulled through the hold to facilitate passage.

Item	Type	OD = Casing OD +		Length
		Maximum	Minimum	
GP Large Hole AD02	Latch-On	6-5/8"	1"	37"
Oversize Hole AE02	Latch-On	10-1/4"	1"	42-1/2"
Oversize Hole Liner AE07	Slip-On (Window)	10-1/8"	1/2"	50"
Telescoping GP Restricted Liner AE09	Slip-On*	10-1/8"	5/8"	58 1/2"

\* Has integral automatic stop collar for application where welding is undesirable.

## B & W Liner or Slim Hole Centralizers

Item	Type	OD = Casing OD +		Length
		Maximum	Minimum	
F22	Slip-On (Insert)*	3-1/4"	3/4"	27"
AB02	Latch-On	2-5/8"	1"	25'

\*With turned automatic stop collar.



# WELL COMPLETION EQUIPMENT

## B & W Turbulence-Generating Centralizers

B & W Turbulence-Generating Centralizers center the casing and create maximum turbulence in the fluid rising through the annulus.

Turbulence-generating vanes inside the centralizer deflect the flow of fluid and generate turbulence up the hole without an increase in pump pressure. This turbulence cleans up the annulus, distributes the cement evenly, and prevents channeling and plug flow to achieve a solid fill. Whenever turbulence-generating centralizers are collapsed to their minimum OD, they always return to their original shape without distortion to either the bows or vanes. Each vane is rib-reinforced for maximum strength and is fully protected by the bows to prevent being stripped off while running in the hole.

Turbine blade centralizers have a spring-steel turbine blade attached to each bow immediately above the lower collar. The blades are oriented for left- or right-hand deflection and the centralizers should be mounted so as to alternate this direction. Double turbine blade centralizers have a blade attached to each end of each bow with those at the bottom oriented in the opposite direction from those at the top.

Two Turbo-Gen or Turbine Blade Centralizers installed on the shoe joint and a minimum of one per joint throughout the cement fill on range two casing are recommended. Closer spacing should be observed in the critical areas.

Item	Type	OD = Casing OD +		Length
		Maximum	Minimum	
Double Turbine Blade AD62	Latch-On*	6-5/8"	1"	37"
Turbo-Gen* BD50	Latch-On	3-3/8"	1"	25"
Turbo-Gen* BD52	Latch-On**	3-3/8"	1"	26"

With hinged friction lock clamp  
 \*\*With integral automatic stop collar

## Installation of B & W Turbulence-Generating Centralizers

Note: Do not install around a casing collar or single stop device.

Item	Installation Procedure
AD62	Latch unit around casing. Insert hinge pins. Hammer down steel tabs on hinge to secure pins and tighten socket head bolt on FLC with long-handled hex wrench.
BD50	Latch unit around casing between stop devices, or with a pair of stop devices inside unit—one each, approximately 3/4" from inside edge of upper and lower collars. Insert hinge pins. Hammer down steel tabs on hinges to secure pins.
BD52	Latch unit around casing. Insert hinge pins. Hammer down steel tabs on hinges to secure pins. Drive slip loops in collar flush against casing with hammer and slip-driving tool, bolt head or chisel.

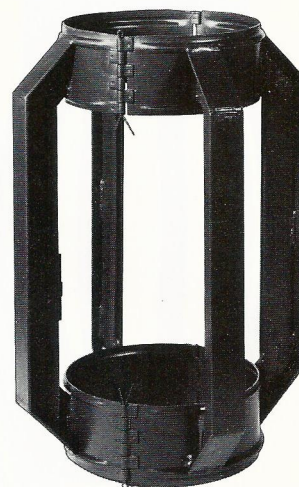
## T-Bar Stabilizer

Produces 100% stand-off even in deviated holes. Friction drag is significantly reduced and concentricity of casing strings is assured. The B & W T-Bar Stabilizer also protects the primary cementation of previously run strings from the shocks of drilling and tripping. Stabilizers are usually 1/8 in. less than drift in all standard sizes, but may be furnished to other specifications.

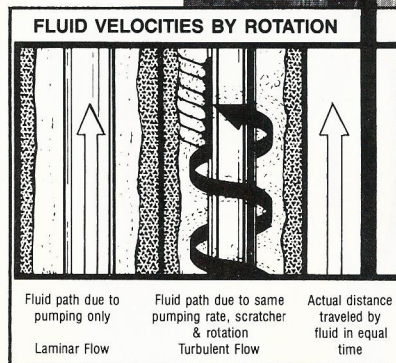
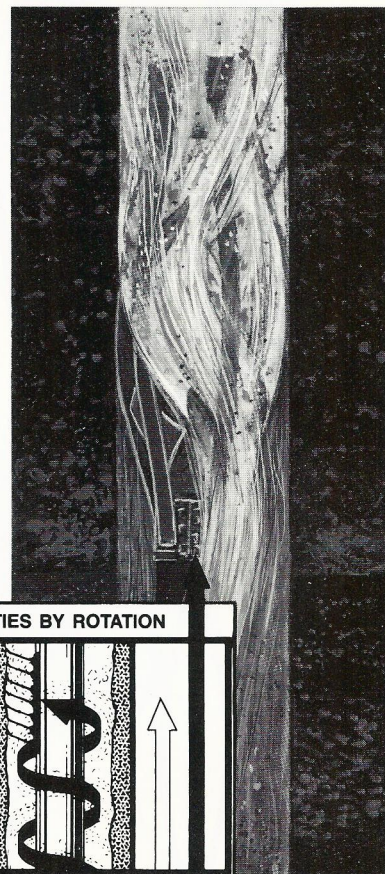
Item	Type	OD = Casing OD +	Length
CB02	Latch-On	These units are made for various combinations of casing OD and hole sizes.	18-1/2"



DOUBLE TURBINE BLADE CENTRALIZER (w/Hinged Friction Lock Clamp)  
 Product No. AD62  
 Latch-On-Type



T-BAR STABILIZER  
 Product No. CB02  
 Latch-On-Type



**ANTI-CHANNELING.** The turbulence-generating fins are shaped to give the slurry a vigorous spin as it flows by. The turbulence breaks up channeling, spins the jelled mud back into circulation and keeps the annulus cleaner for improved bonding of the cement.



## B & W Basic Centralizer Selection Guide

### LEGEND

- R = Recommended Centralizer
- x = Optional Use
- = .125 Bow Thickness
- ▲ = .170 Bow Thickness
- = Shaded Area, Not Avail.

Series			AA		AG		AB		AF		AC		AD		AE	
Overall Length			27"		23"		25"		27"		32"		37"		42"	
Centralizer O. D. =			Max.	Min.*	Max.	Min.*	Max.	Min.*	Max.	Min.*	Max.	Min.*	Max.	Min.*	Max.	Min.*
Casing O. D. +			4½"	1"	3¾"	1"	2½"	1"	2¾"	¾"	6½"	1"	6¾"	1"	10½"	1"
Suggested Use			Peak performance for normal centering operations to most depths		For normal centering operations		Provide excellent stand-off in close tolerance holes		For use on liners or areas of very restricted clearance		Use in deviated holes where optimum strength is required		Gravel Pack Effective in directional hole operations, oversize hole conditions, & gravel packing. Exerts strong centering force in open hole			
API Casing Size To Run			KON KAVE BOW CENTRALIZERS													
Open Hole or Casing ID			KON KAVE BOW CENTRALIZERS													
On	Thru	IN	# Bows		# Bows		# Bows		# Bows		# Bows		# Bows		# Bows	
OD	OD	ID														
2¾"	5"	4¼"	x													
	5½"	4¾"	x													
	6"	5"	x													
	6½"	5½"	x	4•												
2⅞"	6"	5½"	x													
	7"	6½"	x													
	7½"	6"	x	4•												
3½"	5¾"	4¾"	x													
	6½"	6"	x													
	7½"	6¾"	x													
	8½"	7½"	x	4•												
4"	7"	6¼"	x													
	7½"	6¾"	x													
	8½"	7½"	x													
	9½"	8¾"	x	4•												
4½"	6½"	6¼"	R		R											
	7"	6¼"	R		R			x								
	7½"	6¾"	R		R			x								
	7"	6¾"	R		R			x								
	7½"	6¾"	R		R			x								
	8½"	7½"	R		R			x								
	9½"	8½"	R		R											
	10¾"	9½"														
5"	7"	6¼"														
	7½"	6¾"														
	8½"	7½"	x													
	9½"	8½"	x													
	9½"	8½"	x													
	10¾"	9½"														
5½"	7½"	6¾"			R											
	8½"	7½"	R		R			x								
	9½"	8¾"	R		R			x								
	10¾"	9½"	R		R											
	11¾"	11"														
	13¾"	12¼"														
6"	8½"	7½"														
	9½"	8¾"														
	10¾"	9½"														
	13¾"	12¼"														
7"	9"	8½"														
	9½"	8½"	R		R			x								
	9½"	8¾"	R		R			x								
	10¾"	9½"	R		R			x								
	11¾"	10½"	R													
	13¾"	12¼"														
7½"	9½"	8½"														
	10¾"	9½"	x		R			x								
	11¾"	11"	R		R			x								
	12¼"	11¾"	x													
	13¾"	12¼"														
8½"	10¾"	9½"			R											
	11¾"	10½"	R		R											
	13¾"	12¼"	R													
	16"	15"														
9½"	11¾"	11"			R											
	13¾"	12¼"	R		R											
	16"	14"			R											
	16"	15"														
10¾"	16"	14"	R													
	16"	14¾"	R													
	16"	15"	x													
	18½"	17½"														
11¾"	16"	14¾"	R													
	16"	15"	R													
	18½"	17½"														
13¾"	16"	14¾"	R													
	18½"	17½"	R													
	20"	18½"														
16"	20"	18½"	x													
	24½"	24"	x													

\*O.D. given in Minimum Centralizer O.D. without allowance for stop device or casing collar.



## WELL COMPLETION EQUIPMENT

### B & W Stop Device Equipment

Stop collars are devices which mount and secure primary cementing equipment such as centralizers and scratchers permanently to the casing. Once a stop collar is attached to the casing, it supports the primary cementing equipment which is lowered into the hole with the casing. B & W has developed a series of stop devices for mounting primary cementing tools safely and securely. Each B & W stop device fulfills three basic requirements:

1. No damage to the casing.
2. Positive holding on wet or dry casing.
3. Fast and simple installation.

### B & W Automatic Stop Collars

Item	Type	OD = Casing OD +
DA20	Lathe-Turned, Slip-On	5/8"
DA50	Latch-On	1"

The slips on B&W Automatic Stop Collars are carburized and heat treated, resulting in a hard, tough surface. This hardness allows the slip to bite deeply into the casing when it is hammered down flush with the collar during installation. Controlled depth punches, or "dimples", provide additional wedging action between the slip and the collar. These dimples cause the slip to force itself further into the casing, maximizing the bite depth.

DA20. Lathe-Turned Collars are particularly suitable for close-tolerance holes. DA50 Latch-On Collars are for use on upset or non-upset casing.

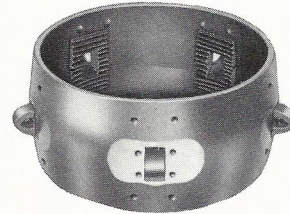
### B & W Friction Lock Clamps

Item	Type	OD = Casing OD +
DB10	Slip-On	7/8"
DB20	Rotator	1- 5/8"
DB30	Latch-On	7/8"

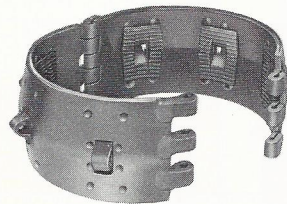
B & W Friction Lock Clamps provide a low-cost, secure, and easy installation of centralizers and scratchers.

### Installation of B & W Stop Devices

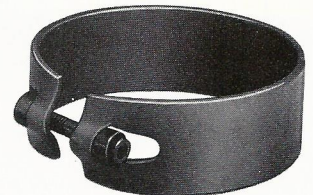
Item	Installation Procedure
DA20	Slip on casing to desired position. Drive slip loops in collar flush against casing with hammer and slip-driving tool, bolt head, or chisel.
DB10 DB30	Slip on casing and tighten socket head bolt with long-handled hex wrench.
DA50	Latch around casing. Drive latch pin home with hammer. Drive slip loops in collar flush against casing as described for DA10.
DB20	Latch on casing. Make sure interlocking button in collar engages hole in end scratcher. Tighten socket head bolts alternately with hex wrench.



LATHE TURNED AUTOMATIC  
STOP COLLAR  
Product No. DA20  
Slip-On-Type  
(Close Tolerance)



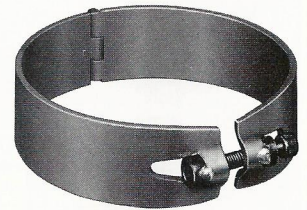
AUTOMATIC STOP COLLAR  
Product No. DA50  
Latch-On-Type



FRICTION LOCK CLAMP  
Product No. DB10  
Slip-On-Type



ROTATOR CLAMP  
Product No. DB20  
Latch-On-Type

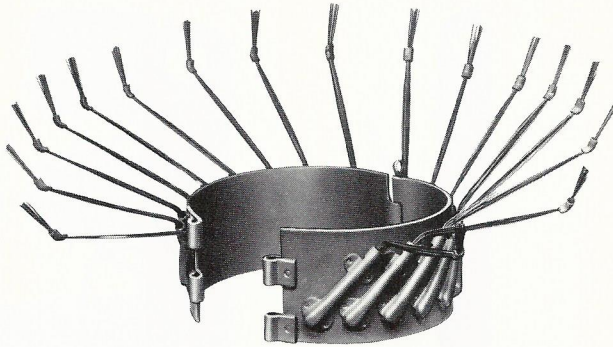


HINGED FRICTION LOCK CLAMP  
Product No. DB30

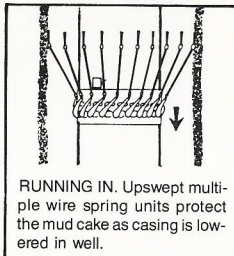




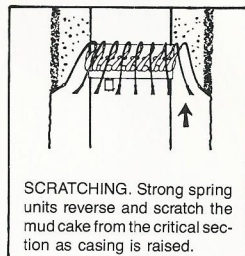
# WELL COMPLETION EQUIPMENT



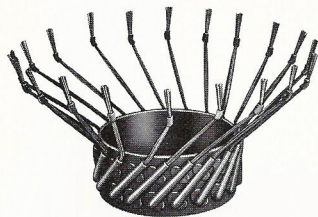
MULTI-FLEX SCRATCHER  
Product No. EA20  
Latch-On-Type



**RUNNING IN.** Upswept multiple wire spring units protect the mud cake as casing is lowered in well.



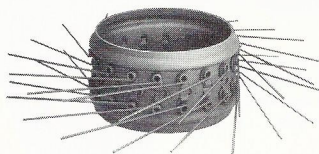
**SCRATCHING.** Strong spring units reverse and scratch the mud cake from the critical section as casing is raised.



MULTI-FLEX SCRATCHER  
Product No. EA10  
Slip-On-Type



TURBOCLAMP  
COMBINATION 54  
Product No. EL54  
(Slip-On-Type Turbulator  
w/integral Friction Lock Clamp)



NU-COIL SCRATCHER  
(Long Wire)  
Product No. EC20  
Latch-On-Type



TURBULATOR  
Product No. ED10  
Slip-On-Type

## B & W Scratcher and Turbulator Equipment

### Reciprocating Type

Successful primary cementing requires centering of the casing, casing movement, and a properly conditioned hole. B & W Scratchers condition the hole by removing mud cake from the face of the formation to ensure a good cement bond and to prevent channeling. They also contribute to the even distribution of the cement slurry and the achievement of a complete fill. B & W Turbulators generate turbulence and remove excessive hole growth without completely removing the filter cake.

### B & W Reciprocating Scratchers & Turbulators

Item	Type	Max. OD = Casing OD +
Multi-Flex EA10 EA20 EL79	Slip-On Latch-On Latch-On with Friction Lock Clamp	7"
Multi-Flex Clusters EL79-04	Latch-On with Friction Lock Clamp (Series of 4)	7"
Nu-Coil (Long Wire) EC10	Slip-On	8"
Turbulator EL54 EL58	Slip-On Latch-On	5-1/2"

B & W Reciprocating Scratchers and Turbulators are constructed to withstand any treatment from the casing rack to the bottom of the well without impairing their effectiveness. The high-strength wire fingers and cable loops disintegrate the toughest filter cake and their working diameter enables them to reach into enlarged sections to agitate gelled mud and make possible a complete cement fill.

**EA10 Multi-Flex Scratchers** have high-alloy multi-wire fingers that reverse to scratch only on the upstroke. They have the highest fatigue life of any scratchers available and are manufactured in all common tubing and casing sizes.

**EL79-04 Multi-Flex Clusters** are recommended for use where casing movement is impracticable, or in single-point entry applications. The clusters provide multiple scratching on the one stroke and help to distribute the cement evenly and prevent channeling. Spacing between the clusters should not exceed 3 ft throughout the critical area, including the joint immediately above and below.

**EC10 Nu-Coil Scratchers** (Long Wire) have high-alloy spring-steel fingers with a wide reach and strong scratching action in either direction.

**ED54 Turbulators** have multiple high-alloy steel cable loops to generate turbulence, break up channel flow, remove excess hole growth, and permit normal velocities at low pump pressures. An ideal tool for cementing surface casing and when cementing through soft formations.

For optimum results, it is recommended that B & W scratchers and turbulators be placed at least every 10 ft throughout the desired height of the cement fill. Casing movement should be continued throughout the entire cementing operation, with sufficient stroke to provide overlap of scratcher or turbulator action on the formation.



## WELL COMPLETION EQUIPMENT

### B & W Scratcher and Turbulator Equipment

*Rotating Type*

#### B & W Rotating Scratchers

B & W Rotating Scratchers create turbulence, remove filter cake, eliminate excess hole growth, and act as slurry spreaders when the casing on which they are mounted is rotated during the cementing operation.

Item	Type	OD = Casing OD + (or Tubing OD) +		Length
		Maximum	Minimum	
ER03	Multi-Flex for casing	7"	7/16"	5'
ER21	Turbulator for casing	6"	3/8"	5'

All B & W Rotating Scratchers are mounted on a concave base that is bowed throughout its length towards the pipe on which it is to be mounted. The combination of concavity and bow (exclusive with B & W scratchers) provides the firmest possible base for this type of tool.

**ER03 Multi-Flex Rotating Scratchers** embody the same high-quality, multiple-strand spring-steel wire fingers as do the reciprocating type. They have the highest fatigue life of any scratcher fingers available.

**ER20 and ER21 Turbulators** embody rugged construction to enable them to withstand the hardest kind of oil field usage, from the rack to the bottom of the hole. They provide excellent turbulence and remove excessive hole growth without damaging the formation.

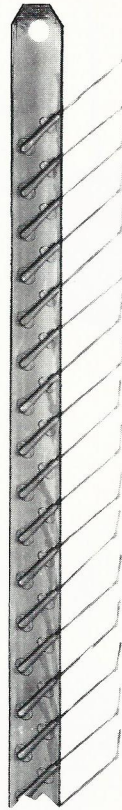
#### Installation of B & W Rotating Scratchers

Slip or latch on DB20 rotator clamp. Engage interlocking buttons with holes in ends of scratcher. Secure clamps as described for stop devices. The scratchers should be installed continuously throughout the entire height of the calculated cement fill. Normal rotary speed for proper fill and cementation is 40 to 50 rpm.

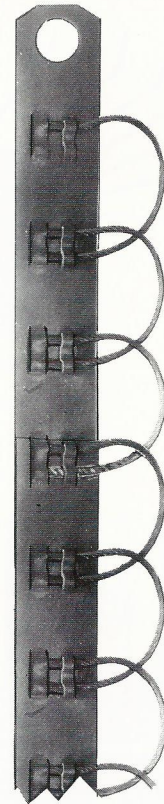
#### B & W Kon-Kave Canvas Cement Basket

Series	Type	O.D. = Casing O.D. +		Length
		Maximum	Minimum	
GA10 . . . . . Slip-On		5"	3/4"	14-1/2"

Designed strictly for use where cementation is accomplished without reciprocation, the Kon-Kave Canvas Cement Basket is one of the most economical on the market. One-piece canvas insert of heavy army duck lines the inside of the sturdy Kon-Kave bow basket to provide positive, leak-proof support of the column of cement.



MULTI-FLEX ROTATING  
SCRATCHER  
Product No. ER03



ROTATING  
TURBULATOR  
Product No. ER21



KON-KAVE KANVAS  
CEMENT BASKET  
Product No. GA10  
Slip-On-Type



## WELL COMPLETION EQUIPMENT

### B & W Cement Basket Equipment

#### B & W Leaf-Loc® Cement Baskets

B & W Leaf-Loc Cement Baskets serve as effective formation packers around the casing to support a column of cement in the annulus above any selected point and to protect lower sections of the formation from excessive hydrostatic head of the cement column. They are essential pieces of equipment for multi-stage cementing and are placed immediately below the stage or port collar.

Item	Type	OD = Casing OD +		Length
		Maximum	Minimum	
Close-Tolerance Leaf-Loc GD20	Slip-On with Automatic Stop Collar	4-1/2"	1-1/2"	35"
Standard Leaf-Loc GB20	Slip-On with Automatic Stop Collar	9-1/2"	2-1/2"	35"

The Leaf-Loc design interlocks the over-lapping steel and opposes any force that may cause separation and loss of the packer effect. This exclusive feature also holds the pre-stressed basket leaves in radial compression to assure a 360° contact with the wall, regardless of hole irregularities, or the number of previous compressions of the basket. The high-tensile strength basket leaves give effective check-valve action in supporting the column of slurry.

#### B & W Very Restricted Clearance (VRC) Cement Baskets

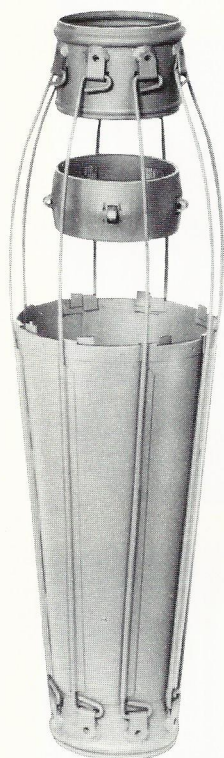
The all-metal construction of the VRC baskets is of drop-forged chrome-alloy spring steel multiple Kon-Kave bows, the lower halves of which are integral with wide overlapping leaves that form a secure support for cement or gravel. These leaves slide against each other throughout the full range of expansion and contraction, functioning in a manner similar to the iris of a camera lens. The baskets can be run in normal position, with the leaves on the lower half, or in an inverted position, in which case any port collar run immediately below must be left open while running in. Mounting options permit both rotation and reciprocation of the pipe.

Item	Type	OD = Casing OD +		Length
		Maximum	Minimum	
VRC Oversize-Hole GK20	Telescoping	10-1/8"	1"	61" extended
GK40	Split	10-1/8"	1"	46"

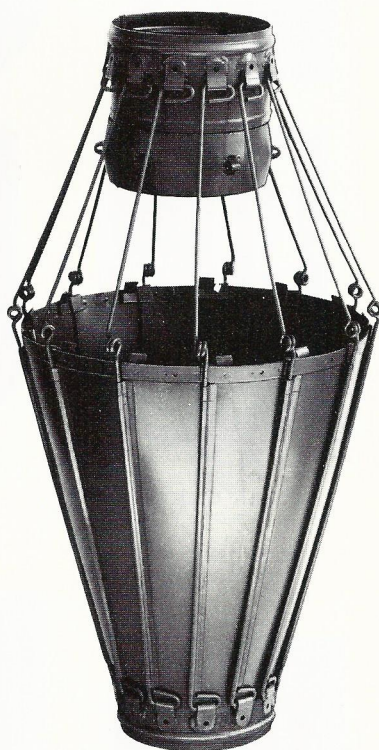
The VRC Oversize-Hole Series can be run under extremely close-tolerance situations; yet they provide positive formation packoff in open hole sizes up to 10-1/8 in. larger than the OD of the casing on which they are run. The high-tensile-strength multiple Kon-Kave bows are integral with wide, overlapping leaves to form a secure support for the cement column.

#### Installation of B & W Cement Baskets

Item	Installation Procedure
GA10	Slip basket on casing to desired location. Install automatic stop collars above and below the basket at a minimum distance of 18 inches apart.
GB20	Slip basket on casing with stop collar inside. Drive slip collar flush with casing with hammer and slip-driving tool, bolt head, or chisel.
GK20	Slip on casing to desired location. Set automatic stop collars by driving slip loops flush against casing with hammer and slip-driving tool, bolt head, or chisel.
GJ40 GK40	Place around casing collar or Turned-Down Automatic Stop Collar (Product No. DA20) and latch together. Lock by driving tabs flat against locking tongue with hammer.



CLOSE TOLERANCE LEAF-LOC  
CEMENT BASKET  
(Slip-On-Type w/Automatic  
Stop Collar)  
Product No. GD20



STANDARD LEAF-LOC  
CEMENT BASKET  
(Slip-On-Type w/Automatic  
Stop Collar)  
Product No. GB20



VRC OVERSIZE-HOLE  
CEMENT BASKET  
Product No. GK40  
Split-Type  
KK7 Bows



## FLOATING EQUIPMENT

### B & W Floating, Guiding, and Cementing Equipment

B & W float and guide shoes provide effective guidance of the running-in string to ensure proper landing, even when the open hole is extensively irregular and deviated. B & W float and baffle collars effectively complement the action of B & W shoes by ensuring the running-in string against contamination or stringing of the shoe joint when the cement plug is seated.

B & W float shoes and collars can be supplied with ball-valve (standard) or flapper-valve (Hyflow) back-pressure control for standard floating action or as automatic fill convertible shoes and collars in a choice of Filtrol Orifice Fill or hydro-differential design for controlled fill while running in. B & W insert valves offer a choice of any of the above valve types with the single exception of hydro-differential. The shoes and collars can also be supplied in stab-in design.

The positive-seal, erosion-proof balls are all of long-wearing, high-impact resin impregnated with a uniform coating of neoprene over their entire surface for maximum sealing ability and to prevent bit gumming and facilitate drill-out.

#### B & W Standard Shoes and Collars (Cement Type)

The B & W standard cement-type shoe is supplied as a float shoe (ball-valve type), guide shoe, or bull plug guide shoe; the collar as a float collar (ball-valve type), baffle collar with hole, or solid baffle collar. All shoes are optionally available with or without down-jet ports.

Collar and shoe fittings are of one-piece, high-strength seamless-steel coupling stock in standard API OD's. The valve is cemented into the shell using high strength concrete. Units are normally supplied with 8 Rd or buttress threads. Other threads can be furnished to specifications on request.

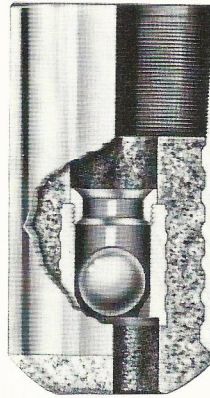
**Cement Float Shoe, Ball-Valve Type, Product No. FA01, and Cement Float Shoe, Ball-Valve Type, Down-Jet, Product No. FA03** — Design permits high-volume circulation to wash away bridges and clean the wall of the hole prior to cementing. Back pressure is controlled positively by the seating of the neoprene-coated ball in the heat-treated aluminum alloy ball seat.

**Cement Float Collar, Ball-Valve Type, Product No. FN01** — Large circulation area allows full volume flow to the shoe below, ensuring effective washing away of bridges and thorough cleaning of the hole. Float collar provides positive back-pressure control as well as rugged stop and seat for the cementing plug.

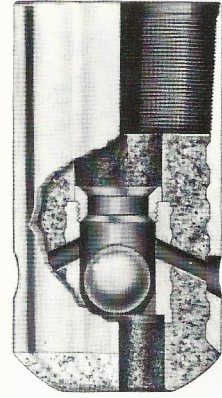
**Cement Guide Shoe, Product No. FC01, and Cement Guide Shoe, Down-Jet, Product No. FC03** — Large internal passageway provides maximum volume flow through guide port during cementation.

**Texas Pattern Casing Shoe, Product No. FC07** — This shoe can be used in running open-ended pipe. It features a full valve opening offering minimum resistance to pump pressure. The resulting higher pump volumes provide easier washdown.

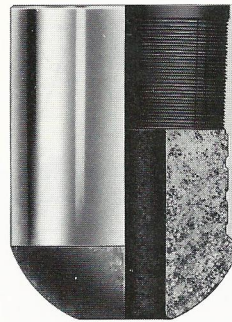
**Cement Bull Plug Guide Shoe, Product No. FD01** — High-strength concrete baffle or bull plug gives dependable isolation of the selected part of the running-in string.



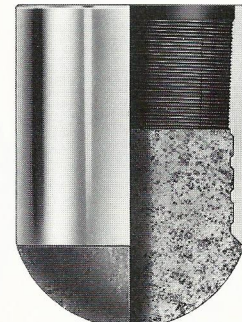
CEMENT FLOAT SHOE  
Product No. FA01  
Ball-Valve-Type



CEMENT FLOAT SHOE  
Product No. FA03  
Ball-Valve-Type  
Down Jet



CEMENT GUIDE SHOE  
Product No. FC01



CEMENT BULL PLUG  
GUIDE SHOE  
Product No. FD01



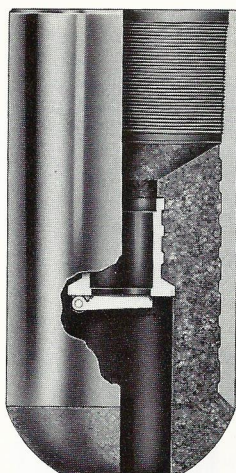
TEXAS PATTERN CASING SHOE  
Product No. FC07



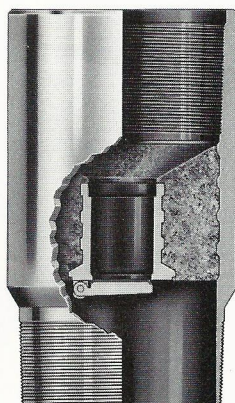
CEMENT FLOAT COLLAR  
Product No. FN01  
Ball-Valve-Type



## FLOATING EQUIPMENT



HYFLOW FLOAT SHOE  
Product No. FB01



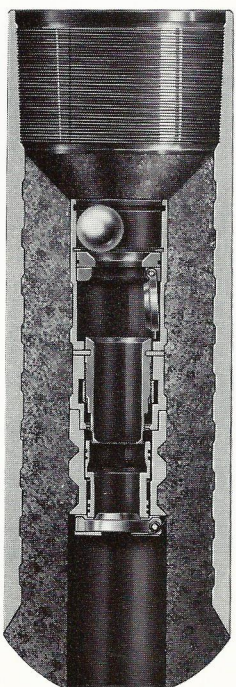
HYFLOW FLOAT COLLAR  
Product No. FP01



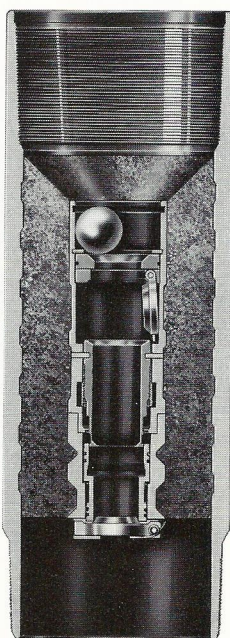
HYFLOW INSERT VALVE  
Product No. FY12



ORIFICE FILL-UP VALVE  
Product No. FY15



HYDRO-DIFFERENTIAL SHOE  
Product No. FG01



HYDRO-DIFFERENTIAL COLLAR  
Product No. FU01

### Hyflow Shoes, Collars and Insert Valves

**B & W Flapper-Valve-Type Hyflow Float Shoes, Float Collars and Insert Valves** are designed to wash away bridges to condition the hole prior to cementing. They provide a flapper-type check valve that allows straight-through circulation without the impingement characteristics of ball- and disc-type construction. Drill-out characteristics are similar to those of a cement plug.

**Hyflow Float Shoe, Product No. FB01, and Hyflow Float Shoe, Down-Jet, Product No. FB03** — These shoes act as perfect guides, even in deviated holes, to ensure proper landing of the casing string. They allow straight-through circulation to accomplish hole conditioning. The neoprene-coated, flapper-type back-pressure valve is spring loaded and comes into instant operation when circulation is discontinued.

**Hyflow Float Collar, Product No. FP01** — The B & W Hyflow Float Collar may be used in conjunction with a standard guide shoe or with a Hyflow float shoe to provide a secondary back-pressure valve. It permits circulation at any time and allows passage of a ball of given size to actuate downhole equipment. Also available are Hyflow Orifice Fill-Up Shoe, Product No. FZ25, and Hyflow Orifice Fill-Up Collar, Product No. FZ55.

**Hyflow Insert Valve, Product No. FY12** — This flapper-valve-type insert valve is designed to provide an economical float or check valve that can be threaded and installed in the "JJ" of any standard API 8 Rd or buttress coupling in a matter of minutes. In operation, it provides the same features as those described above for the Hyflow float collar. A Spacer Ring, Product No. DE02, must be run below the insert valve in certain lighter weights of casing. Always specify the size and weight of the casing to determine whether or not a ring is required.

**Orifice Fill-Up Insert Valve, Product No. FY15** — Installation is the same as for Hyflow insert valve. A fixed orifice tube holds the flapper valve open to provide automatic fill while running in. Unit converts to flapper-type floating equipment when Kirksite ball is dropped and pumped through.

### Hydro-Differential Shoes and Collars

B & W Hydro-Differential Shoes and Collars are designed to provide hydrostatically controlled fill of the casing in medium-depth to very deep wells. A 90% fill is possible when one piece of the hydro-differential equipment is used and an 81% fill when two pieces are run together. The equipment greatly reduces the possibility of ram effects, which can damage the production zone and contaminate it by causing drilling mud to cake up and block production. These ram effects may also break down a thief zone. At the same time, practically all displacement circulation is eliminated when hydro-differential equipment is run and this may, in some cases, increase the difficulty of getting casing to bottom and starting circulation.

Hydro-differential shoes and collars are shipped with the 1-3/4 in. ball included. Conversion to floating equipment is accomplished by merely dropping the ball downhole ahead of the cement normally 15 joints above bottom.

Note: When shoe and collar are run together, a single Kirksite ball will serve to trip both units.

**Hydro-Differential Shoe, Product No. FG01, and Hydro-Differential Shoe, Down-Jet, Product No. FG03** — This shoe ensures proper landing of the casing string in the deepest, most deviated holes. Valve limits fill to 90%. When run with ball retained at the surface, the shoe allows straight-through circulation at any time before or after conversion to float equipment, and ensures positive back-pressure control after the ball has been pumped through the valve as pins holding the inner sleeve shear and release the upper flapper.

**Hydro-Differential Collar, Product No. FU01** — This collar effectively limits fill to 90% and provides backup for the hydro-differential shoe.



## FLOATING EQUIPMENT

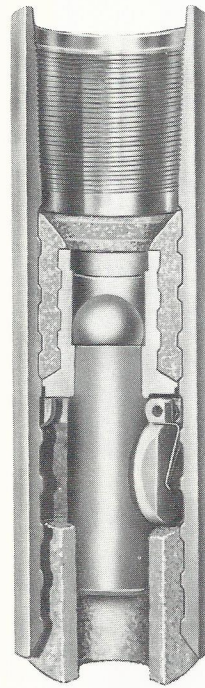
### B & W Orifice Shoes and Collars

Designed for use in moderate-depth wells to provide a means of controlling the fill of the casing while running in and of subsequently converting to float equipment. Shoes and collars are constructed of strong coupling material with high-strength concrete. Valve assemblies are of easily drillable heat-treated aluminum with neoprene-coated parts and seals.

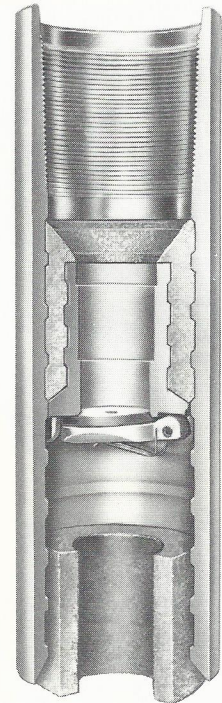
Orifice shoes and collars are manufactured with the ball held in place above the dilating orifice by an optionally removable spring. If run in this "non-circulating" mode, any high-volume circulation will immediately convert the unit to float equipment. Therefore, if circulation is to be required prior to conversion, the spring and ball must be removed and retained at the surface. Conversion is then accomplished by merely dropping the ball downhole ahead of the cement.

**Orifice Shoe, Product No. FZ25** — Shoe can be run as circulating or non-circulating equipment. Before conversion to float equipment, the orifice controls the fill of the casing to a safe level. Unit can be run alone or in combination with any up-hole equipment that will not interfere with the controlled fill action or with the dropping of the ball where required.

**Orifice Collar, Product No. FZ55** — This collar effectively complements the Filtrol shoe, serving to provide double fill-protection as well as double back-pressure holding ability after conversion to float equipment. If run together, one ball will close flapper in collar and shoe.



**NON-CIRCULATING MODE**  
(Ball and spring in place above orifice. Circulation will immediately convert unit to float equipment by dropping ball to remove sleeve).



**CIRCULATING MODE**  
(Ball removed and retained at surface pending conversion to float equipment).

**ORIFICE SHOE**  
Product No. FZ25

### Stab-in Equipment for Large Casing Primary Cementing

#### Stab-in Primary Cementing

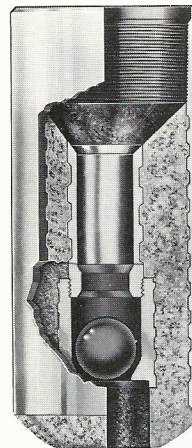
Stab-in type primary cementing requires less cement and less pumping time. Additionally, the quality of cementation is markedly improved. With the stab-in drill pipe carrying the cement slurry downhole, the serious mud contamination encountered when pumping down the casing is eliminated. There is continuous slurry flow with less pumping pressure, virtually no channeling in the annulus, and bonding is complete.

B & W's stab-in equipment is guided home by a tapered guide in the stab-in receiver. After the stinger seats, cement is pumped down the drill pipe through the shoe and up the annulus for maximum cementing efficiency.

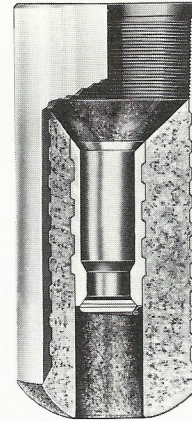
**Ball-Valve Float Shoe, Stab-In-Type, Product No. FM01** — This shoe features an erosion-proof, high impact resin ball coated with neoprene. Ball seats in an aluminum alloy chamber, providing easy drill out. All outer shells are available to customer specifications; i.e., K-55, N-80, etc. Stab-In Float Collar, Product No. FM51.

**Hyflow Flapper Valve Float Shoe, Stab-In-Type, Product No. FM08** — The flapper-type check valve in this shoe allows the greatest straight-through circulation volume. Flapper seal has neoprene coating to resist corrosion and maintain a positive seal. Hyflow Stab-In Float Collar, Product No. FM54.

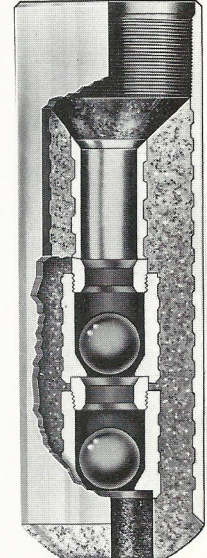
**Cement Float Shoe, Double Valve, Stab-In-Type, Product No. FM18** — This shoe is recommended for offshore and deep large diameter wells. It furnishes the added protection of two back pressure valves and the benefit of stab-in cementing through the drill pipe or tubing.



**BALL VALVE FLOAT SHOE**  
Product No. FM01  
Stab-In-Type



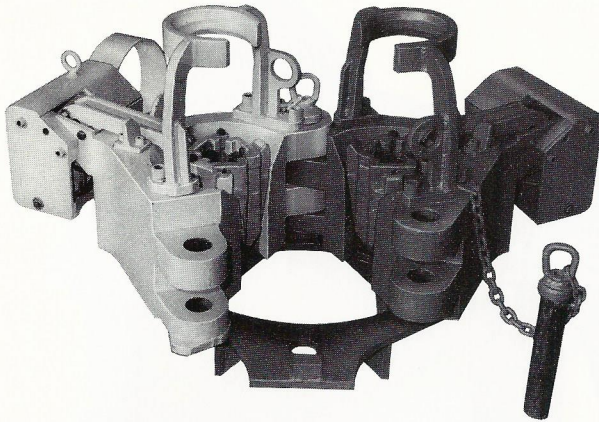
**HYFLOW FLAPPER-VALVE  
FLOAT SHOE**  
Product No. FM08  
Stab-In-Type



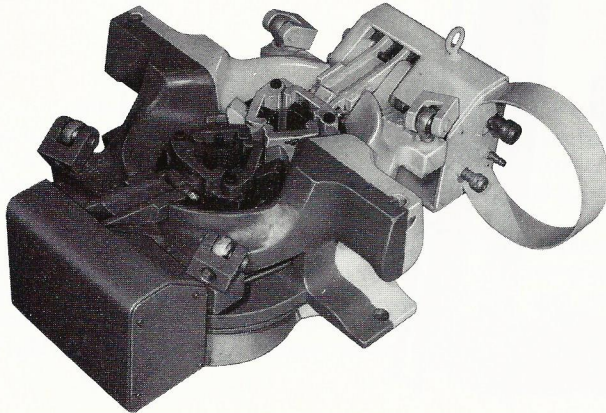
**CEMENT FLOAT SHOE  
DOUBLE FLOAT**  
Product No. FM05  
Stab-In-Type



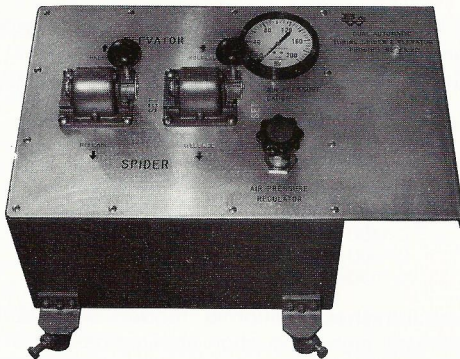
## TUBING SPIDER ELEVATORS



HINGED DUAL AUTOMATIC TUBING SPIDER  
Product No. KR22



DUAL AUTOMATIC TUBING ELEVATOR  
Product No. KR23



DUAL STRING CONSOLE CONTROL PANEL  
Product No. KR26

### Dual String, Product No. KR20, and Triple String, Product No. KR30, Spider-Elevator Assemblies

- Can run any size tubing from 1 through 4-1/2 in. with a simple change of the slip assembly.
- Handles up to three 20,000 ft strings of 2-7/8 in. tubing.
- Exclusive double automatic safety features.
- Independent control of each string.
- Opening of 19-1/2 in. with hinged spider open; 5-7/8 in. per string with spider closed.

Elevator has heat-treated 4130 cast alloy steel body. Spider has heat-treated 4340 forged alloy steel body. Both are fully tested for fatigue, cobalt X-ray inspected, magnafluxed, and load tested to 360 tons.

Positive slips grip against rotation in either direction and have three-point contact for automatic alignment. Rayon reinforced neoprene hose has high abrasive and acid resistance creating an extremely safe pneumatic system. Each section is painted a distinctive color which is keyed to the control console.

### Entirely Power Controlled

The strings can be raised or lowered individually. The driller can level the strings at any time, or can control the landing point of each string from the control console. The slips are pneumatically controlled. The driller easily controls complete power operation from the control console which can be any place on the rig floor. The quick-action automatic controls are color-keyed to the elevator and spider, to minimize effort and wasted motion and provide faster time in and out of the hole.

### Double Safety

Accidental release of a string into the hole is prevented by the exclusive B & W automatic safety setting feature. When a string is released from one set of slips the other set of slips set automatically. In case of air supply loss, all slips set automatically.

Dual Automatic, Product No. KR22, and Triple Automatic, Product No. KR32, Tubing Spiders—Maximum ID in the closed position is 5-7/8 in. per string. In the open position overall ID is limited only by the hole size. Units will handle any tubing or casing sizes from 1 through 4-1/2 in. with just a simple change of the slip assembly for each size. Hinge feature allows running of dual packers without stripping off spider.

Dual Automatic, Product No. KR23, and Triple Automatic, Product No. KR33, Tubing Elevators—The dual unit has a capacity of 120 tons, or the equivalent of two 20,000 ft strings of 2-7/8 in. tubing, while the triple unit has a capacity of 180 tons, or the equivalent of three 20,000 ft string of 2-7/8 in. tubing. Elevators will handle any tubing or casing sizes from 1 through 4-1/2 in. with just a simple change of the slip assembly for each size.

The driller controls the entire operation from the B & W dual or triple control console, which can be located at any convenient point on the rig floor.

### Control Console

An exclusive B & W automatic setting feature makes it impossible to release spider slips without automatically setting corresponding elevator slips and vice versa. Every string is safe, as it is always held by either the elevator or spider slips. The driller has complete freedom to raise or lower each string individually.

- Only three lever valves to set or release elevator or spider.
- All controls color-keyed to elevator and spider for error-free operation.
- Self-relieving air regulator for effective air control.
- Console control panel easy to read and provides a desk area so driller can keep records or other material.



## PUMPING UNITS



CRANK BALANCED  
PUMPING UNIT

### Trico Pumping Units

Trico Crank Balanced Pumping Units are designed and manufactured in accordance with API standards 11-E and the API monogram is carried on both the structural assembly and gearbox.

Each Trico pumping unit is a precision piece of machinery manufactured to the highest standards of the industry — so much so that each unit carries a full two-year warranty on parts and labor backed by Trico Industries, Inc. Provided proper installation and normal use and maintenance procedures are followed, Trico pumping units should provide many years of dependable, trouble-free service.

Trico pumping units are furnished with API-rated double-reduction gear reducers, with gear ratios of approximately 30:1. The structural assemblies can be furnished with T-type bases for use on cement foundations or with heavy-duty portable-type bases for use on gravel foundations with cross timbers as supports. Elevated electric-motor prime-mover bases can be furnished as well as prime-mover bases to fit multi-cylinder gas or slow speed engines. Belt guards are

available for all types of prime movers. Crank guards and foundation holdowns are also available.

Trico Crank Balanced Pumping Units are available in the following API sizes:

C-114D-143-64	C-228D-213-86
C-114D-119-86	C-228D-246-86
C-160D-143-64	C-228D-213-120
C-160D-173-74	C-320D-305-100
C-160D-200-74	C-320D-256-120
C-160D-213-86	
C-160D-173-100	

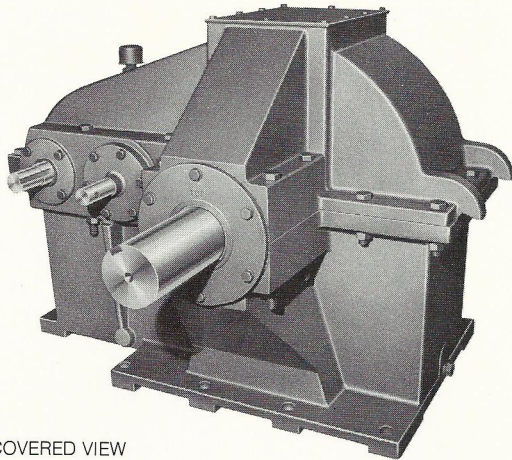
Trico also furnishes "California" models of the above sizes for shallow well, high production applications.

Trico Industries, Inc. has capable sales and service personnel throughout U.S. oil producing areas. These men are not only well versed in the proper sizing of pumping units, but are trained to provide any service, from routine maintenance to complete design and construction of turn-key production facilities.

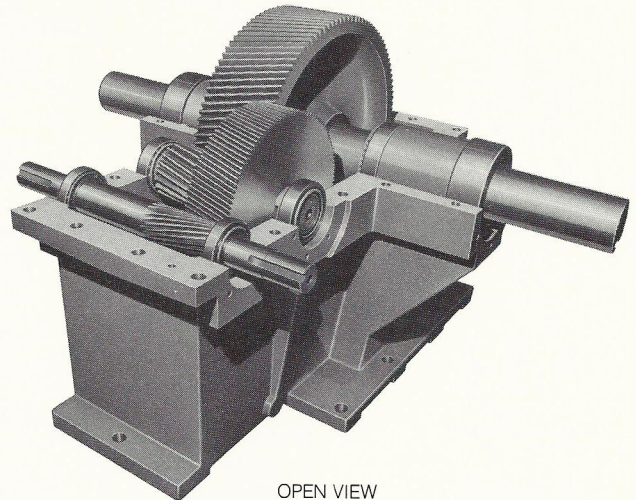




## PUMPING UNITS



COVERED VIEW



OPEN VIEW

GEAR  
BOX

Trico Crank-Balanced Pumping Units feature a heavy-duty helical, double-reduction gearbox manufactured exclusively for Trico by Western Gear Corporation. These gearboxes are built in accordance with API standards and designed especially for rugged oilfield use.

The housings are of a cast iron, stress-relieved, two-piece design, featuring full depth external ribs and large continuous bearing bosses to ensure maximum support for the gear elements and rotating counterweights. Single helical gearing is employed throughout to achieve maximum space utilization

and minimum weight, as well as smoothness of operation. Tapered roller bearings, with an average life of 100,000 hr at rated load, are fitted to all shafts to absorb gearing and external loads.

An oil splash and wiper lubrication system ensures positive lubrication of all gears and bearings. The gearbox can also be rotated in either direction without affecting the lubrication system. Nitrile, double lip-type oil seals on all shaft extensions provide maximum oil retention and protection against abrasive dust and moisture.

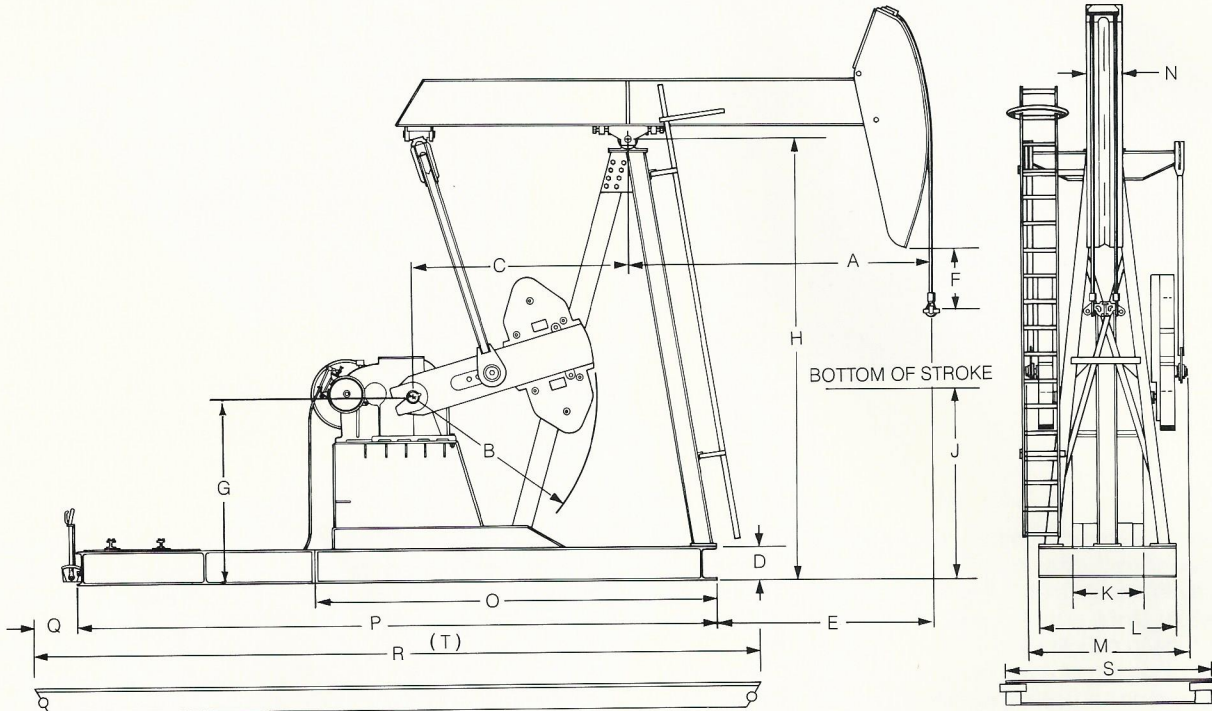
### GEAR SPECIFICATIONS—DOUBLE REDUCTION (SINGLE HELICAL)

PEAK TORQUE @ MAX. CONT. SPEED (in.-lb)	114,000	160,000	228,000	320,000
Gear Ratio	29.96:1	29.53:1	29.30:1	29.61:1
Standard Sheave	30" 3C	30" 4C	30" 5C	30" 6C
(a) Hub Bore	2"	2-1/4"	2-1/2"	3"
(b) Hub Keyway	1/2" x 1/4"	1/2" x 1/4"	5/8" x 5/16"	3/4" x 3/8"
Weight of Gearbox (lb)	2,500	3,500	4,900	7,300
Shaft Diameter (in.)				
(a) Low Speed	4.330	5.500	5.875	6.250
(b) High Speed	2.00	2.25	2.50	3.00
Oil Capacity (gal)	27	22	57	53
Teeth Cut and Finish Process	Hobbing	Hobbing	Hobbing	Hobbing
Teeth Hardening	Thru	Thru	Thru	Thru
Gear to Shaft	Shrunk	Shrunk	Shrunk	Shrunk
Pinion Shaft Bearings	Tapered Roller	Tapered Roller	Tapered Roller	Tapered Roller
Crank Shaft Bearings	Tapered & Roller	Tapered & Roller	Tapered & Roller	Tapered & Roller
Housing	Cast Iron	Cast Iron	Cast Iron	Cast Iron
Oil Seals	Nitrile	Nitrile	Nitrile	Nitrile
Pinion Shaft Material, Steel	4340 Alloy	4340 Alloy	4340 Alloy	4340 Alloy
Crank Shaft Material, Steel	4140 Alloy	4140 Alloy	4140 Alloy	4140 Alloy
Gear Material, Steel	4340 Alloy	4340 Alloy	4340 Alloy	4340 Alloy
Pinion Hardness, BHn.	352/388	352/388	352/388	363/393
Gear Hardness, BHn.	302/341	302/341	302/341	311/341
Rated Input Speed (rpm)	600	600	600	600
Rated Output Speed (rpm)	20	20	20	20
Pitch Line Velocity (fpm)				
(a) Low Speed	121	128.1	144	170.2
(b) High Speed	339	459.5	501	612.9



# PUMPING UNITS

## CONVENTIONAL PUMPING UNIT ASSEMBLIES GENERAL DIMENSIONS



### GENERAL DIMENSIONS (in.)

SIZE	A	B	C	D	E	F	G	H	J	K	L	M	N	O
C-114D-143-64	84	56	72	12	62-3/4	18-3/4	57	144	53-1/4	25	72	66-3/4	9	128-1/4
C-114D-119-86	111	68	84	12	79	15-1/2	69	165-3/4	54	25	72	66-3/4	12	151
C-160D-143-64	84	56	72	12	62-3/4	18-3/4	57	144	53-1/4	25	72	66-3/4	9	128-1/4
C-160D-173-74	96	68	84	12	64	17-1/4	69	165-3/4	68-1/4	25	72	67-1/2	9	151
C-160D-200-74	96	78	96	16	59-1/2	35-3/4	80-1/8	192	77-1/4	29	72	67-1/2	9	169
C-160D-213-86	111	78	96	16	74-1/2	24-1/2	80-1/8	192	74-1/2	29	72	67-1/2	12	169
C-160D-173-100	129	78	96	16	92-1/2	12	80-1/8	192	63	29	72	67-1/2	12	169
C-228D-213-86	111	78	96	16	74-1/2	24-1/2	80-1/8	192	74-1/2	37	82	78-1/2	12	177-1/2
C-228D-246-86	111	95	111	16	69-1/2	60-3/4	96-3/8	228	75-1/2	37	82	78-1/2	12	197-1/2
C-228D-213-120	153	95	111	16	113-1/2	26	96-3/8	228	75-1/2	37	82	78-1/2	12	197-1/2
C-320D-305-100	129	95	111	16	87-1/2	46-1/4	97	228	75-3/4	43	82	86	12	203-1/2
C-320D-256-120	155	95	111	16	113-1/2	26	97	228	75-3/4	43	82	86	12	203-1/2

SIZE	P	Q	R	S	T
C-114D-143-64	243	3	258	80	152
C-114D-119-86	243	3	258	80	175
C-160D-143-64	243	3	258	80	152
C-160D-173-74	243	3	258	80	175
C-160D-200-74	261	5	281	83	211
C-160D-213-86	261	5	281	83	211
C-160D-173-100	261	5	281	83	211
C-228D-213-86	295	5	315	93	211
C-228D-246-86	315	5	335	93	211
C-228D-213-120	315	5	335	93	211
C-320D-305-100	315	5	335	93	235
C-320D-256-120	315	5	335	93	235

#### Dimension Description

- A Center bearing to center well
- B Crank radius
- C Center bearing to drive shaft
- D Base height
- E Center wellhead to front T-base
- F Top of carrier bar to horsehead
- G Bottom of base to drive shaft
- H Bottom of base to center bearing
- J Bottom of stroke
- K Width of main base
- L T-base front beam
- M Over crank-pin housing
- N Carrier bar spread
- O T-base
- P T-base & add on base
- Q Set-back
- R Wide base-multicycle
- S Wide base width
- T Wide base electric motor high prime



# PUMPING UNITS

## STRUCTURAL SPECIFICATIONS

ITEM	C-114D-143-64	C-114D-119-86	C-160D-143-64	C-160D-173-74
Peak Polished Rod Capacity (lb)	14,300	11,900	14,300	17,300
Stroke Lengths (in.)	64, 52, 40	86, 72, 59	64, 52, 40	74, 62, 51
Walking Beam (in. x lb)	18 x 71	24 x 84	18 x 71	24 x 84
Wireline Hanger (in.)	1-1/8 x 202	1-1/8 x 255	1-1/8 x 202	1-1/8 x 298
Crank Pin Bearing	Self-Aligning	Self-Aligning	Self-Aligning	Self-Aligning
	Roller Bearings	Roller Bearings	Roller Bearings	Roller Bearings
Equalizer Bearing	Roller Bearings	Roller Bearings	Roller Bearings	Roller Bearings
	Tapered	Tapered	Tapered	Tapered
Center Bearing	Roller Bearings	Roller Bearings	Roller Bearings	Roller Bearings

ITEM	C-160D-200-74	C-160D-213-86	C-160D-173-100	C-228D-213-86
Peak Polished Rod Capacity (lb)	20,000	21,300	17,300	21,300
Stroke Lengths (in.)	74, 64, 54	86, 74, 62	100, 86, 73	86, 74, 62
Walking Beam (in. x lb)	24 x 94	24 x 104	24 x 104	24 x 104
Wireline Hanger (in.)	1-1/8 x 306	1-1/8 x 272	1-1/8 x 290	1-1/8 x 272
Crank Pin Bearing	Self-Aligning	Self-Aligning	Self-Aligning	Self-Aligning
	Roller Bearings	Roller Bearings	Roller Bearings	Roller Bearings
Equalizer Bearing	Roller Bearings	Roller Bearings	Roller Bearings	Roller Bearings
	Tapered	Tapered	Tapered	Tapered
Center Bearing	Roller Bearings	Roller Bearings	Roller Bearings	Roller Bearings

ITEM	C-228D-246-86	C-228D-213-120	C-320D-305-100	C-320D-256-120
Peak Polished Rod Capacity (lb)	24,600	21,300	30,500	25,600
Stroke Lengths (in.)	86, 74, 61	120, 102, 85	100, 85, 70	120, 102, 85
Walking Beam (in. x lb)	24 x 117	24 x 131	27 x 146	27 x 146
Wireline Hanger (in.)	1-1/8 x 345	1-1/8 x 322	1-1/4 x 332	1-1/8 x 332
Crank Pin Bearing	Self-Aligning	Self-Aligning	Self-Aligning	Self-Aligning
	Roller Bearings	Roller Bearings	Roller Bearings	Roller Bearings
Equalizer Bearing	Roller Bearings	Roller Bearings	Roller Bearings	Roller Bearings
	Tapered	Tapered	Tapered	Tapered
Center Bearing	Roller Bearings	Roller Bearings	Roller Bearings	Roller Bearings

## COUNTERBALANCE APPLICATION DATA

All counterbalance shown in pounds, effective at the polished rod, with weights at maximum position, including structural unbalance.

UNIT SIZE	C-114D-143-64	C-114D-119-86	C-160D-143-64	C-160D-173-74	C-160D-200-74	C-160D-213-86
Stroke	64"	86"	64"	74"	74"	86"
Structural Unbalance	+300 lb	-300 lb	+300 lb	+450 lb	+800 lb	+400 lb
Cranks (Trico Number)	D 131	D 199	D 182	D 873	D 875	D 875
C'Bal. Cranks Only	2,679	3,238	2,679	4,524	7,061	5,815
2 No. 9 C'Wts. (800 #)	4,910	5,323	4,910	6,931	9,879	8,252
4 No. 9 C'Wts.	7,141	7,408	7,141	9,339	12,698	10,690
4 No. 9 C'Wts. + 2 Aux. C'Wts. (230 #)	7,782	8,008	7,782	10,031	13,508	11,391
4 No. 9 C'Wts. + 4 Aux. C'Wts.	8,424	8,608	8,424	10,723	14,319	12,092
4 No. 9 C'Wts. + 8 Aux. C'Wts.	9,707	9,807	9,707	12,107	15,940	13,494
2 No. 10 C'Wts. (1400 #)	6,229	6,416	6,229	8,193	11,457	9,617
4 No. 10 C'Wts.	9,780	9,594	9,780	11,862	14,854	13,419
4 No. 10 C'Wts. + 2 Aux. C'Wts. (430 #)	10,979	10,715	10,979	13,156	17,369	14,730
4 No. 10 C'Wts. + 4 Aux. C'Wts.	12,178	11,836	12,178	13,450	18,884	16,040
4 No. 10 C'Wts. + 8 Aux. C'Wts.	**	**	**	17,038	**	18,661

UNIT SIZE	C-160D-173-100	C-228D-213-86	C-228D-246-86	C-228D-213-120	C-320D-305-100	C-320D-256-120
Stroke	100"	86"	86"	120"	100"	120"
Structural Unbalance	+300 lb	+400 lb	+610 lb	-400 lb	+450 lb	-450 lb
Cranks (Trico Number)	D 875	D 876	D 433	D 516	D 682	D 682
C'Bal. Cranks Only	4,959	5,815	8,897	5,525	7,559	5,466
2 No. 9 C'Wts. (800 #)	7,057	8,252	11,982	7,738	10,213	7,675
4 No. 9 C'Wts.	9,154	10,690	15,067	9,950	12,868	9,885
4 No. 9 C'Wts. + 2 Aux. C'Wts. (230 #)	9,758	11,391	15,954	10,586	13,631	10,520
4 No. 9 C'Wts. + 4 Aux. C'Wts.	10,361	12,092	16,841	11,223	14,394	11,155
4 No. 9 C'Wts. + 8 Aux. C'Wts.	11,567	13,494	18,616	12,495	15,920	12,425
2 No. 10 C'Wts. (1400 #)	8,231	9,617	13,833	9,066	11,806	9,001
4 No. 10 C'Wts.	11,503	13,419	18,770	12,606	16,053	12,536
4 No. 10 C'Wts. + 2 Aux. C'Wts. (430 #)	12,630	14,730	20,429	13,795	17,480	13,723
4 No. 10 C'Wts. + 4 Aux. C'Wts.	13,758	16,040	22,087	14,984	18,907	14,911
4 No. 10 C'Wts. + 8 Aux. C'Wts.	16,013	18,661	**	17,363	21,760	17,285

\*\*Not Recommended



## COLUMBIAN DIVISION

### Bolted Steel Tanks

Trico Bolted Steel tanks are made up of pre-engineered components which are precision designed, fabricated and packaged at the factory for shipment to the job site. As such, they offer a wide range of benefits that simply cannot be matched by welded or concrete tanks:

1. Their initial cost is substantially lower.
2. They can be shipped in compact packages, resulting in freight economies and easier handling at the job site.
3. They go up faster without expensive labor skills or specialized equipment.
4. They can be easily repaired, expanded or relocated.

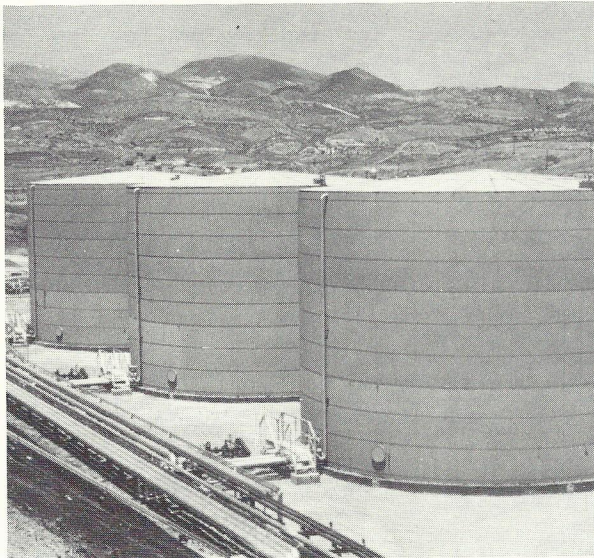
But you don't have to sacrifice quality. The quality of Trico tank components is built in at the factory, to exacting standards of quality control. And we believe the finished product is as

good or better than any other storage method.

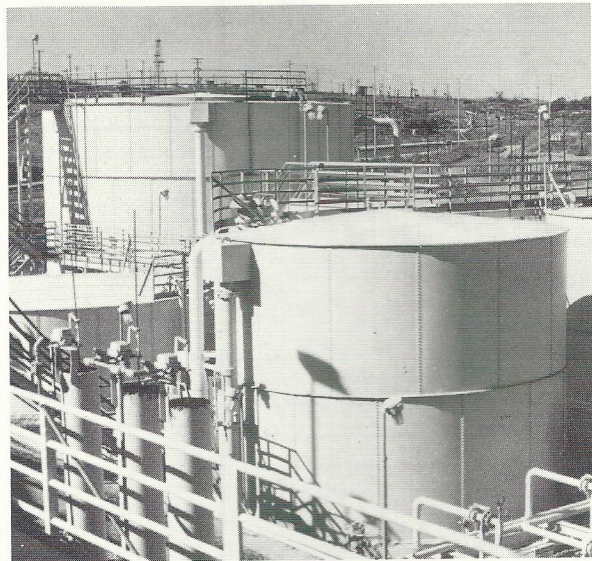
And no wonder.

Trico has been master crafting smooth wall bolted steel tanks for liquid storage since 1918. And we are among the leaders in the factory application of epoxy coatings to tank components.

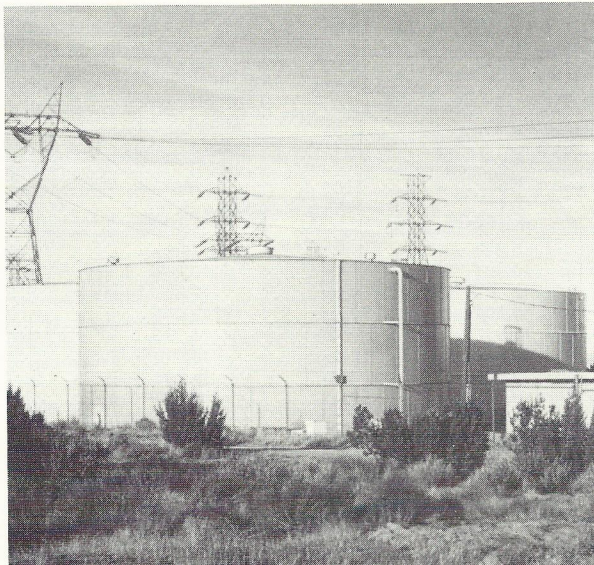
But what's more, Trico tanks are designed and built to stay on the job. Trico-Bond 478 is a two-component, spray-applied, factory-baked epoxy coating that shrugs off the effects of corrosion. And not only does it resist corrosion in nasty solutions like hydrocarbons, sour crude oils, brines, alkalis and fertilizer, both the Food and Drug Administration (FDA) and the Environmental Protection Agency (EPA) have approved Trico-Bond 478 as a non-contaminating coating suitable for the storage of potable liquids.



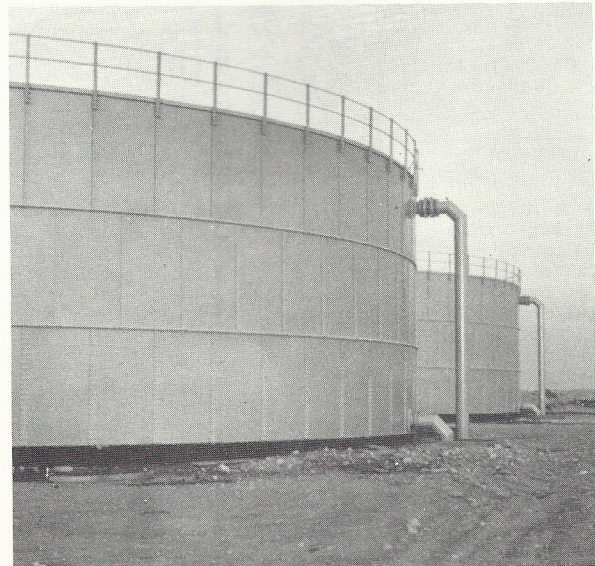
HEAVY CRUDE OIL STORAGE.



PRODUCTION TANK BATTERY.



MUNICIPAL WATER STORAGE.



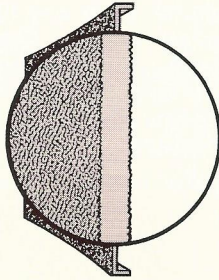
MILLION PLUS GALLON WATER STORAGE TANKS.

### Factory Applied Corrosion Protection.

From Wheelabrator surface preparation to special racking for coating protection, Trico employs the most advanced technology and ultramodern equipment in its application of baked-on coatings to tank components.

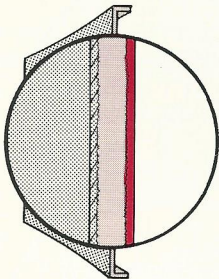
#### 1. Surface Profiling

Note how the technique of Wheelabrator grit blasting prepares the surfaces of the steel parts to a near-white metal blasted surface and provides a surface profile of 2 to 3 mils for the best possible anchoring pattern.



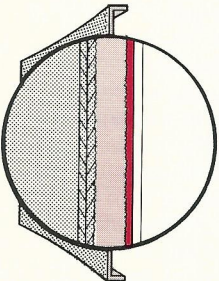
#### 2. First Phase Application

Coatings are spray applied, in accordance with rigid specifications, to create an excellent bond to the blasted surface. Interior surfaces are completely coated with Trico-Bond 478. Exterior surfaces are sprayed with a zinc-rich primer or epoxy ester.



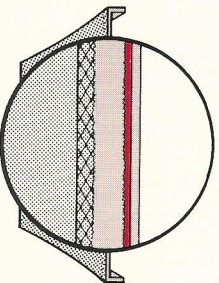
#### 3. Second Phase Application

After parts have baked to a partial cure, the final spray of Trico-Bond 478 and the exterior coating is applied. Coating application is carefully controlled to assure proper inter-coat adhesion and proper film thickness prior to the final Thermo Tron X cure.



#### 4. Cross Link Cure

In the final stage, parts are passed through a Thermo Tron X high-temperature oven where the coatings are thermally cross-linked to provide maximum bonding characteristics.

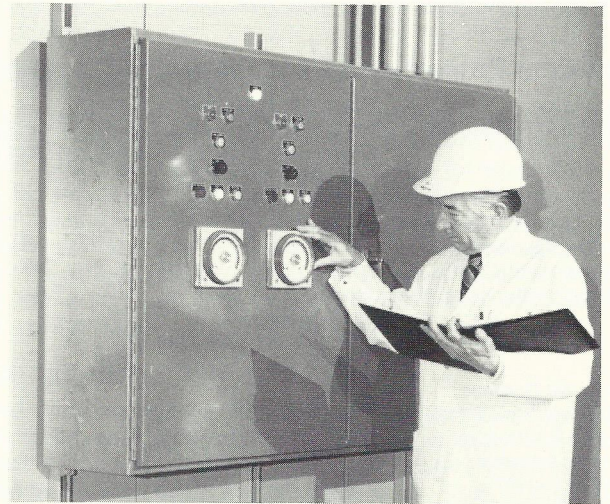


The economy of the modular concept in the design and fabrication of Trico Bolted Steel Tanks has been consistently proven. Factory automation eliminates the field expense of welding crews, special expertise and costly tools.

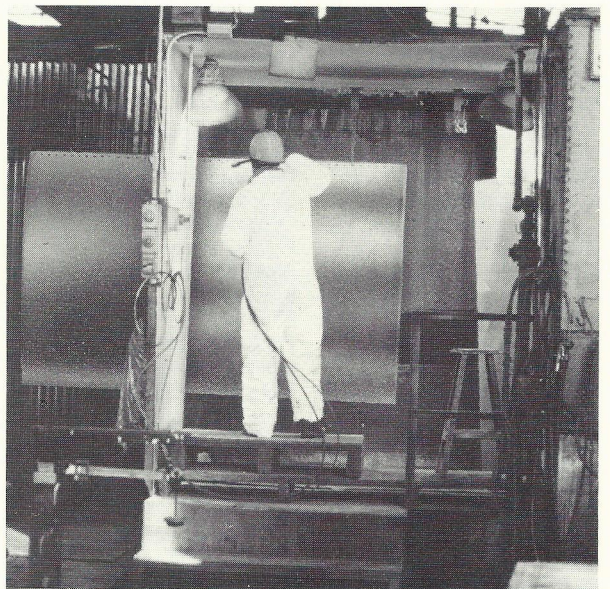
However, what is built-in at the factory is only as good as its field erection. Just as a factory baked-on coating is essential for effective corrosion resistance, factory craftsmanship is essential to efficient field erection.

For years Trico has enjoyed the "Master Crafted" reputation for our tank performance.

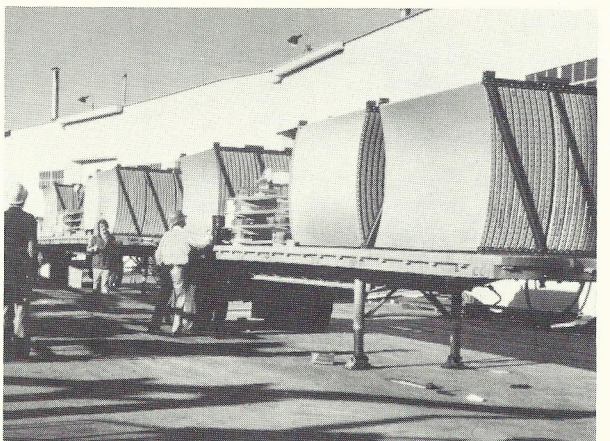
Components that erect more smoothly, become tanks that perform better in liquid storage.



ADJUSTING THERMO TRON X OVEN.



APPLYING TRICO-BOND 478.



READYING TANK COMPONENTS FOR SHIPMENT.



## COLUMBIAN DIVISION

### Specifications

#### Physical Properties of Trico-Bond 478 Coating.

Application	Factory applied, thermally cured
Corrosion Resistance	Excellent to most acids, alkali, brines, sea water, sour crude oil, refined stocks, aromatics, and salt spray.
Salt Spray (ASTMB-117)	7,000 hr
Total Dry Film Thickness	5-6 mils
Limiting Operating Temperature (Dry Heat)	300°F
Operating Temperature (Immersed)	
	212°F crude oil
	180°F oilfield sour water
	140°F general chemical
Gloss 60 Degrees	25-40
Abrasion Resistance	84 mg loss (cs 10 wheel)
Impact Resistance	60-90 in-lb on 10-gauge steel
Scrape Adhesion (ASTM D-2197)	Passes 10
Shear-Bond Adhesion	1,200 psi
Color	Gold

#### Chemical Properties of Trico-Bond 478 Coating.

Trico-Bond 478 is suitable for immersion in the following:

10% Aluminum Sulfate	Mineral Oil
10% Ammonium Hydroxide	Sour Crude Oil 180°F
28% Ammonium Hydroxide	Vegetable Oil
10% Ammonium Nitrate	Denatured Alcohol
30% Ammonium Nitrate	Deionized Water
30% Ammonium Sulfate	Distilled Water
5% Boric Acid	Oilfield Produced Water 200°F
25% Citric Acid	Potable Water
20% Ferric Chloride	Salt Water
10% Phosphoric Acid	Waste Water
10% Sodium Chloride	Fatty Acids
50% Sodium Hydroxide	Liquid Manure
15% Sodium Sulfate	Monoethanotamine
15% Urea	Monsanto "Lasso"
Benzine	Parafin Wax
Castor Oil	Sydrol 500 A
Coconut Oil	Sydrol 500 B
Cottonseed Oil	Sewage
Fuel Oil	Toluene
Lubricating Oil	4-10-10 Fertilizer
	10-34-0 Fertilizer

Note: In tests, this coating has been immersed in boiling deionized water for more than 10,000 hr with no adverse effect on physical properties.

#### General

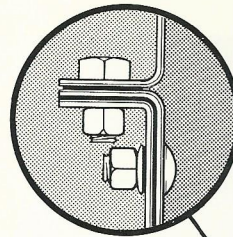
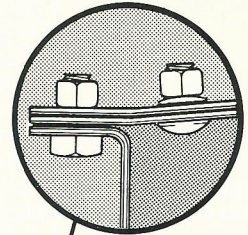
Decks are coned to a 1:12 slope. Bottoms are flat. Tanks are shipped knocked down.

#### Available Finishes

- 1. Trico-Bond 478.** Interior and both sides of bottom factory coated with Trico-Bond 478 (gold). Exterior primed with a zinc-primer or epoxy ester and finished with acrylic enamel (sand). Poly-capped bolts on sidewall and deck interior connections. Hot-dipped galvanized nuts and bolts on all other connections.
- 2. Galvanized.** Hot-dipped galvanized throughout, including nuts and bolts.
- 3. Red Oxide.** Interior and exterior primed with red oxide. Exterior finished with aluminum paint. Black nuts and bolts.
- 4. Unpainted.** Black nuts and bolts.

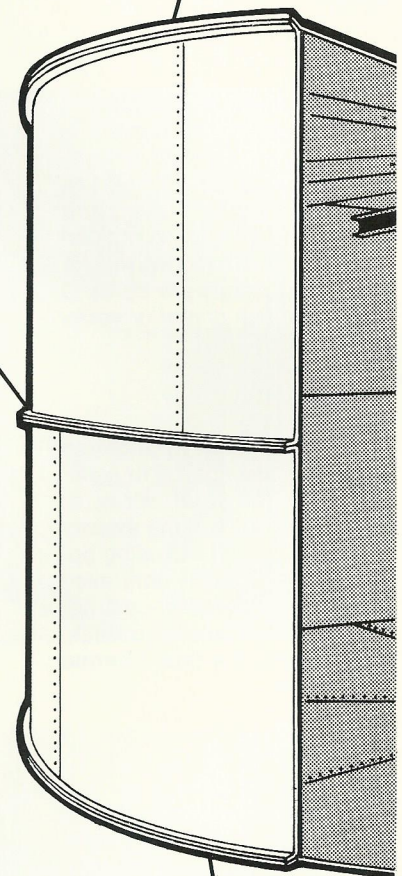
#### Deck and Vapor Area:

Factory application of coating plus encapsulated bolt heads make this entire area 100% corrosion resistant. The coating extends under gasketed seams; under field coating conditions, such total protection is impossible.



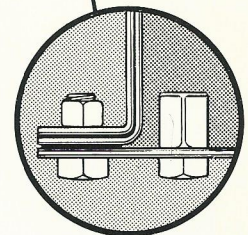
#### Side Walls:

Factory formed flanges at horizontal seams give the bolted tank added structural strength. Buna N gaskets and special sealants create leakproof joints at both horizontal and vertical seams. Factory applied coating and encapsulated bolt heads provide corrosion-resistance at all seams, joints and connections.



#### Bottom:

Bottom segments are coated on both sides with Trico-Bond 478 and assembled with galvanized nuts and bolts. Use of optional encapsulated nuts provides maximum corrosion-resistance against both outside contaminants and internally-stored liquids.



# COLUMBIAN DIVISION



## Standard Equipment

- 24 x 46 in. cleanout door
- 20 in. circular or 24 x 24 in. square manway
- Vent hatch
- Center deck support as required
- All necessary erection hardware consisting of bolts, nuts, washers and gaskets.

## Optional Equipment

- Liquid level indicator with float and target board
- Unitank Flanges: Threaded-type black or galvanized ductile iron, 1/2, 3/4, 1, 2, 3, 4 and 6 in.
- Bolt-On Union Flanges: Black or galvanized steel, 1, 2, 3, 4, and 6 in.
- Welded-Type Bolted-On Nozzles: Black, galvanized or Trico-Bond 478 coated, 2 through 18-in.
- Stairways, walkways and ladders
- Encapsulated nuts

## Bolts and Nuts

Trico Steel Tank bolts have a tensile strength of 90,000 psi and are black or hot-dipped galvanized. Stainless steel, diffusion-

coated or poly-capped bolt heads are available for corrosion resistance. Plastic encapsulated steel nuts offer additional corrosion protection.

## Gaskets and Sealants

Trico gaskets are manufactured to our specifications and meet or exceed AWWA, FDA and EPA standards. We also have a gasket available to satisfy the requirements for wastewater, recycled water, and agricultural water. Gaskets are prepunched with accurately spaced holes that are slightly smaller in diameter than the bolts. This permits the gasket to cling to the bolts, preventing leakage along the threads and ensuring a tight, leakproof seal. Every gasket is combined with a silicone sealant to further assure a satisfactory installation.

## Foundations

Bolted tank foundations can be a variety of types including rock, sand, wood, concrete slab or concrete retainer wall with a rock or sand filled center. The rock or sand foundations should be retained by a steel retainer ring 6 to 12 in. deep. They must all be prepared on a grade that is level, accessible, and tested for soil-bearing capability.

**BOLTED STEEL TANKS FOR LIQUID STORAGE**

Capacity (Nominal)				Physical Characteristics					
U.S. Gal.	Imperial Gal.	Liters	Cubic Meters	Inside Diameter		Shell Height		Weight	
				Ft./In.	Meters	Ft./In.	Meters	Lb	Kg
4,000	3,300	15,000	15.2	9'2-3/4"	2.8	8'-1/2"	2.45	2,066	937
8,000	6,700	30,000	30.5	9'2-3/4"	2.8	16'1"	4.9	3,164	1,435
12,000	10,000	46,000	45.7	9'2-3/4"	2.8	24'1-1/2"	7.4	4,261	1,933
16,000	13,400	61,000	60.8	9'2-3/4"	2.8	32'2"	9.8	5,361	2,432
20,000	16,800	76,000	76.0	9'2-3/4"	2.8	40'2-1/2"	12.25	6,801	3,085
24,000	20,100	91,000	91.2	9'2-3/4"	2.8	48'3"	14.7	8,241	3,738
7,000	5,800	27,000	26.6	12'3-11/16"	3.8	8'-1/2"	2.45	3,290	1,492
14,000	11,700	53,000	53.2	12'3-11/16"	3.8	16'1"	4.9	4,902	2,223
21,000	17,500	80,000	79.8	12'3-11/16"	3.8	24'1-1/2"	7.4	6,781	3,075
29,000	24,100	110,000	110.2	12'3-11/16"	3.8	32'2"	9.8	8,681	3,937
36,000	30,100	137,000	137.0	12'3-11/16"	3.8	40'2-1/2"	12.25	10,751	4,876
43,000	35,800	163,000	163.4	12'3-11/16"	3.8	48'3"	14.7	12,821	5,814
11,000	9,300	42,000	42.3	15'4-5/8"	4.7	8'-1/2"	2.45	4,510	2,046
22,000	18,200	83,000	83.0	15'4-5/8"	4.7	16'1"	4.9	6,640	3,012
34,000	27,900	127,000	127.0	15'4-5/8"	4.7	24'1-1/2"	7.4	9,300	4,218
45,000	37,200	169,000	169.2	15'4-5/8"	4.7	32'2"	9.8	12,000	5,443
56,000	46,600	212,000	211.5	15'4-5/8"	4.7	40'2-1/2"	12.25	14,700	6,668
67,000	55,900	254,000	253.8	15'4-5/8"	4.7	48'3"	14.7	17,400	7,893
22,000	18,200	83,000	83.0	21'6-1/2"	6.6	8'-1/2"	2.45	8,060	3,656
44,000	36,400	166,000	166.0	21'6-1/2"	6.6	16'1"	4.9	11,040	5,008
66,000	54,700	249,000	249.0	21'6-1/2"	6.6	24'1-1/2"	7.4	14,020	6,359
88,000	73,000	332,000	332.0	21'6-1/2"	6.6	32'2"	9.8	17,820	8,083
110,000	91,300	415,000	415.0	21'6-1/2"	6.6	40'2-1/2"	12.25	22,770	10,328
132,000	109,500	498,000	498.0	21'6-1/2"	6.6	48'3"	14.7	28,370	12,868
32,000	26,900	122,000	122.4	26'1-7/8"	8.0	8'-1/2"	2.45	9,940	4,509
65,000	53,800	245,000	244.7	26'1-7/8"	8.0	16'1"	4.9	13,030	5,910
97,000	80,700	367,000	367.1	26'1-7/8"	8.0	24'1-1/2"	7.4	17,650	8,006
129,000	107,700	489,000	489.6	26'1-7/8"	8.0	32'2"	9.8	22,650	10,274
162,000	134,600	612,000	612.0	26'1-7/8"	8.0	40'2-1/2"	12.25	29,050	13,177
194,000	161,500	734,000	734.4	26'1-7/8"	8.0	48'3"	14.7	37,050	16,806
42,000	34,700	158,000	158.0	29'8-5/8"	9.1	8'-1/2"	2.45	14,490	6,573
83,000	69,500	316,000	316.0	29'8-5/8"	9.1	16'1"	4.9	18,490	8,387
125,000	104,200	474,000	473.9	29'8-5/8"	9.1	24'1-1/2"	7.4	23,780	10,786
167,000	139,000	632,000	632.0	29'8-5/8"	9.1	32'2"	9.8	31,130	14,120
209,000	173,800	790,000	790.0	29'8-5/8"	9.1	40'2-1/2"	12.25	40,330	18,293
250,000	208,500	948,000	948.0	29'8-5/8"	9.1	48'3"	14.7	50,430	22,875
71,000	58,700	267,000	267.0	38'7-5/8"	11.8	8'-1/2"	2.45	25,865	11,732
141,000	117,400	534,000	534.0	38'7-5/8"	11.8	16'1"	4.9	32,115	14,567
212,000	176,000	801,000	801.0	38'7-5/8"	11.8	24'1-1/2"	7.4	40,660	18,443
282,000	235,000	1,068,000	1,068.0	38'7-5/8"	11.8	32'2"	9.8	52,160	23,659
353,000	293,600	1,335,000	1,335.0	38'7-5/8"	11.8	40'2-1/2"	12.25	66,860	30,327
423,000	352,200	1,601,000	1,601.7	38'7-5/8"	11.8	48'3"	14.7	79,600	36,100
106,000	88,300	401,000	401.3	47'6-3/8"	14.5	8'-1/2"	2.45	36,000	16,300
212,000	176,500	802,000	802.5	47'6-3/8"	14.5	16'1"	4.9	46,000	20,900
318,000	264,800	1,204,000	1,203.8	47'6-3/8"	14.5	24'2"	7.4	58,000	26,300
424,000	353,000	1,605,000	1,605.0	47'6-3/8"	14.5	32'3"	9.8	73,000	33,100
530,000	441,300	2,006,000	2,006.3	47'6-3/8"	14.5	40'4"	12.3	98,000	44,500
143,000	118,900	541,000	540.7	54'11-3/4"	16.8	8'-1/2"	2.45	49,230	22,330
286,000	237,800	1,081,000	1,081.3	54'11-3/4"	16.8	16'1"	4.9	62,260	28,241
428,000	356,700	1,622,000	1,622.0	54'11-3/4"	16.8	24'1-1/2"	7.4	80,460	36,496
571,000	475,700	2,163,000	2,162.8	54'11-3/4"	16.8	32'2"	9.8	101,460	46,021
202,000	168,200	765,000	767.6	65'4-5/16"	19.9	8'-1/2"	2.45	62,200	28,208
404,000	336,400	1,529,000	1,535.0	65'4-5/16"	19.9	16'1"	4.9	78,826	35,748
606,000	504,600	2,294,000	2,302.8	65'4-5/16"	19.9	24'1-1/2"	7.4	100,293	45,482
807,000	672,100	3,055,000	3,066.6	65'4-5/16"	19.9	32'2"	9.8	121,760	55,218
304,000	253,100	1,151,000	1,150.9	80'2-9/16"	24.5	8'-1/2"	2.45	123,800	56,155
608,000	506,300	2,302,000	2,301.7	80'2-9/16"	24.5	16'1"	4.9	149,500	67,812
912,000	759,500	3,453,000	3,453.0	80'2-9/16"	24.5	24'3"	7.4	169,800	77,020
401,000	333,700	1,517,000	1,517.2	92'1-3/16"	28.0	8'-1/2"	2.45	151,000	68,492
802,000	667,300	3,034,000	3,034.4	92'1-3/16"	28.0	16'1"	4.9	180,000	81,647
1,203,000	1,001,000	4,551,000	4,551.6	92'1-3/16"	28.0	24'3"	7.4	210,000	95,254