CABLECRAFT PRODUCT CATALOG

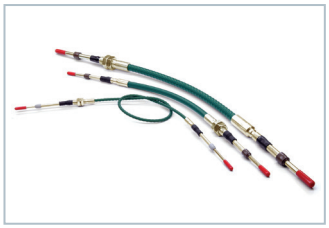


Cablecraft®
Motion Controls

Connecting a World in Motion

Engineered solutions for your motion control needs.

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"Cablecraft puts powerful control safely in the hands of the world's drivers, pilots, and equipment operators."

Control Cable Assemblies

Today's Cablecraft® control cables and heads have evolved from over 50 years of experience in meeting a wide variety of motion control applications. Combining careful selection of materials with optimized fabrication methods, Cablecraft Motion Controls provides users with the most versatile, highest quality control cables available. Our cables are the most flexible in the industry and offer superior protection from contaminants and damage.


Pull-Only Brake Controls

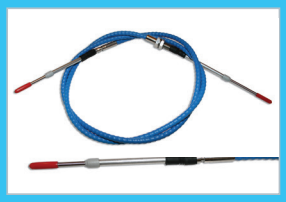

Pull-Only Clutch Control Cables


Pull-Only Tension Controls

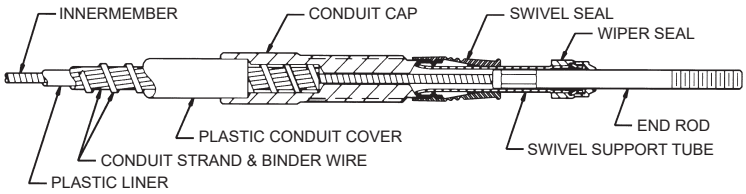

Pull-Only T-Flex Controls


Push-Pull 4B Cables


Push-Pull Standard Controls


Push-Pull Blue Max Cable

Time Proven Design



Conduit: Superior binder wire design outperforms the competition's imitations.

Innermember: Made of flexible 1 x 19 carbon strand and armored with a swaged steel jacket for smoothness and compression strength.

Lubrication: All standard Cablecraft controls are lubricated during construction with carefully selected compounds to provide optimum performance. No further service is necessary or recommended.

End Rods: All end rods are 300 series stainless steel with a burnished finish.

Wiper Seals: Designed to prevent entry of moisture and contamination into the support tube and provide a bearing surface for the end rod. Model 5 seals are standard and Model 6 seals are optional for severe conditions.

Support Tube and Swivel Seal: The swivel joint between the support tube and conduit cap is designed to allow 8 degrees swivel from control center line and protects this joint from moisture and contamination.

Conduit Caps: Threaded for bulkhead installation or grooved for clamp application.

Control Cable Assemblies

Specifications

Part	Operation	Materials – Inner Member			Materials – Conduit			
		Strand	Binder	Cover	Linear	Strand	Binder	Cover
Bristow	Push/Pull	1 x 19 CS	CS Flat Wire	N/A	HDPE	Carbon Steel	N/A	LDPE
Utility	Push/Pull	1 x 19 CS	CS Flat Wire	N/A	HDPE	Carbon Steel	Carbon Steel	LDPE
Low Friction EXT	Push/Pull	1 x 19 CS	CS Flat Wire	Nylon	HDPE	Carbon Steel	Carbon Steel	LDPE
Low Friction	Push/Pull	1 x 19 CS	CS Flat Wire	PTFE	Polyester	Carbon Steel	Carbon Steel	LDPE
Performance	Push/Pull	1 x 19 SS	300 Series SS	N/A	PTFE	Carbon Steel	CS Galvanized	Polyethylene
800# Brake	Pull Only	1 x 19 Galv WR	N/A	Nylon	HDPE	Carbon Steel	N/A	LDPE
1500# Brake	Pull Only	1 x 19 Galv WR	N/A	Nylon	HDPE	Carbon Steel	Carbon Steel	LDPE
3000# Brake	Pull Only	1 x 19 Galv WR	N/A	Nylon	HDPE	Carbon Steel	Carbon Steel	LDPE

Part	Specifications								Duties					
	Bend Radius	Efficiency @ 270°	Backlash @ 360°	Load Rating Push* Working Force (lbs)	Load Rating Pull* Working Force (lbs)	Seals	Min Temp	Max Temp	VLD	LD	MD	HD	ULD	EMD
Bristow	2-5"	65%	.072″	30-250	120-400	5	-65°F	230°F	X	X	X	X	X	
Utility	2-6"	65%	.072″	15-700	70-1000	5	-65°F	230°F	X	X	X	X	X	
Low Friction EXT	2-5"	76%	.072″	30-250	120-400	5	-65°F	230°F	X	X	X	X	X	
Low Friction	2-6"	79%	.072″	30-700	120-1000	5	-65°F	230°F	X	X	X	X	X	X
Performance	2-5"	76%	.072″	30-250	120-400	6	-65°F	230°F	X	X	X	X	X	
800# Brake	5"				230			230°F						
1500# Brake	5"				400			230°F						
3000# Brake	7"				800			230°F						

**Depends upon duty*

Performance Comparison

Part	Temperature	Bend Radius	Strength Integrity	Economy	Efficiency	Service Life	Flexibility	Lost Motion
Bristow	↓	↓	↓	↑	↓	↓	→	↓
Utility	→	↑	↑	→	↓	→	↑	→
LF-EXT	→	↑	↑	→	→	↑	↑	↑
Low Friction	↑	↑	↑	↓	↑	→	↑	↑
Performance	→	↑	↑	↓	↑	↑	↑	↑
800# Brake	→	↑	↓	↑	→	→	↑	
1500# Brake	→	→	→	→	→	→	→	
3000# Brake	→	↓	↑	→	→	→	↓	

Industrial Controls Cautions

The following cautions describe application and installation information:

1. Do not install Cablecraft® control cables on any application which may exceed any of the design parameters of the control cable.
2. Cablecraft control cables are designed and assembled to be non-repairable. Do not attempt to modify this control cable.
3. Cablecraft control cables are designed to be contaminant resistant: not contaminant proof. Protect the cable from contaminants such as gas, oil, diesel fuel, water, dirt, and chemicals which may damage the control cable.
4. Protect the Cablecraft control cable from physical damage by paint, kinking, vibration, etc., which may damage the control cable.
5. Cablecraft control cables have the best load capacity in the pull mode. Always install the control cable so it pulls the greatest load, and pushes the smaller load; and pulls the item into the neutral or off position.
6. Do not install the Cablecraft control cable with power on or the engine running. Serious injury or death could result.
7. The usable stroke must be centered within the available travel (see Figure 1 below).
8. The swivel angle must be centered within the available swivel angle (see Figure 2 below).
9. This cable is not for use on aircraft installations.

FIGURE 1

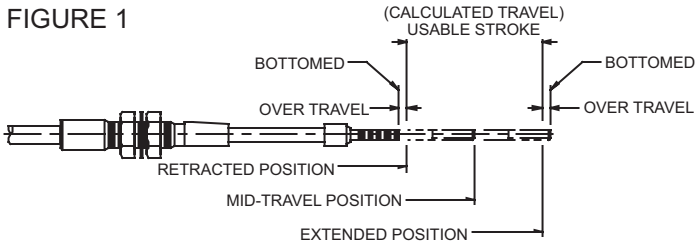
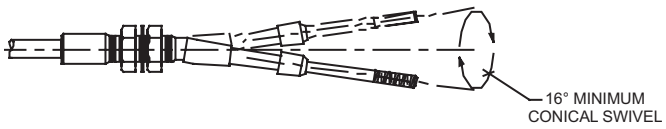


FIGURE 2



Industrial Controls Warnings

The following warnings describe important push-pull cable operation and maintenance information:

1. Do not adjust the Cablecraft control cable with the power on or the engine running. Serious injury or death could result.
2. A gradual or sudden increase in the no-load friction (cable disconnected at both ends) of a Cablecraft control cable is an indication of a pending or present performance problem. The control cable should be replaced, otherwise serious injury or death may result.
3. A gradual or sudden decrease in the usable stroke is an indication of a pending or present performance problem. The Cablecraft control cable should be replaced, otherwise serious injury or death may result.
4. Cablecraft control cables which have moisture inside of them and/or have frozen should be replaced. Do not apply heat to thaw or dry control cables.
5. Cablecraft control cables are lubricated for the life of the control cable. Do not remove the seals or lubricate the control cable.
6. Cablecraft control cables are designed to be non-repairable. Do not attempt to repair this control cable.

Pull-Only Brake Controls

1500 & 3000 Control Cable Assemblies

Simple to install and easy to maintain, these versatile pull controls are found on numerous types of mechanical equipment. Specifically designed for applications that require a high load capability and low deflection, this flexible control is designed to transmit pull motion between two mechanical devices without the use of rods, bellcranks, or other rigid mechanical linkage.

Common Applications: Park brakes, pull-only cable systems

- High load capacity
- Low deflection
- Installed bend radius down to 5 inches

Material:

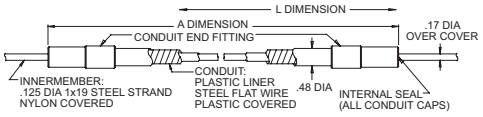
- Carbon steel and plastic

Suggested End Fittings:

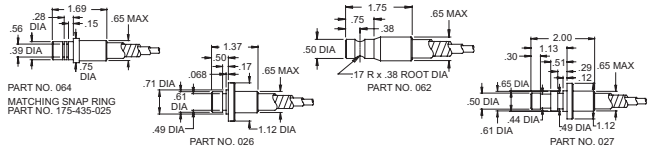
- All 1,500-3,000 lb. brake cable fittings
- Rod ends
- Clevises



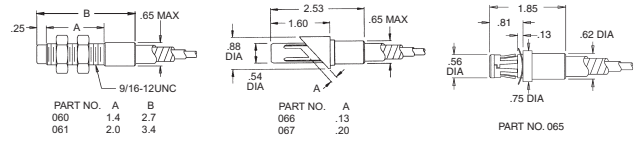
1500lb Series Ultimate Load: 1500lb
Minimum Bend Radius: 5”



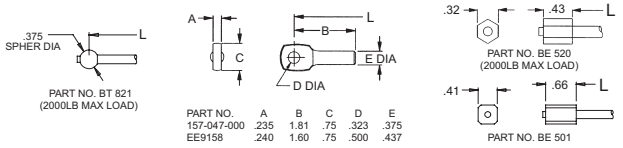
Grooved End Fittings



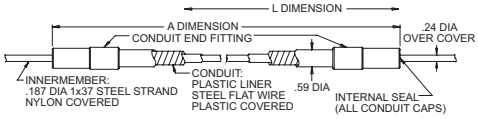
Threaded End Fittings | **48° Clip-Lock End Fitting** | **Clip-Lock End Fitting**



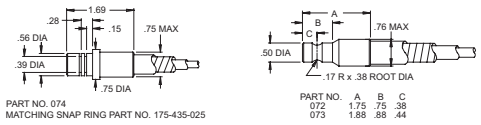
Ball End | **Eye End** | **Cable Stop**



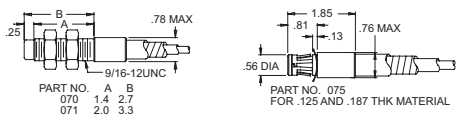
3000lb Series Ultimate Load: 3000lb
Minimum Bend Radius: 7”



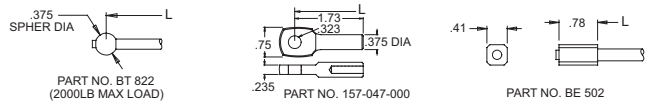
Grooved End Fittings



Threaded End Fittings | **Clip-Lock End Fitting**



Ball End | **Eye End** | **Cable Stop**



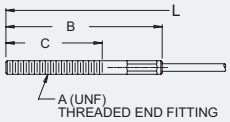
WARNING *- Since the manufacturer is unable to determine all applications in which a part may be placed, it is the user's responsibility to determine the suitability of the part for its intended use. This is especially true where safety is a factor. Incorrect application or installation may result in property damage, bodily injury, or death. For technical assistance, call 260-749-5105.*

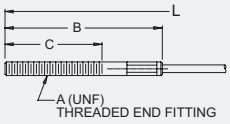
1500 Brake

Threaded End Fitting	A	B	C
TE504	5/16-24	3.70	2.22
TE504-006	5/16-24	2.08	.97
TE504-007	5/16-24	6.08	4.60
TE506	3/8-24	2.74	1.47
TE523-001	1/4-28	3.68	2.47

3000 Brake

Threaded End Fitting	A	B	C
TE505	3/8-24	2.95	2.00
TE505-001	3/8-24	1.88	1.00
TE508	3/8-24	2.62	1.50
TE509-001	3/8-24	4.95	3.75
TE510-001	5/16-24	2.50	1.50
TE510-002	5/16-24	3.62	2.24
TE510-004	5/16-24	4.00	3.00
TE510-005	1/4-28	3.62	2.50
TE510-006	5/16-24	2.12	1.00
TE510-007	5/16-24	2.88	1.50
TE510-008	5/16-24	5.60	4.47
TE510-009	5/16-24	3.00	1.91
TE605	3/8-24	6.00	5.00





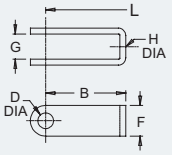
Strap Clevis Part Numbers (For both 1500 and 3000 brake)

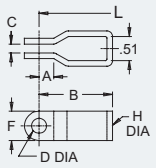
Open Strap Clevis	A	B	D	F	G	H
CS540	-	1.62	.31	.62	.43	.266
CS540-001	-	1.62	.31	.62	.51	.266
CS540-006	-	2.50	.38	.75	.57	.386
CS540-007	-	2.50	.31	.62	.51	.266
CS541	-	1.94	.38	.75	.51	.266
CS541-003	-	1.94	.38	.75	.51	.323
CS541-005	-	2.00	.38	.75	.51	.266
CS541-007	-	2.50	.38	.75	.51	.266
CS541-008	-	2.50	.38	.75	.51	.323
CS542*	-	1.08	.50	1.00	.58	.323

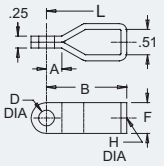
Step Strap Clevis	A	B	C	D	F	H
CS550	.31	1.56	.19	.31	.62	.266
CS550-001	.31	1.56	.19	.38	.62	.266
CS550-002	.31	1.56	.19	.31	.62	.316
CS550-004	.31	1.56	.19	.25	.62	.266
CS551	.38	1.75	.25	.31	.62	.266
CS551-001	.38	1.75	.25	.38	.62	.266
CS551-002	.75	2.38	.25	.31	.62	.316
CS551-003	.38	1.50	.25	.25	.62	.266
CS552	.31	2.38	.25	.31	.75	.266
CS552-001	.31	2.38	.25	.38	.75	.266
CS552-003	.38	2.38	.25	.43	.75	.316
CS552-004	.38	2.38	.25	.31	.75	.316

Closed Strap Clevis	A	B	C	D	F	H
CS563	.28	1.75	-	.31	.62	.316

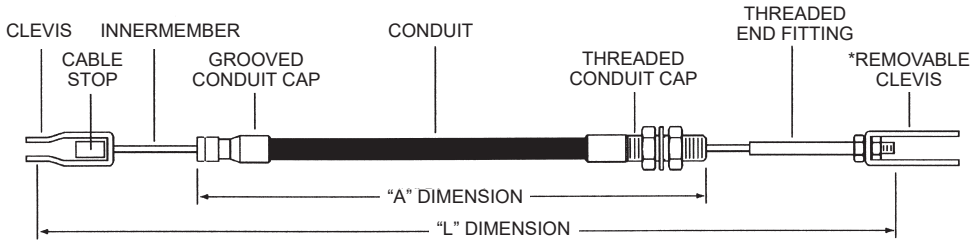
*use with 5/16 threaded end rod with nuts only







1500 & 3000 Pull-Only Brake Order Code



To specify a pull-only brake, the following information must be given in the order listed:

1. Left innermember end fitting part number.
2. Left conduit end fitting part number.
3. Length "A" between conduit fitting reference points in inches.
4. Right conduit end fitting part number.
5. Right innermember end fitting part number.
6. Length "L" of innermember assembly between fitting reference points in inches.
7. Travel of the innermember in the conduit in inches. (Note: dimensions "L" must be sufficiently greater than dimension "A" to allow desired travel).

Removable items should be listed separately.

Cablecraft® Ordering Codes

CS551 - 072 - 54 - 070 - TE505 - 64.5 - 6

Left Innermember End Fitting Part Number
(Clevis End Fitting with Cable Stop)

Left Conduit End Fitting Part Number
(Grooved Conduit End Fitting)

Length of Conduit Assembly
(54") "A" Dimension

Right Conduit End Fitting Part Number
(Threaded Conduit End Fitting)

Right Innermember End Fitting Part Number
(Threaded Conduit End Fitting)

Length of Innermember Assembly
(64.5") "L" Dimension

Travel (inches)
(6")

All line art dimensions are represented in inches

Cablecraft® Motion Controls

Pull-Only Brake Controls

800 Control Cable Assemblies

This 800 lb. pull-only brake cable provides an efficient and flexible means to transmit pull only motion between two mechanical devices. Simple to install and easy to maintain, our versatile pull controls are found on many types of mechanical equipment.

Common Applications: Brake levers, lift levers, and steering assemblies

- All hardware meets recognized industry related standards for environmental protection and corrosion resistance
- Wide variety of fittings to meet our customers design needs

Material:

- Standard 1 x 19 galvanized wire rope innermember with nylon jacket
- Nylon core, galvanized stranded conduit with durable nylon covering

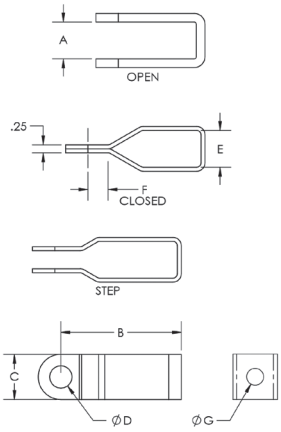
Specifications:

- Operating Temperature: -65ºF – 185ºF (-54ºC – 110ºC)
- Minimum Bend Radius: 5" (152 mm)



Strap Clevis Part Numbers (Dimensions - Inches)

	Part No.	A	B	C	D	E	F	G
Open	CS540	0.43	1.62	0.62	0.31	--	--	0.266
	CS540-001	0.51	1.62	0.62	0.31	--	--	0.266
	CS540-007	0.51	2.50	0.62	0.31	--	--	0.266
	CS541	0.51	1.94	0.75	0.38	--	--	0.266
Step	CS550	0.19	1.56	0.62	0.31	0.51	0.31	0.266
	CS550-004	0.19	1.56	0.62	0.25	0.51	0.31	0.266
	CS551	0.25	1.75	0.62	0.31	0.51	0.38	0.266
	CS551-001	0.25	1.75	0.62	0.38	0.51	0.38	0.266
	CS551-003	0.25	1.50	0.62	0.25	0.51	0.38	0.266
	CS552	0.25	2.38	0.75	0.31	0.51	0.31	0.266
	CS552-001	0.25	2.38	0.75	0.38	0.51	0.31	0.266
Closed	CS563	--	1.75	0.62	0.31	0.51	0.28	0.316

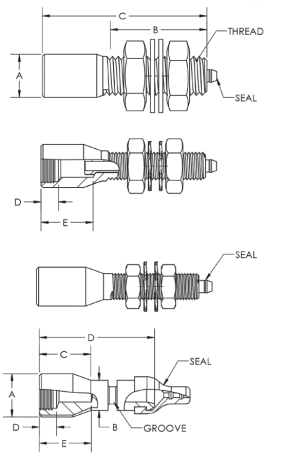


Threaded Conduit Cap Part Numbers and Detail

Part No.	Thread	A Dia.	B	C	D	E	E w/Seal	Trim Length	Swage Dia.
161-387-209	9/16 - 12	0.625	1.50	2.37	.025	0.75	0.63	0.50	.587 / .577
	Carbon Nut 175-412-209			Carbon Washer 175-413-020			Seal 159-002-001		
161-387-210	7/16 - 20	0.625	1.38	2.37	0.25	0.75	0.63	0.50	587 / .577
	Carbon Nut 175-412-036			Carbon Washer 175-413-016			Seal 159-002-001		
161-387-211	3/8 - 24	0.563	1.25	2.37	0.25	0.75	0.63	0.50	.505 / .515
	Carbon Nut 175-412-005			Carbon Washer 175-413-020			Seal 159-002-001		

Grooved Conduit Cap Part Numbers and Detail

Part No.	Groove Dim.	A Dia.	B	C	D	E	E w/Seal	Trim Length	Swage Dia.
161-387-212	.131 x .250	0.625	0.438	0.74	1.66	0.75	0.75	0.50	.587 / .577
	Seal p.n. 175-328-001				U-bolt w/nuts 161-010-001				



Standard conduit caps:

- Zinc plated per ASTM B633, RoHS Compliant

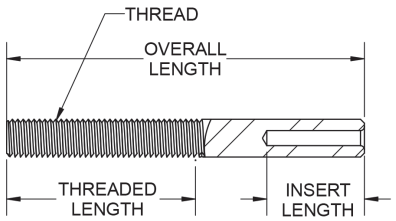
Specifications:

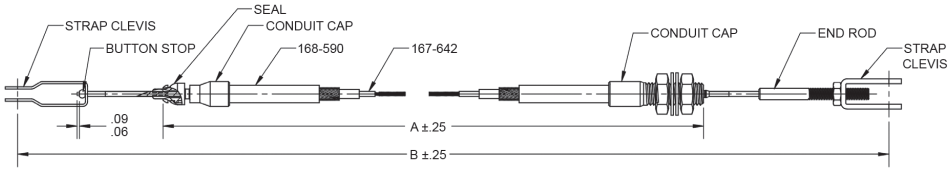
- Salt Spray: 96 hr white corrosion
- End Rod Pull-Off: 1.25 min. FOS vs load rating

WARNING *- Since the manufacturer is unable to determine all applications in which a part may be placed, it is the user's responsibility to determine the suitability of the part for its intended use. This is especially true where safety is a factor. Incorrect application or installation may result in property damage, bodily injury, or death. For technical assistance, call 260-749-5105.*

Pull-Only Brake Controls

End Rod Part Number and Detail (Dimensions - Inches)							
Part No.	**Thread**	**Overall Length**	**Minimum Thread Length**	**Insert Length**	**Swage Hex**	**Swage Length**	**Swage Index**
TE800-150-075	5/16-24 Unit-2A	1.50	0.75	0.75	.270+003	0.500	0.12
TE800-175-100	5/16-24 Unit-2A	1.75	1.00	0.75	.270+003	0.500	0.12
TE800-200-100	5/16-24 Unit-2A	2.00	1.00	0.75	.270+003	0.500	0.12
TE800-225-100	5/16-24 Unit-2A	2.25	1.00	0.75	.270+003	0.500	0.12
TE800-225-125	5/16-24 Unit-2A	2.25	1.25	0.75	.270+003	0.500	0.12
TE800-250-125	5/16-24 Unit-2A	2.50	1.25	0.75	.270+003	0.500	0.12
TE800-250-150	5/16-24 Unit-2A	2.50	1.50	0.75	.270+003	0.500	0.12
TE800-275-150	5/16-24 Unit-2A	2.75	1.50	0.75	.270+003	0.500	0.12
TE800-275-175	5/16-24 Unit-2A	2.75	1.75	0.75	.270+003	0.500	0.12
TE800-300-150	5/16-24 Unit-2A	3.00	1.50	0.75	.270+003	0.500	0.12
TE800-300-200	5/16-24 Unit-2A	3.00	2.00	0.75	.270+003	0.500	0.12
TE800-325-150	5/16-24 Unit-2A	3.25	1.50	0.75	.270+003	0.500	0.12
TE800-325-200	5/16-24 Unit-2A	3.25	2.00	0.75	.270+003	0.500	0.12
TE800-350-250	5/16-24 Unit-2A	3.50	2.50	0.75	.270+003	0.500	0.12
TE800-350-200	5/16-24 Unit-2A	3.50	2.00	0.75	.270+003	0.500	0.12
TE800-375-250	5/16-24 Unit-2A	3.75	2.50	0.75	.270+003	0.500	0.12
TE800-375-200	5/16-24 Unit-2A	3.75	2.00	0.75	.270+003	0.500	0.12
TE800-400-250	5/16-24 Unit-2A	4.00	2.50	0.75	.270+003	0.500	0.12
TE800-400-200	5/16-24 Unit-2A	4.00	2.00	0.75	.270+003	0.500	0.12
TE800-450-250	5/16-24 Unit-2A	4.50	2.50	0.75	.270+003	0.500	0.12
TE800-450-200	5/16-24 Unit-2A	4.50	2.00	0.75	.270+003	0.500	0.12
TE554	#10-32 Unit-2A	1.40	0.75	0.75	.162+003	0.440	0.12
TE543	1/4-28 Unit-2A	1.94	1.13	0.75	.221+003	0.500	0.12
TE540	M6x-1-6g	2.45	1.33	0.75	.221+003	0.500	0.12
TE524	M6x-1-6g	1.38	0.62	0.75	.221+003	0.500	0.12
TE527	M6x-1-6g	1.55	0.75	0.75	.221+003	0.500	0.12
TE526	M6x-1-6g	1.71	1.18	0.75	.221+003	0.500	0.12





To specify a pull-only cable, the following information must be given in the order listed:

1. Left innermember end fitting part number. Enter 000 if no fitting is required.
2. Left conduit end fitting part number.
3. Length "A" between conduit fitting reference points.
4. Right conduit end fitting part number.
5. Right innermember end fitting part number.
6. Length "B" of innermember assembly between fitting reference points.
7. Travel of innermember in reference to conduit.

(Note: Dimension "B" must be significantly longer than dimension "A" to allow desired travel.)

Cablecraft® Ordering Codes

CS540 - 011 - 54.5 - 021 - TE100 - 60.25

- Member End Fitting Part Number
- Left Conduit End Fitting Part Number
- Assembly ("A" Dimension)
- Right Conduit End Fitting Part Number
- Right Innermember End Part Number
- Member Assembly ("B" Dimension)

Cablecraft® Motion Controls

Pull-Only Clutch Control Cables

Control Cable Assembly

This flexible control is designed to transmit pull motion between two mechanical devices without the use of rods, bellcranks, or other rigid mechanical linkage. Simple to install and easy to maintain, these versatile pull controls are specifically designed for applications that require a high load capability and low deflection.

Common Applications: Clutch controls, heavy-duty lanyards

- Custom engineered assembly
- Installed bend radius down to 5 inches
- Sealed and lubricated for life

Material:

- Nylon covered innermember
- Plastic covered conduit

Suggested End Fittings:

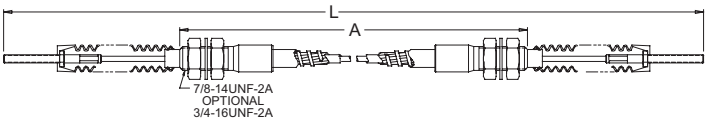
- Clevis



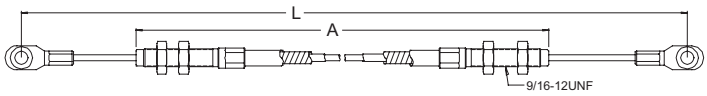
Pull-Only Clutch Specifications

Generic clutch replacement cables HD conduit, special clutch innermember Part No. CA235-A-L (5/16-24 end rods), Part No. CA236-A-L (3/8-24 end rods)

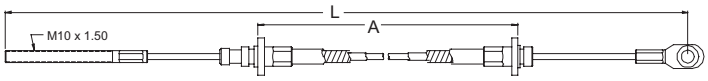
Order Code: A = Conduit length; L = Length overall



General Motors® style clutch cable, 1500 lb brake conduit and innermember Part No. CA271-A-L (A = Conduit length; L = Length overall)



General Motors® style clutch cable, 1500 lb brake conduit and innermember Part No. CA270-XXX (XXX = Dash number, see table below)



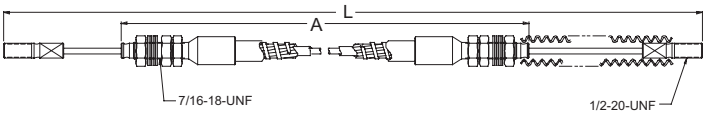
CA270-XXX

Dash No.	GM® Part No.	A	L
-010	15520115	47.56	76.69
-009	15518380	43.31	71.65
-008	15518379	51.18	79.53
-007	15518378	44.88	74.21
-006	15518377	37.60	66.93
-005	15507983	44.55	69.01
-004	15507982	26.00	52.75
-003	15507981	45.27	72.91
-002	15507980	44.49	72.95
-001	15507979	40.94	68.07

GM is a registered trademark of General Motors.

WARNING *- Since the manufacturer is unable to determine all applications in which a part may be placed, it is the user's responsibility to determine the suitability of the part for its intended use. This is especially true where safety is a factor. Incorrect application or installation may result in property damage, bodily injury, or death. For technical assistance, call 260-749-5105.*

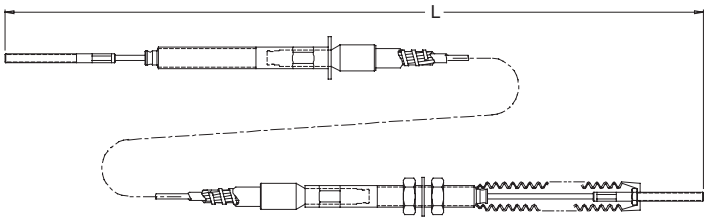
Mack Truck® style clutch cable, HD conduit and special clutch innermember
Part No. CA312-A-L (A = Conduit length; L = Length overall; see table below)



CA312-A-L

Part No.	A	L
CA312-34.6-42.0	34.6	42.0
CA312-55.6-63.0	55.6	63.0
CA312-79.6-87.0	79.6	87.0
CA312-85.6-93.0	85.6	93.0
CA312-91.6-99.0	91.6	99.0
CA312-102.6-110.0	102.6	110.0
CA312-127.6-135.0	127.6	135.0
CA312-25.6-36.0	25.6	36.0
CA312-34.6-45.0	34.6	45.0
CA312-43.6-54.0	43.6	54.0
CA312-55.6-66.0	55.5	66.0
CA312-67.6-78.0	67.6	78.0
CA312-79.6-90.0	79.6	90.0
CA312-85.6-96.0	85.6	96.0
CA312-91.6-102.0	91.6	102.0
CA312-103.6-114.0	103.6	114.0
CA312-118.6-129.0	118.6	129.0
CA312-29.6-40.0	29.6	40.0
CA312-95.6-106.0	95.6	106.0
CA312-107.6-118.0	107.6	118.0

Mack Truck® style clutch cable, HD conduit and special clutch innermember
Part No. CA312-A-L (A = Conduit length; L = Length overall)

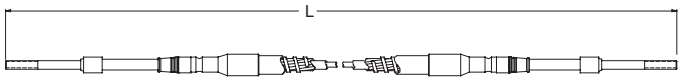


High Performance Clutch Cables

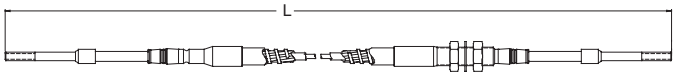
HD conduit, brake/clutch innermember 500 lb. pull-only operating load.

Order Code: T = Travel 2"- 6" L = Length overall

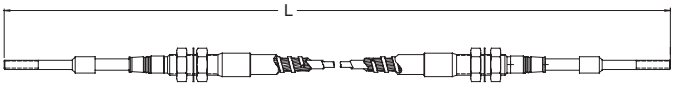
Part No. A183-400-T-L (5/16-24 end rods MD) Grooved-Grooved
Part No. A183-111-T-L (3/8-24 end rods HD) Grooved-Grooved



Part No. A183-401-T-L (5/16-24 end rods MD) Grooved-Threaded 11/16-16
Part No. A183-110-T-L (3/8-24 end rods HD) Grooved-Threaded 7/8-14



Part No. A183-402-T-L (5/16-24 end rods MD)
Threaded-Threaded (both ends 11/16-16)
Part No. A183-104-T-L (3/8-24 end rods HD)
Threaded-Threaded (both ends 7/8-14)



Pull-Only Tension Controls

Pull-Only Tension

Durable and long lasting, this versatile cable assembly is easily customized with threaded or grooved ends, and a wide range of end fittings.

Common Applications: Throttle control, blade engagement, choke, latch release, window release, seat release

- Durable, long lasting construction
- Wide range of end fittings, with a stainless steel option
- Low cost, economical choice
- Sealed and lubricated for life

Material:

- Brass conduit caps (optional)
- Stainless end fittings (optional)

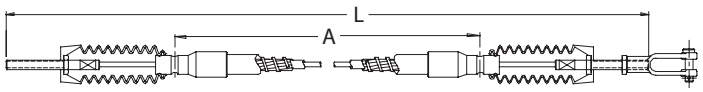
Suggested End Fittings:

- Rod ends
- Clevises
- Threaded end fittings

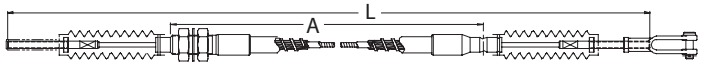


Pull-Only Tension Specifications

Part No. A156-637-L (1/4-28 end rods) Grooved-Grooved
Part No. A156-657-L (10-32 end rods) Grooved-Grooved



Part No. A156-638-L (1/4-28 end rods) Threaded-Grooved
Part No. A156-658-L (10-32 end rods) Threaded-Grooved



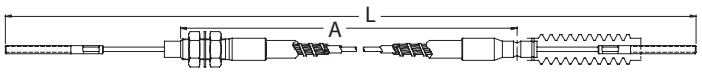
Part No. A156-679-L (1/4-28 end rods) Threaded-Threaded
Part No. A156-680-L (10-32 end rods) Threaded-Threaded



Part No.CA305-TT-A-L (1/4-28 end rods) Threaded-Threaded
Part No. CA306-TT-A-L (10-32 end rods) Threaded-Threaded



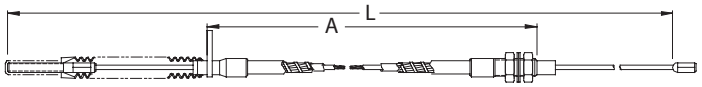
Part No. CA305-TG-A-L (1/4-28 end rods) Threaded-Grooved
Part No. CaA306-TG-A-L (10-32 end rods) Threaded-Grooved



Part No. CA305-GG-A-L (1/4-28 end rods) Grooved-Grooved
Part No. CA306-GG-A-L (10-32 end rods) Grooved-Grooved



Part No. CA307-A-L (1/4-28 end rods) Special



WARNING *- Since the manufacturer is unable to determine all applications in which a part may be placed, it is the user's responsibility to determine the suitability of the part for its intended use. This is especially true where safety is a factor. Incorrect application or installation may result in property damage, bodily injury, or death. For technical assistance, call 260-749-5105.*

Pull-Only T-Flex Controls

Pull-Only T-Flex

Cost-effective product range for pull only applications. The inner cable is multi-strand, high-tensile steel and is tinned or galvanized for corrosion resistance. The outer is a flexible conduit comprised of one or two high-tensile steel wires, wound spirally to give maximum compression strength.



Common Applications: Clutch cable, throttle cable, hand brake cable, engine stop cable

- Protective covering of polypropylene, PVC, or can be uncoated
- Some sizes can be fitted with high density polypropylene liner for extra smooth low-friction operation
- Can fit a variety of accessory components, available in both UNF and metric thread options
- Wide range of sizes combinations w/loads range of 0 – 2200 lbs.
- Armored strands and solid wires available

Material:

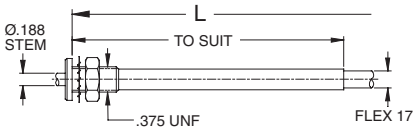
- Plated steel (stainless steel optional)
- Pull-only twin-V high compression load conduit, lined and unlined

Suggested End Fittings:

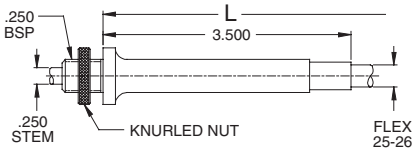
- Clevises
- Eye ends
- Swivels
- Knobs

Pull-Only T-Flex Specifications

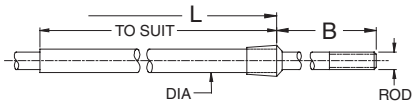
HB .375 Headed Bush



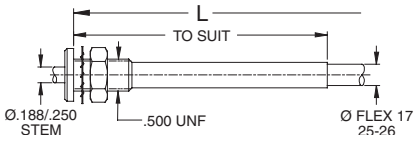
RB Reverse Bush (Die Cast)



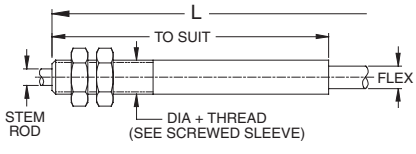
SP Sleeve Plain



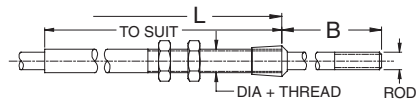
HB .500 Headed Bush



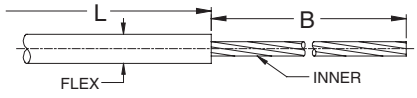
D Dashboard



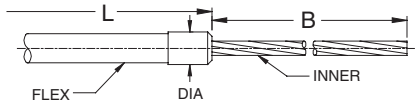
SS Sleeve Screwed



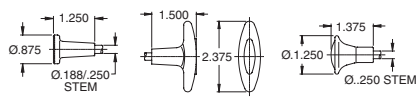
EP End Plain



EC End Capped



Knobs (Motif, Tee, Plain)



All line art dimensions are represented in inches

Cablecraft® Motion Controls

Push-Pull 4B

Commercial product range that is cost-effective for simple push-pull applications. The inner member consists of a multi-strand high tensile steel cable, which is over-wound with an armored covering to prevent spreading under compressive loads. This also gives a smooth surface for low-friction sliding action.

Common Applications: Clutch controls, heavy duty lanyards, truck crane – cross link system, power take off, gear selection, hydraulic valve systems, accelerator systems

- Can be used in conjunction with most control lever systems
- Black UV stabilized polypropylene provides a tough hard-wearing jacket
- Will withstand working stress between -40°F and 212°F
- Highly resistant to abrasion and most organic and inorganic media
- Available with swivel flange, in both metric and UNF thread mounting fittings
- Economically priced for cost effective solutions
- Available in four different sizes



Material:

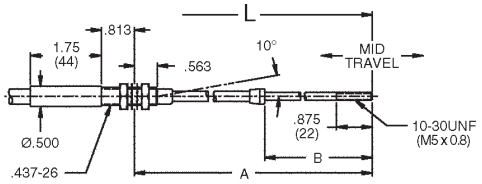
- Plated steel standard (stainless steel optional)
- Plastic coated high tensile steel lined conduit
- Armored push-pull steel innermember
- Black polypropylene

Suggested End Fittings:

- Rod ends
- Clevises

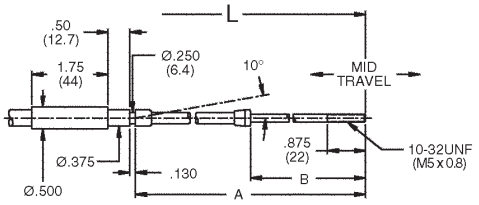
* Available from our Hailsham, U.K. facility only

Push-Pull 4B30 – M5 Specifications



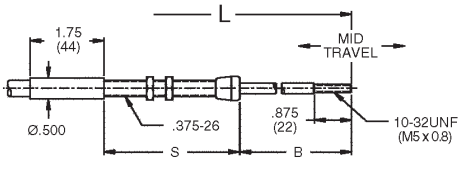
B Bulkhead (Threaded)

Travel	1″	25	2″	50	3″	75	4″	100
Dim "A"	4.375″	110	5.875″	150	7.375″	187	8.875″	225
Dim "B"	1.5″	38	2″	50	2.5″	63	3″	76



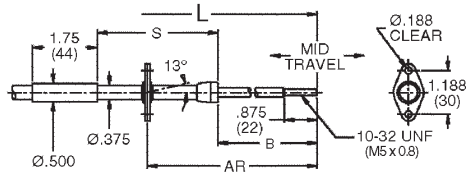
C Clamp (Grooved)

Travel	1″	25	2″	50	3″	75	4″	100
Dim "A"	3.785″	98	5.375″	136	6.875″	175	8.375″	213
Dim "B"	1.5″	38	2″	50	2.5″	63	3″	76



D Dashboard (Rigid Ends)

Travel	1″	25	2″	50	3″	75	4″	100
Dim "S"	3.25″	82	3.25″	82	4.5″	114	4.5″	114
"B" Min	1.5″	38	2″	50	2.5″	63	3″	76

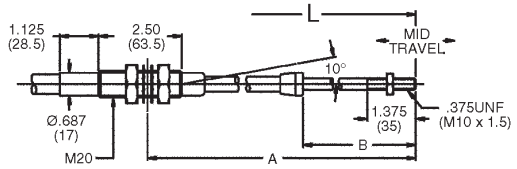


SF Swivel Flange

Travel	1″	25	2″	50	3″	75	4″	100
"S" Min	1.75″	44	2.75″	70	3.75″	95	4.75″	120
"B" Min	1.5″	38	2″	50	2.5″	63	3″	76

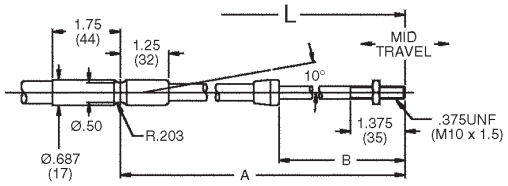
WARNING *- Since the manufacturer is unable to determine all applications in which a part may be placed, it is the user's responsibility to determine the suitability of the part for its intended use. This is especially true where safety is a factor. Incorrect application or installation may result in property damage, bodily injury, or death. For technical assistance, call 260-749-5105.*

Push-Pull 4B60 – M10 Specifications



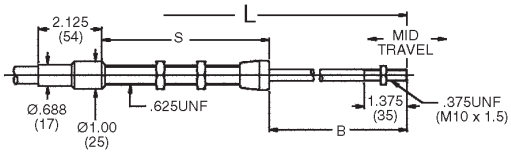
B Bulkhead (Threaded)

Travel	2″	50	3″	75	4″	100	5″	125
Dim "A"	7.375″	187	8.875″	225	10.375″	264	11.875″	302
Dim "B"	2.625″	67	3.125″	80	3.625″	92	4.125″	105



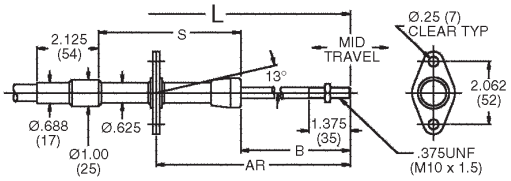
C Clamp (Grooved)

Travel	2″	50	3″	75	4″	100	5″	125
Dim "A"	6.125″	156	7.625″	194	9.125″	232	11.875″	302
Dim "B"	2.625″	67	3.125″	79	3.625″	92	4.125″	105



D Dashboard (Rigid Ends)
AF Adj Flange

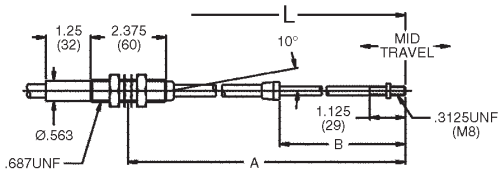
Travel	1″	25	2″	50	3″	75	4″	100
Dim "S"	3.25″	82	3.25″	82	4.5″	114	5.5″	140
"B" Min	2.125″	54	2.625″	67	3.125″	79	3.625″	92



SF Swivel Flange

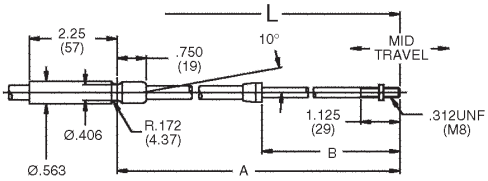
Travel	2″	50	3″	75	4″	100	5″	125
"S" Min	3.25″	82	4.5″	114	5.5″	140	6″	150
"B" Min	2.625″	67	3.125″	80	3.625″	92	4.125″	105

Push-Pull 4B45 – M8 Specifications



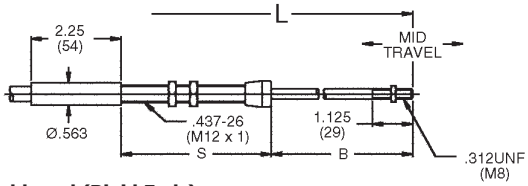
B Bulkhead (Threaded)

Travel	2″	50	3″	75	4″	100	5″	125
Dim "A"	6.625″	168	8.125″	206	9.625″	244	11.125″	283
Dim "B"	2.375″	60	2.875″	73	3.375″	86	3.875″	98



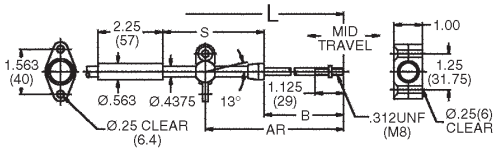
C Clamp (Grooved)

Travel	2″	50	3″	75	4″	100	5″	125
Dim "A"	5.875″	149	7.325″	187	8.875″	225	10.375″	270
Dim "B"	2.375″	60	2.875″	73	3.375″	86	3.875″	98



D Dashboard (Rigid Ends)
AB Adj. Block
AF Adj Flange

Travel	1″	25	2″	50	3″	75	4″	100
Dim "S"	3.25″	82	3.25″	82	4.5″	114	4.5″	114
"B" Min	1.75″	44	2.25″	57	2.75″	70	3.25″	82



SF Swivel Flange
SB Swivel Block

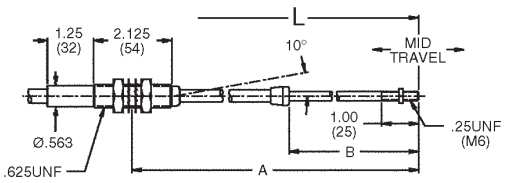
Travel	2″	50	3″	75	4″	100	5″	125
"S" Min	2.75″	70	4″	101	4.75″	120	5.75″	146
"B" Min	2.25″	57	2.75″	70	3.25″	82	3.75″	95

All line art dimensions are represented as follows: in (mm)
Note: Threads available in both UNF and metric

Cablecraft® Motion Controls

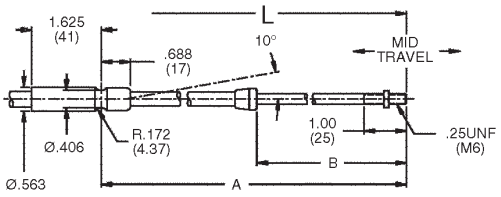
Push-Pull 4B

Push-Pull 4B45 – M6 Specifications



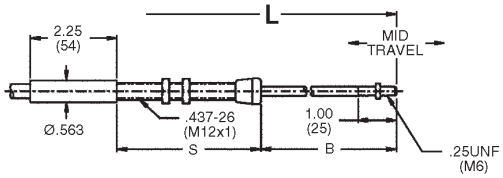
B Bulkhead (Threaded)

Travel	1″	25	2″	50	3″	75	4″	100
Dim "A"	4.625″	117	6.125″	55	7.625″	193	9.125″	232
Dim "B"	1.625″	41	2.125″	54	2.625″	67	3.125″	79



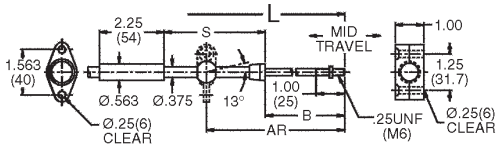
C Clamp (Grooved)

Travel	1″	25	2″	50	3″	75	4″	100
Dim "A"	4.625″	103	5.625″	141	7.125″	179	8.625″	217
Dim "B"	1.562″	40	2.125″	52	2.625″	65	3.125″	78



D Dashboard (Rigid Ends)
AB Adj. Block
AF Adj Flange

Travel	1″	25	2″	50	3″	75	4″	100
Dim "S"	3.125″	82	3.25″	82	4.5″	114	4.5″	114
"B" Min	1.625″	41	2.125″	54	2.625″	68	3.125″	79



SF Swivel Flange
SB Swivel Block

Travel	1″	25	2″	50	3″	75	4″	100
"S" Min	1.75″	44	2.75″	70	3.75″	95	4.75″	120
"B" Min	1.625″	41	2.125″	54	2.625″	68	3.125″	79

Cablecraft® Ordering Codes UNF Threads

4B45 - 1/4 - BC - 3 - XXX

- **Duty – Size**
- **Output Options** (Bulkhead Clamp)
- **Travel (inches)**
- **Cable Length (inches)**

Cablecraft® Ordering Codes Metric Threads

4B45 - M6 - BC - 75 - XXX

- **Duty – Size**
- **Output Options** (Bulkhead Clamp)
- **Travel (mm)**
- **Cable Length (mm)**

All line art dimensions are represented as follows: in (mm)
Note: Threads available in both UNF and metric

Push-Pull Standard

Control Cable Assembly

Our range of push-pull controls provide a means of transmitting linear motion from one location to another. They offer ease of installation as well as superior performance.

Bristow® – Economical construction for applications that do not require tight bend radii.

Utility – Adds a binder wire for structural integrity and a tighter minimum bend radius than other controls.

Low Friction EXT – Have the same advantages as Utility with an added plastic covered innermember which provides improved efficiency.

Low Friction – The standard of excellence for industrial controls. Features include a binder wire for structural integrity, tight minimum bend radius, and PTFE covered innermember for the ultimate in efficient, smooth operation. Provides long life in the most demanding applications.

Common Applications: Implement control, throttle control, PTO/4WD activation, valve actuation, remote battery disconnect, remote electrical disconnect, transmission shift, hydrostatic drives, latches

- Made of tough/durable materials
- Environmentally protected with long-lasting seals
- Temperature rated for use from a low of -65°F to a peak of 310°F

Efficiency Factor: Input Force = (Output Load x Total Degrees of Bend x Efficiency Factor) + Output Load

Bristow & Utility = .002

Low Friction EXT & Low Friction = .001

Note: Efficiency will be slightly reduced in applications when output load is substantially less than rated loads.

Material:

- Stainless steel or plated carbon steel
- Plastic coated carbon steel conduit and innermember
- Plastic seals

Suggested End Fittings:

- Full range



Comparison Chart

Arrows indicate relative position within the family of products

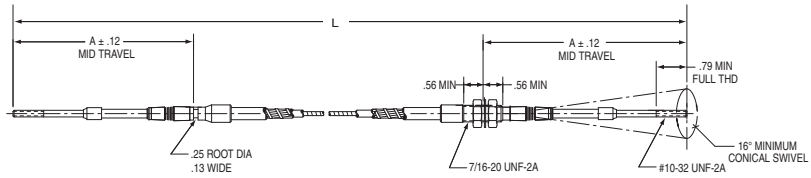
Part	Temperature	Bend Radius	Strength Integrity	Economy	Efficiency	Service Life
Bristow	↓	↓	↓	↑	↓	↓
Utility	→	↑	↑	→	↓	→
LF-EXT	→	↑	↑	→	→	↑
LF	↑	↑	↑	↓	↑	→

Cablecraft® Motion Controls

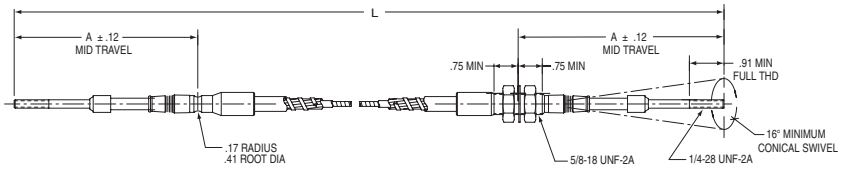
Push-Pull Standard

Push-Pull Standard Specifications (for Ordering Code see page 20)

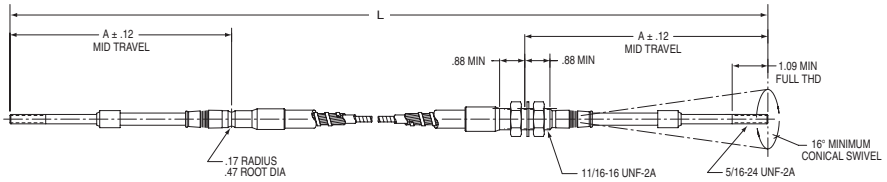
	A Dimension Grooved Swivel (in) (control at mid travel)	Minimum Travel Push-Pull (in)	Working Input Load (lbs) Push-Pull	Maximum Input Overload (lbs)	A Dimension Threaded Swivel (in) (control at mid travel)
VLD	3.69	1″	80/120	120/180	4.38
Very Light Duty	5.19	2″	80/120	120/180	5.87
	6.69	3″	70/120	110/180	7.38
Cablecraft® Min Bend Radius 2″	8.19	4″	60/120	90/180	8.87
Bristow® Min Bend Radius 5″	9.69	5″	45/120	70/180	10.38
Backlash Factor .00015 Per Deg. of Bend	11.19	6″	30/120	45/180	11.87



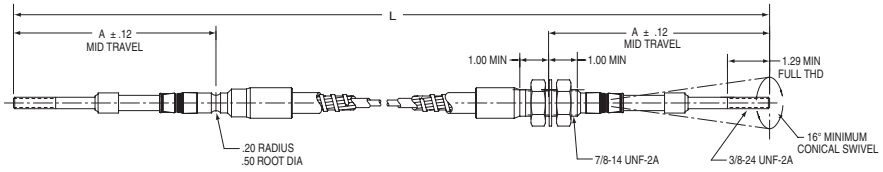
LD	4.00	1″	150/230	230/350	4.62
Light Duty	5.50	2″	150/230	230/350	6.12
	7.00	3″	125/230	190/350	7.62
Cablecraft® Min Bend Radius 3″	8.50	4″	100/230	150/350	9.12
Bristow® Min Bend Radius 7″	10.00	5″	75/230	110/350	10.62
Backlash Factor .00020 Per Deg. of Bend	11.50	6″	50/230	75/350	12.12



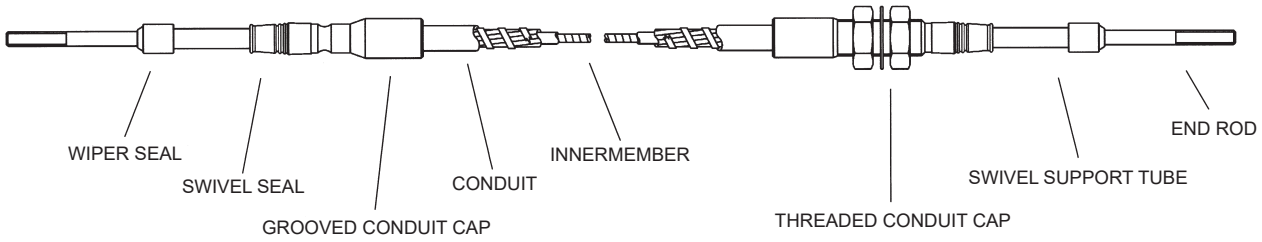
MD	4.38	1″	250/400	400/600	5.06
Medium Duty	5.87	2″	250/400	400/600	6.56
	7.38	3″	210/400	300/600	8.06
Cablecraft® Min Bend Radius 5″	8.87	4″	170/400	250/600	9.56
Bristow® Min Bend Radius 9″	10.38	5″	130/400	200/600	11.06
Backlash Factor .00025 Per Deg. of Bend	11.87	6″	100/400	150/600	12.56



HD	5.19	1″	700/1000	1000/1500	5.69
Heavy Duty	6.69	2″	700/1000	1000/1500	7.19
	8.19	3″	600/1000	900/1500	8.69
	9.69	4″	500/1000	750/1500	10.19
Cablecraft® Min Bend Radius 6″	11.19	5″	400/1000	600/1500	11.69
Backlash Factor .00030 Per Deg. of Bend	12.69	6″	30/1000	450/1500	13.19



Standard Push-Pull Cable Terminology



How to Identify Push-Pull Cables

Follow the steps below to determine your "ordering code" or part number. An example of a typical ordering code is 173-VTG-3-144.

173 - VTG - 3 - 144

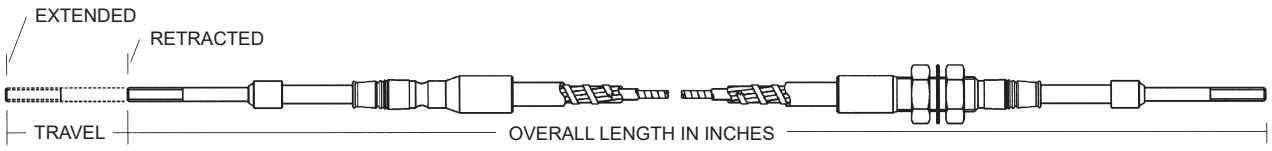
Step 1: Determine the "duty" (size) of the cable by the diameter and threads of the end rods.

V = 10-32 (Very light duty)
L = 1/4-28 (Light duty)
M = 5/16-24 (Medium duty)
H = 3/8-24 (Heavy duty)

Step 2: Determine the type of conduit end fittings (conduit caps) for left end and right end.

T = Threaded
G = Grooved
TT, GG or TG combinations

Step 3: Determine the travel of the end rod. 1" through 6" in one inch increments.



Step 4: Determine the overall length of the cable.

Step 5: Determine cable materials depending on usage and conditions.

Utility: "The Rugged Gray Cable" is the industry-standard and is designed for a long life under rugged conditions (173, 174, 175).

Low Friction EXT: "The Green Cable" is the proper cable to use when superior efficiency is required. The extruded nylon cover over the innermember works very smoothly with the polyliner (313, 314, 315).

Low Friction: The proper cable to use when superior efficiency is required. The bonded PTFE cover over the inner operating member works very smoothly with the plastic liner (183, 184, 185).

Push-Pull Standard Order Code

Cablecraft® Ordering Codes

314 – (6) – L – TT – 3 – 144 – (AP)

Control Type

Low Friction-EXT
- 313 with Stainless Steel End Rods
- 314 with Stainless Steel Support Tubes and End Rods
- 315 all Exposed Fittings/Parts are Stainless Steel

Utility
- 173 with Stainless Steel End Rods
- 174 with Stainless Steel Support Tubes, End Rods and Innermember Armor
- 175 all Exposed Fittings/Parts are Stainless Steel plus Stainless Innermember Armor

Low Friction
- 183 with Stainless Steel End Rods
- 184 with Stainless Steel Support Tubes and End Rods
- 185 all Exposed Fittings/Parts are Stainless Steel

Seal Options

- 6 (Use this number only if requesting optional Model 6 wiper seal, optional on all controls)

Cable Size

Letter	End Rod Thread
V	10-32 UNF
L	1/4-28 UNF
M	5/16-24 UNF
H	3/8-24 UNF

End Fitting Combinations (Options: GG, TG, TT)

- T Threaded Swivel
- G Grooved Swivel

Cable Travel: 1, 2, 3, 4, 5, 6 (inches)

Length +/-.25 (inches)

Suffix Letters for Additional Features

(Use only if requesting optional features)
- N End Rod Jam Nuts (2 each)
- W Extra Shake-proof Washers on Conduit Ends
- A Combination of N and W
- P Stamp with Customer Part Number
- S Stamp with Cablecraft and Customer Part Number
- M Metric End Rods (optional)
  - V M5 x .8
  - L M6 x 1.0
  - M M8 x 1.25
  - H M10 x 1.5

Push-Pull Blue Max™

High Performance Controls

The Blue Max™ high performance cable line was born of aviation engineering design, with extreme low friction and minimal loss of motion. Offering unparalleled performance with the finest, smoothest feel in the industry.

Common Applications: Marine, racing

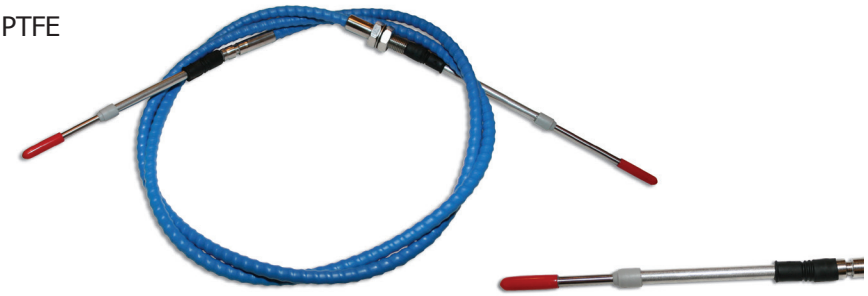
- Excellent for long runs with complicated cable routing
- Extremely efficient on shorter runs
- Outer jacket is resistant to abrasion, gasoline, diesel, and chemicals
- Lubricated for life
- BB, BC, CC options are available
- High temperature

Material:

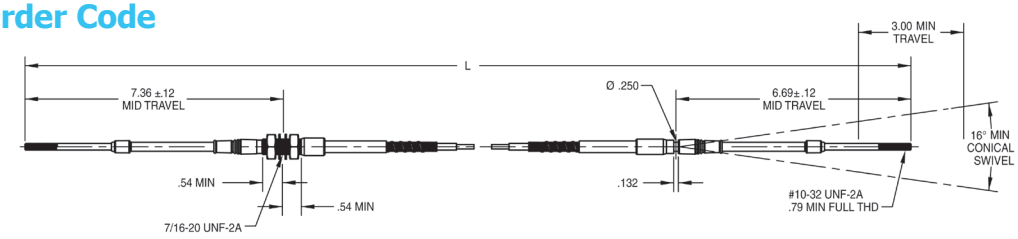
- RHOS rated
- Stainless steel
- LDPE covered (blue) conduit
- Spring wire liner core PTFE

Suggested End Fittings:

- Full range



Push-Pull Order Code



Notes: (Design Parameters)
Travel: 1"- 6"
Minimum bend radius: 4.00"

Operating temperature:
from -65°F to +350°F

Slim line grooved conduit cap for marine applications, call for details

Cablecraft® Ordering Codes

795 - 6 - V - TT - 3 - 144

Control Type *(All End Rods are Stainless Steel)

795 All Exposed Fittings/Parts are Stainless Steel – both ends
796 All Exposed Fittings/Parts are Stainless Steel – one end – Carbon Steel Opposite*

Seal Options

6 Standard

Cable Size

V 10-32 UNF End Rods – Very Light Duty

End Fitting Combinations (TT, TG, GT, GG)

				stainless end	opposite end
795	T	T	**796**	T	T
	T	G		T	G
				G	T
				G	G

Cable Travel: 1-6 (inches)

Length +/-.25 (inches)

All line art dimensions are represented in inches

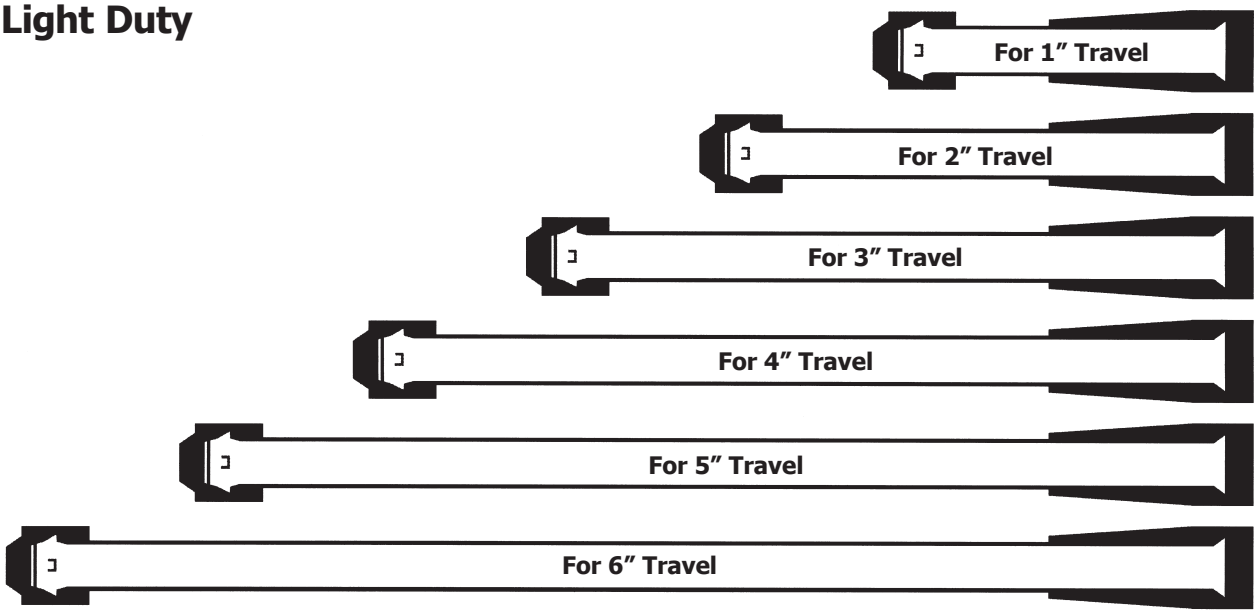
Cablecraft® Motion Controls

Push-Pull Identification Chart

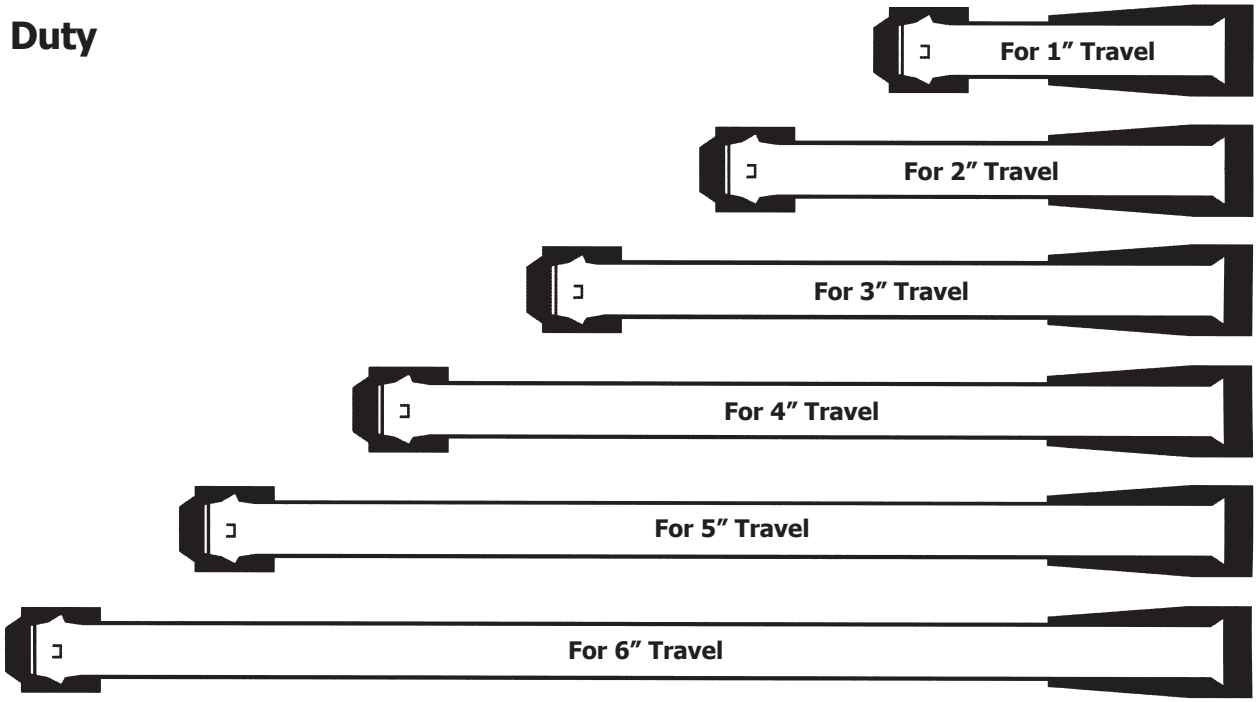
Visual Comparison Chart for Determining Travel

To determine the "travel" on an existing cable, you can compare the length of the support tubes with the illustrations below and on the next page.
Determine the "**duty**" (size) of the cable by the diameter and threads of the end rods.
V = 10-32, **L** = 1/4-28, **M** = 5/16-24, **H** = 3/8-24.
(**V**ery light duty; **L**ight duty; **M**edium duty; **H**eavy duty)

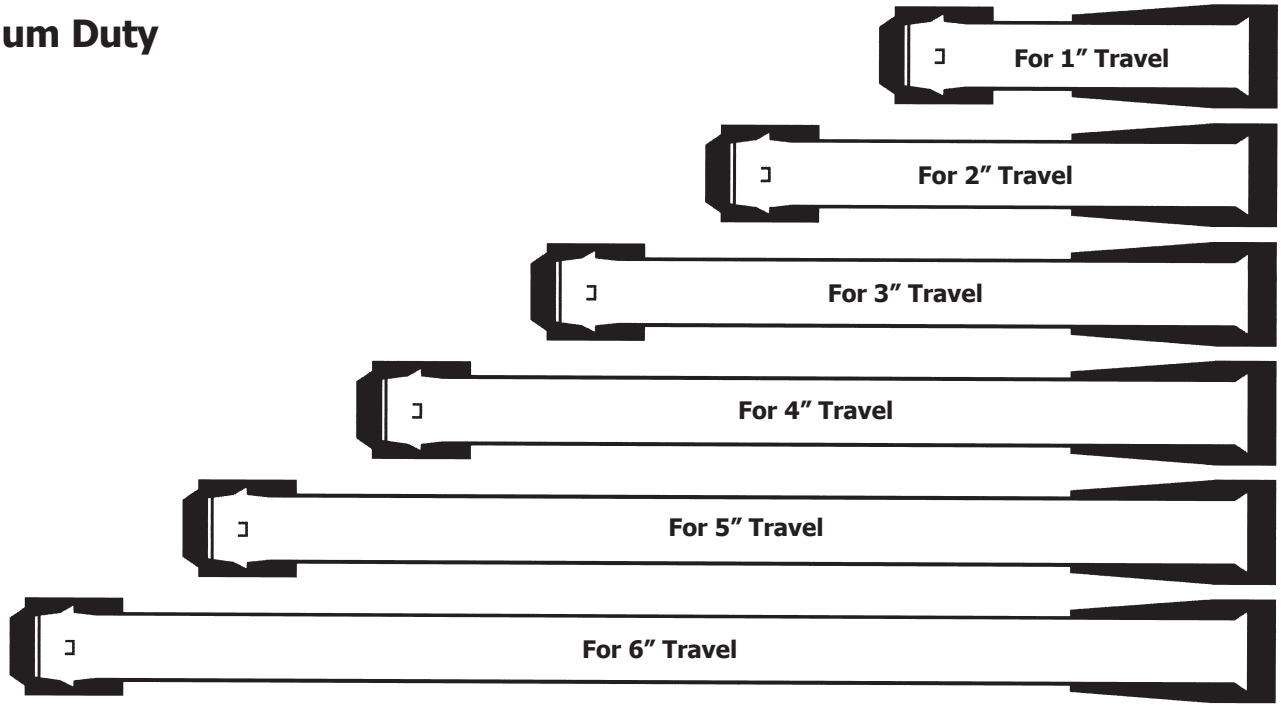
Very Light Duty



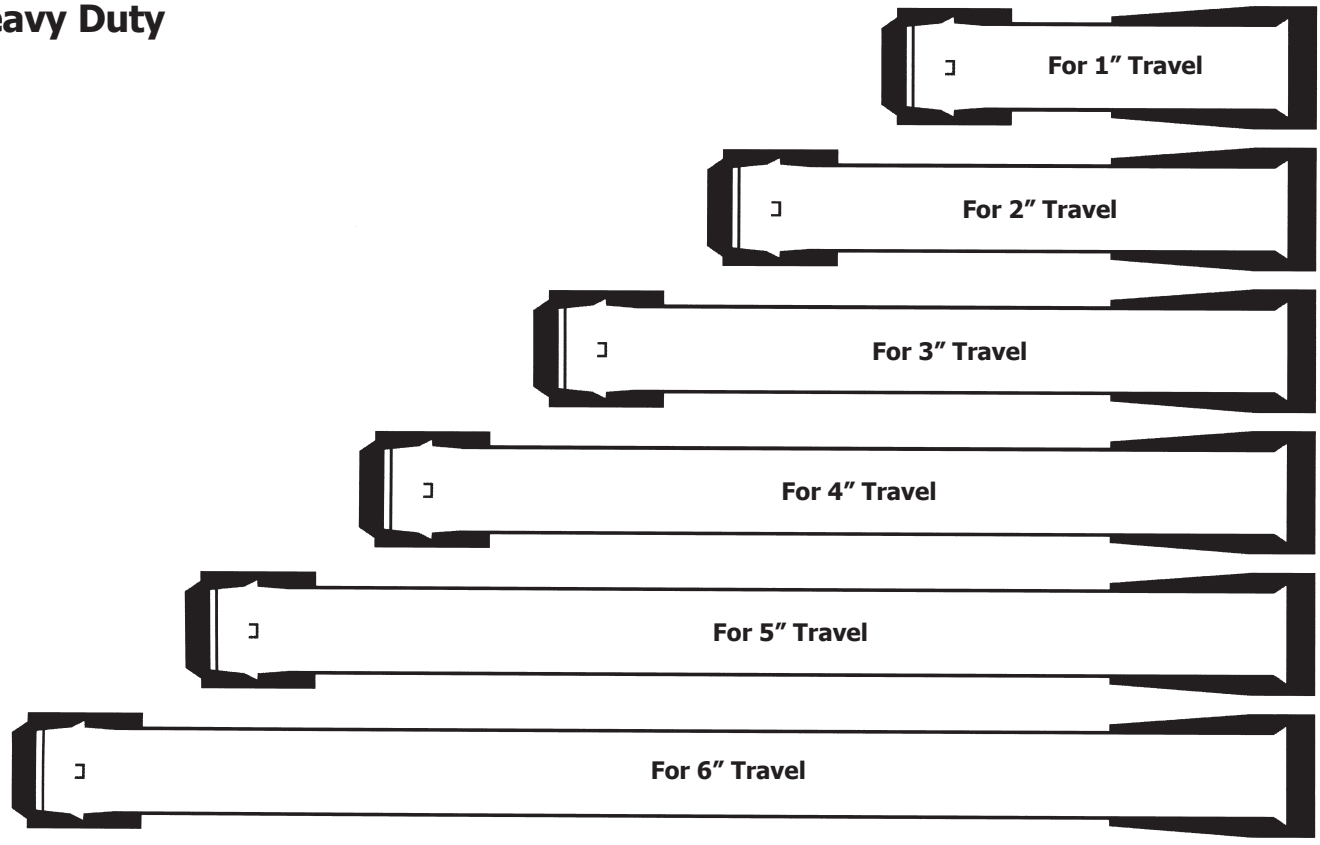
Light Duty



Medium Duty



Heavy Duty



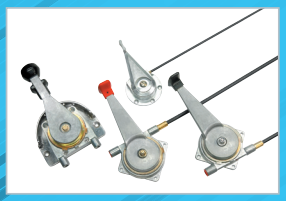
Hand Control Assemblies

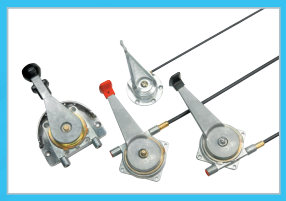
We manufacture a wide selection of mechanical levers and hand control assemblies including miniature levers, and industrial joysticks. From light duty to heavy duty, we have a hand control that will meet your push-pull or pull-only needs. All hand controls come in non-corrosive materials.


Brake Lever


Leverstak - High Lever


Light Duty Lever


Unidrum Lever


Unidrum Lever Metric


Custom Hand Controls

Specifications

Type	Part Number	Motion	Materials		
			Housing	Internal	Lever
Leverstak	CH400	Single Axis	Zinc Die-Cast	Plated CS	Plated CS
Unidrum	CH205/206, CH240, CH260	Single Axis	Zinc Die-Cast	Zinc Die-Cast	Zinc Die-Cast
Unidrum	CH220	Single Axis	Zinc Die-Cast	Zinc Die-Cast	Zinc Die-Cast
Unidrum	CH290	Single Axis	Zinc Die-Cast	Zinc Die-Cast	Zinc Die-Cast
Hand Control	CH980	Single Axis	Zinc Die-Cast	Zinc Die-Cast	Plated CS
Hand Control	165-042-001	Single Axis	Plated CS	Plated CS	Plated CS
Joystick	165-038-199	Dual Axis			Plated CS

Type	Part Number	Specifications – Light Duty for Comparison									
		Spring Detent	Spring Return	Pos. Lock	Adj. Friction	Adj. Stop Pos.	Adj. Lever Pos.	Articulation Input-Linear Output	Max Load	Mech. Adv.	Typical Cable Const.
Leverstak	CH400						Std	105°=1.75″		6:1	LD Utility, LD Bristow
Unidrum	CH205/206, CH240, CH260				Std	Std	Std	90°=2″ / 135°=3″	26 lb.	5:1	VLD Utility, LD Utility, VLD Bristow
Unidrum	CH220				Std			315°=2.62″	12 lb.	5:1	ULD Bristow
Unidrum	CH290			Std	Std	Std	Std	90°=2″ / 135°=3″	26 lb.	5:1	VLD Utility, LD Utility, VLD Bristow
Hand Control	CH980		Std					90°=1.88″, 45° fore/aft		5.:5:1	LD Utility, LD Bristow
Hand Control	165-042-001					Std		90°=2.50″, 45° fore/aft		5:1	MD Utility, MD Bristow
Joystick	165-038-199							60°=1.50″, 30° fore/aft		6.5:1	MD Utility, MD Bristow, MD LF

Note: Travel depicts total linear travel.

***WARNING** - Since the manufacturer is unable to determine all applications in which a part may be placed, it is the user's responsibility to determine the suitability of the part for its intended use. This is especially true where safety is a factor. Incorrect application or installation may result in property damage, bodily injury, or death. For technical assistance, call 260-749-5105.*

Brake Lever

Over Center Locking Hand Control

Cablecraft® park brake levers offer superior performance, quality and service life to both the designer and user.

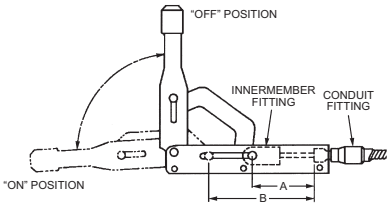
- Two distinct lever positions – Over center and off, which are approximately 90° apart
- No ratcheting to limit travel or secondary unlocking required for operation
- Heat-treated 4130 load link provides durability and reliability
- Adjusting knob allows for setting the initial cable tension, travel, and compensates for system wear
- Adaptable with side or flange mount configurations
- Input lever and side plates have an epoxy finish or electro-static paint, and all other components are coated for corrosion resistance
- Optional tamper-resistant knob to inhibit unauthorized adjustment
- Optional weather-resistant switch at the off position
- Supplied with hardware necessary to attach the cable end fittings to the load link
- Loads of up to 1,000 lb.
- Travel range is 2-7/16" maximum



Material:

- Nylon covered innermember
- Plastic covered conduit
- Stainless steel

Cablecraft® Lever	Innermember Fitting		Conduit Fitting		Dimension		
	3000 lb	1500 lb	3000 lb	1500 lb	A	B min.	B max.
165-508-008	CS550-2	CS550	073 072	- 062	3.23 3.36	3.87 4.0	5.47 5.6
165-508-011	CS550-2	CS550	072	062	2.71	3.35	4.95
165-508-023	154-047-002	157-047-000	072	062	2.38	3.02	4.62
165-508-028	CS550-2	CS550	075	065	3.14	3.78	5.35
165-508-010	CS550-2	CS550	073 072	- 062	1.7 1.83	2.34 2.47	3.94 4.07
165-508-009	CS550-2	CS550	-	-	-	-	-
165-508-078	CS550-2	CS550	073 072	- 062	1.7 1.83	2.34 2.47	3.94 4.07
165-508-013	157-047-002	157-047-000	073 072	- 062	2.27 2.4	2.91 3.04	4.51 4.69



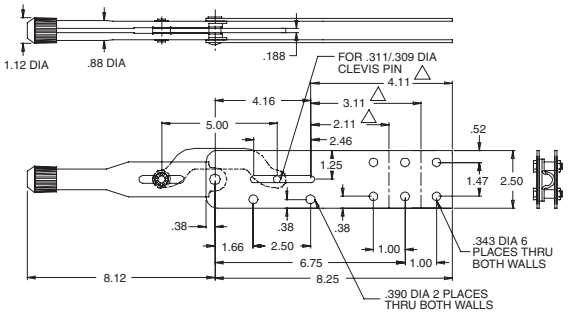
1. Dimension A is with the lever in full "OFF" position. Use dimension A in calculating cable length.
2. Dimension B minimum is with the lever in full "ON" position and adjusted for minimum (CCW) travel. Use dimension B minimum during installation and initial adjustment. Turn knob (CW) to add travel and increase brake pressure setting.
3. Dimension B maximum is with the lever in full "ON" position and adjusted for maximum (CW) travel.

Brake Lever

Side Mount 165-508-008

2.5 inches (64mm) wide side plates; one cable, with three alternate sets of cable clamp holes. For cowl, instrument panel, seat riser or frame installation.

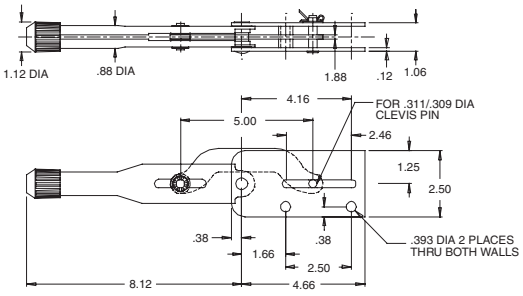
Kit B815 — supplied with the following hardware:
Clevis pin
Cotter pin
Washer
Mounting spacers (2)
Cable clamp
Clamp base
Clamp spacers (2)



Side Mount 165-508-009

2.5 inches (64mm) wide side plates; one cable. For cowl, instrument panel, seat riser or frame installation. No cable support.

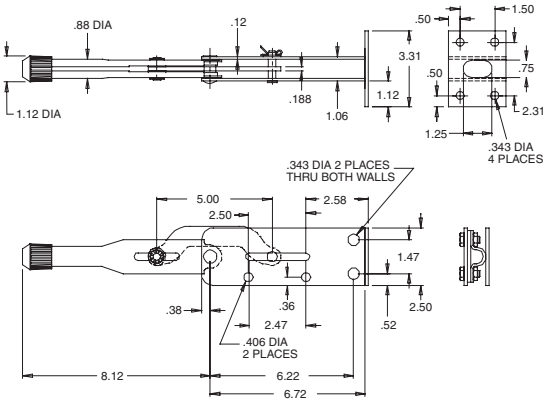
Kit B816 — supplied with the following hardware:
Clevis pin
Cotter pin
Washer
Mounting spacers (2)



Flange Mount 165-508-010

2.5 inches (64mm) wide side plates; one cable. For bulk-head floor or island (doghouse) installation. The rigid frame maintains alignment of clevis pin guide slots for improved life of both the pin and side plates.

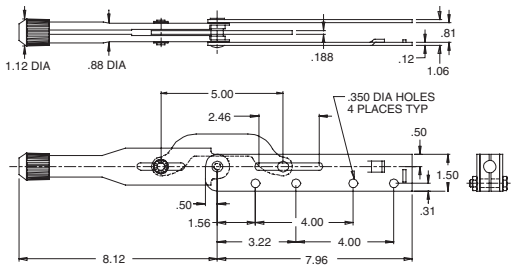
Kit B817 — supplied with the following hardware:
Clevis pin
Cotter pin
Washer
Cable clamp
Clamp base
5/16-24 Bolts (2) nuts (2)



Side Mount 165-508-011

1.5 inches (38mm) wide side plates; one cable. For cowl, instrument panel, seat riser or frame installation.

Kit B834 — supplied with the following hardware:
Clevis pin
Cotter pin
Washer
Mounting spacers (2)
Cable clamp



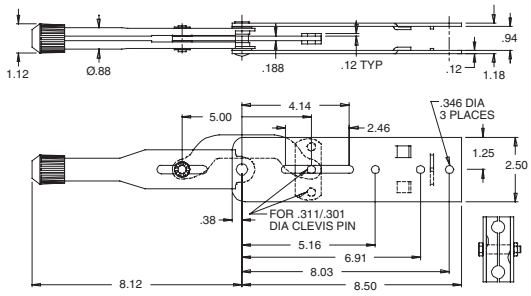
WARNING *- Since the manufacturer is unable to determine all applications in which a part may be placed, it is the user's responsibility to determine the suitability of the part for its intended use. This is especially true where safety is a factor. Incorrect application or installation may result in property damage, bodily injury, or death. For technical assistance, call 260-749-5105.*

Brake Lever

Side Mount 165-508-013

2.5 inches (64mm) wide side plates; two cables. For cowl, instrument panel, seat riser or frame installation. NOTE: When considering load requirements, the load on the lever assembly will be the sum of the load in each cable.

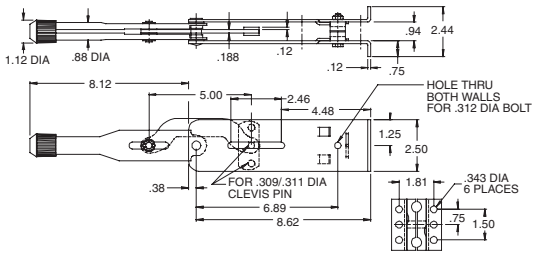
Kit B835 — supplied with the following hardware:
Clevis pins (2)
Cotter pins (2)
Washers (2)
Mounting spacers (2)
Cable clamps



Flange Mount Rigid 165-508-023

1.5 inches (38mm) wide side plates; one cable.
For cowl, instrument panel, seat riser or frame installation.

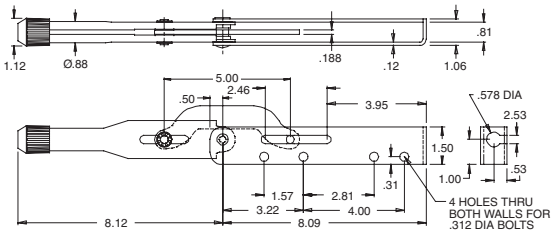
Kit B837 — supplied with the following hardware:
Clevis pin
Cotter pin
Washer
Mounting spacers (2)
Cable clamp
Clamp spacers (2)



Side Mount 165-508-028

1.5 inches (38mm) wide side plates; one cable.
For cowl, instrument panel, seat riser or frame installation.

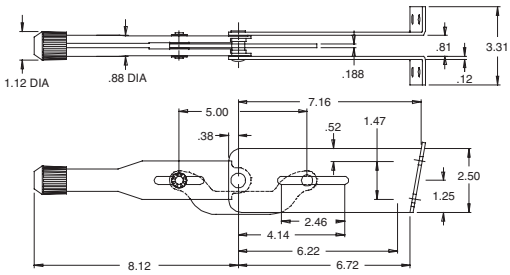
Kit B837 — supplied with the following hardware:
Clevis pin
Cotter pin
Washer
Mounting spacers (2)
Cable clamp
Clamp spacers (2)



Flange Mount 165-508-078

2.5 inches (64mm) wide side plates; two cables. For bulkhead, floor or island (doghouse) installation. NOTE: When considering load requirements, the load on the lever assembly will be the sum of the load in each cable. Wing flange mounting.

Kit B835 — supplied with the following hardware:
Clevis pins (2)
Cotter pins (2)
Washers (2)
Mounting spacers (2)
Cable clamps



All line art dimensions are represented in inches

Leverstak - High Lever

Hand Control

The Leverstak hand control is designed specifically for the agricultural equipment market. One of its major uses is in the operating of tractor automatic pick-up hitch systems.

Common Applications: High lever, automatic pick-up hitch release control cable operation, power take off engagement/disengagement

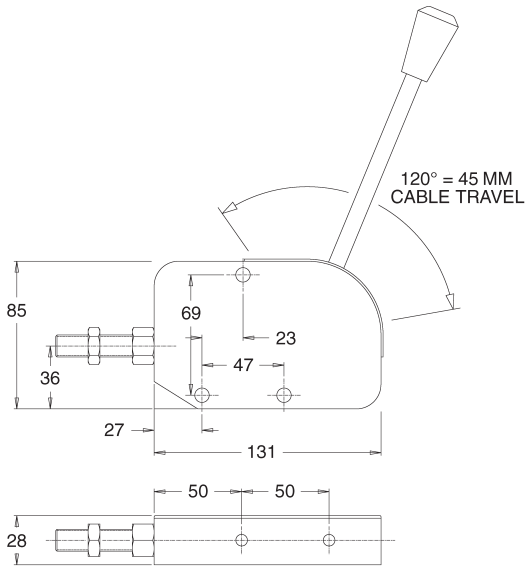
- High lever to cable movement ratios - 120° which produces a maximum of 1.7” cable travel
- Operating handle can be supplied cranked to a specific position
- Spring return-to-center version available
- Detent version, which holds the lever in a predetermined position, available

Mounting the lever(s) - Any number of operators may be secured together by studs, which may also be used to mount the control onto the machine. The studs are typically supplied with banked operator sets. Alternatively, the operators can be mounted by using the two holes in the base and securing with 1/4” diameter bolts.



Material:

- Zinc based die-cast body
- Plated steel internal components



WARNING *- Since the manufacturer is unable to determine all applications in which a part may be placed, it is the user’s responsibility to determine the suitability of the part for its intended use. This is especially true where safety is a factor. Incorrect application or installation may result in property damage, bodily injury, or death. For technical assistance, call 260-749-5105.*

Light Duty Lever

Push-Pull Hand Control

This light duty industrial push-pull hand control offers a 4.5 to 1 mechanical advantage.

Common Applications: Throttle control, set detent control

- Adjustable friction control with 2-bolt mounting scheme
- Weatherproof cast alloy assembly
- Available in various travels
- Compatible with various cable constructions (Utility, EXT)
- Adjustable friction lock

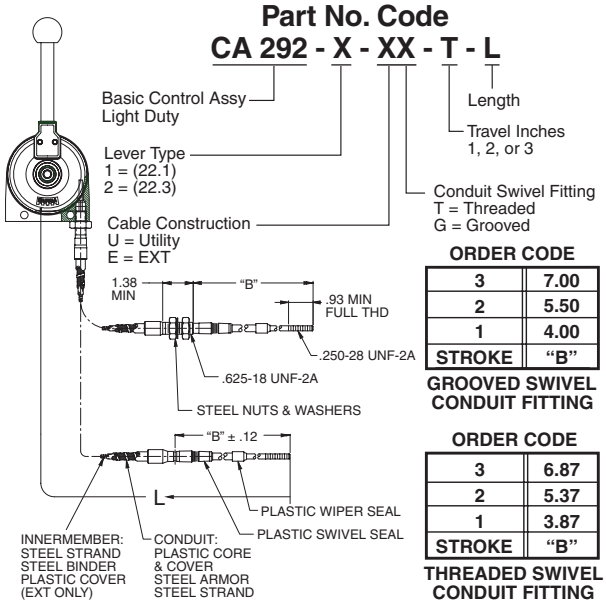
Material:

- Die-cast body
- Inserts for custom detent locations
- Chrome steel
- Black plastic



Part No. Code

CA 292 - X - XX - T - L



ORDER CODE

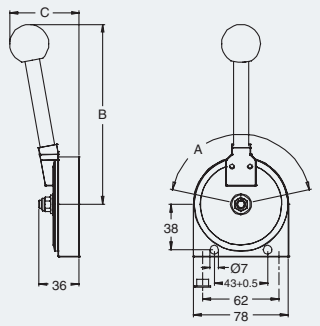
3	7.00
2	5.50
1	4.00
STROKE	"B"

GROOVED SWIVEL CONDUIT FITTING

ORDER CODE

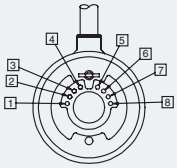
3	6.87
2	5.37
1	3.87
STROKE	"B"

THREADED SWIVEL CONDUIT FITTING



Model	**22.1**
Travel	3.15" (80mm)
Mech. Advantage	1:4.5
Maximum Load	68lb (300N)
A) Lever Angle	156°
B) Lever Length	5.75" (146mm)
C) Lever Offset	2.20" (56mm)

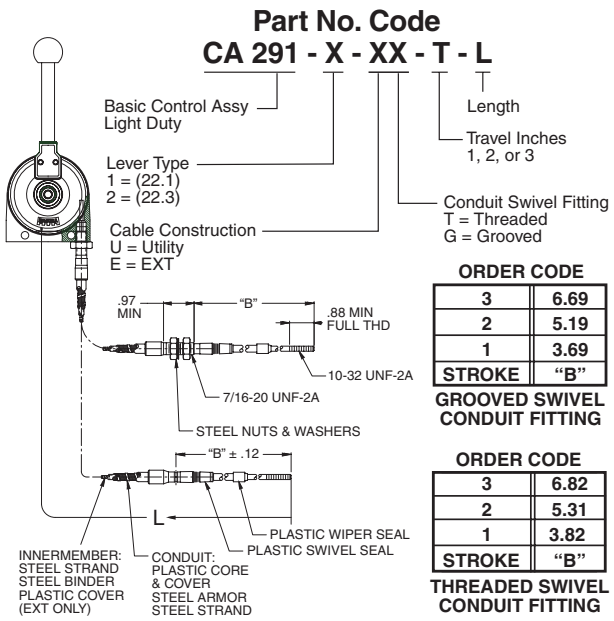
Travel can be limited symmetrically or asymmetrically, on both 22.1 and 22.3 levers, 10/20mm using coiled spring pins (sold separately). Coiled Pin P/N 175-420-034



Pin in:	Travel:	Travel Course:
1 or 8	40mm	asymmetrical
2 or 7	50mm	asymmetrical
3 or 6	60mm	asymmetrical
4 or 5	70mm	asymmetrical

All line art dimensions are represented in millimeters

Light Duty Lever



ORDER CODE

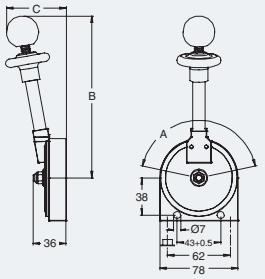
3	6.69
2	5.19
1	3.69
STROKE	"B"

GROOVED SWIVEL CONDUIT FITTING

ORDER CODE

3	6.82
2	5.31
1	3.82
STROKE	"B"

THREADED SWIVEL CONDUIT FITTING



Model	**22.3**
Travel	3.15" (80mm)
Mech. Advantage	1:4.5
Maximum Load	68lb (300N)
A) Lever Angle	156°
B) Lever Length	6.30" (160mm)
C) Lever Offset	2.32" (59mm)

Detents at 0, 24.5, 49, 73.5mm of travel. Pushing down on spring loaded knob releases lever from detents.

All line art dimensions are represented in inches

Unidrum Lever

Push-Pull and Pull-Only Hand Control

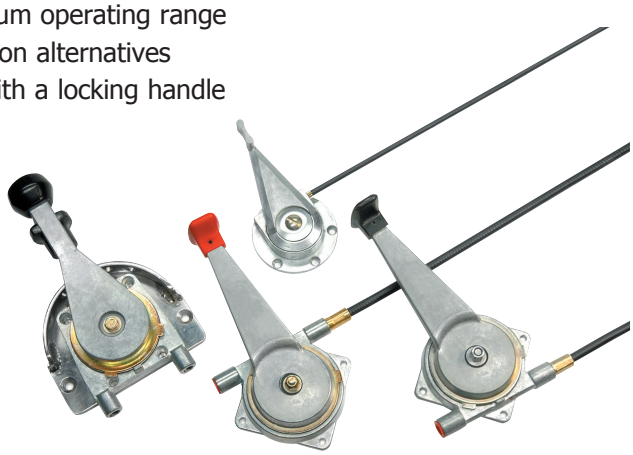
This control head is designed for hand throttle applications on commercial and industrial vehicles, and is also suitable for many other uses.

Common Applications: Medium to light duty throttle compactors, valve dump control jackhammers, hydraulic valve control, concrete cutters, backhoe throttle

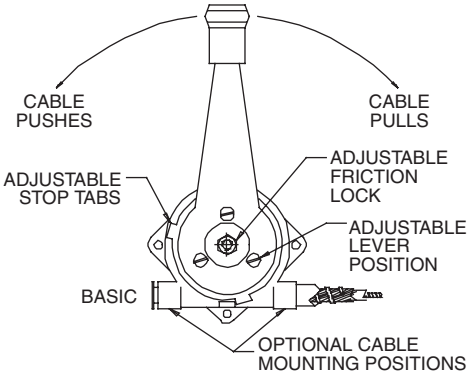
- Compact and efficient for imparting light-to-medium pull-only or push-pull loads through flexible conduits and innermembers
- Hold and operate up to 26 lb. (12kg) push-pull or pull-only output loads
- Mechanical advantage at knob is 5 to 1
- Self-locking nut for operator adjustment of friction setting
- Adjustable stop plates allow 10° (3/16" linear output/5mm linear output) incremental travel adjustment
  - Two inches (50mm) of cable travel requires approximately 90° lever travel.
  - Three inches (75mm) of cable requires approximately 135° lever travel.
- Lever position is adjustable in 60° increments to provide optimum operating range
- Optional cable entry offers four mountings/directions of operation alternatives
- Available with a smaller handle for light duty applications, or with a locking handle

Material:

- Zinc based die-cast body, drum, and lever
- Internal long life nylon bearings
- Optional black powder coat paint finish



- Hold and operate up to 25 lb. push-pull or pull-only output load. Mechanical advantage at knob is 5/1.
- Self-locking nut for operator adjustment of friction setting.
- Adjustable stop plates allow 10° incremental travel adjustment.
- Lever position is adjustable in 60° increments.
- Four optional cable entry alternatives.
- Rugged diecast zinc alloy material.
- Mount with (4) 3/16" screws or bolts.



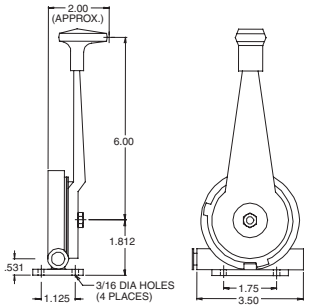
All line art dimensions are represented in inches

Cablecraft® Motion Controls

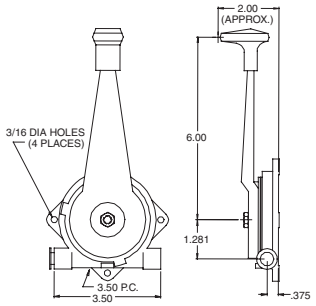
Unidrum Lever

Output End Configurations

CH205/206



CH240



VLD Utility

1 Threaded Swivel

Dimension A Per Stroke (extended)

2″ 6.94″

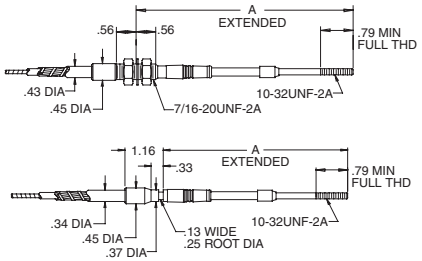
3″ 8.94″

2 Grooved Swivel

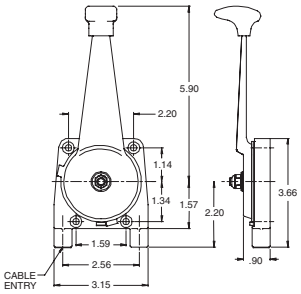
Dimension A Per Stroke (extended)

2″ 6.25″

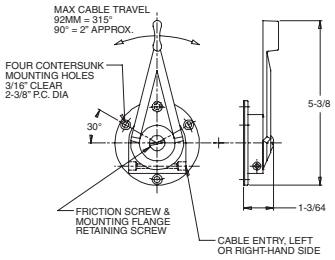
3″ 8.25″



CH260



CH220 (Miniature)



LD Utility

3 Threaded Swivel

Dimension A Per Stroke (extended)

2″ 7.18″

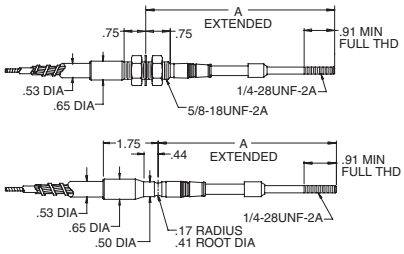
3″ 9.18″

4 Grooved Swivel

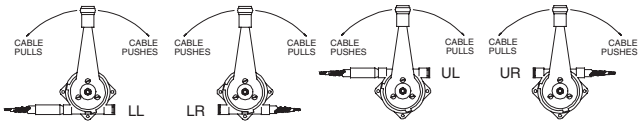
Dimension A Per Stroke (extended)

2″ 6.56″

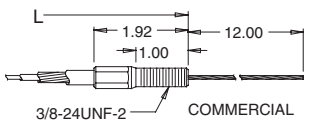
3″ 8.56″



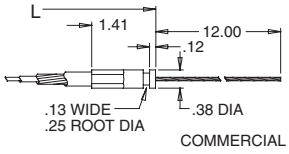
Cable Exit Positions



VLD Bristow®



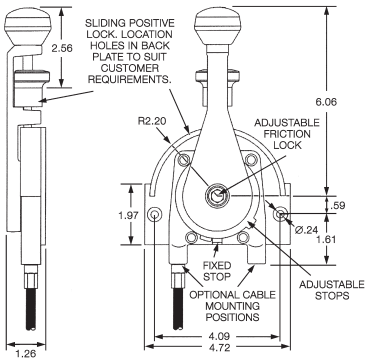
5 Threaded Cap



6 Grooved Cap

CH290 (Unidrum Operator Positive Lock)

- Hold and operate up to 26 lb. push-pull or pull-only output load. Mechanical advantage at knob is 5/1.
- Self-locking nut for operator adjustment of friction setting.
- Adjustable stop plates allow 10° (.2 linear output) incremental travel adjustment. 2″ of cable travel requires approximately 90° lever travel.
- Optional cable entry.
- Rugged die-cast zinc alloy material.



WARNING *- Since the manufacturer is unable to determine all applications in which a part may be placed, it is the user's responsibility to determine the suitability of the part for its intended use. This is especially true where safety is a factor. Incorrect application or installation may result in property damage, bodily injury, or death. For technical assistance, call 260-749-5105.*

Unidrum Lever

Cablecraft® Ordering Codes

UDL - 1 - 4 - 4 - 2 - 120

Basic Unidrum Lever

Knob Color

1	Black 165-505-101
2	Red 165-505-102

Cable Exit Position (see illustration)

1	Lower Mount, Left Exit
2	Lower Mount, Right Exit
3	Upper Mount, Left Exit
4	Upper Mount, Right Exit

Output End Configuration, Cable Size & Type

	Style	Size	Type
1	Threaded Swivel	VLD	Utility
2	Grooved Swivel	VLD	Utility
3	Threaded Swivel	LD	Utility
4	Grooved Swivel	LD	Utility
5	Threaded Cap	VLD	Bristow®
6	Grooved Cap	VLD	Bristow®

Travel (inches)

	Cable	Lever
2	2″	approx. 90°
3	3″	approx. 135°

Overall Length (inches)

Replacement Cables

Part Number	Duty	Cap	Travel
A17X-330	LD	T	2″
A17X-331	LD	T	3″
A17X-332	LD	G	2″
A17X-333	LD	G	3″
A17X-530	VLD	T	2″
A17X-531	VLD	T	3″
A17X-532	VLD	G	2″
A17X-533	VLD	G	3″

Custom Hand Controls

Push-Pull Hand Control

Available to meet a variety of needs, these levers and joysticks can be used with push-pull controls for many applications including truck mixer, vibrator control, remote valve actuation, drive engagement and automatic pick-up hitch systems.

CH980
Single axis hand control for use with push-pull controls, allows easy connection to input end for a variety of applications.

Common Applications: Boom lock, drive engagement, remote valve actuation



- 5:1 Mechanical advantage
- For use on LD or MD cable assemblies
- Rugged construction
- Easy grip large molded handle
- Easy mount base

Materials:

- Primarily plated steel
- Black plastic

Valve Lever Single Axis
165-041-002
Single axis hand control for use with push-pull controls, allows easy connection to input end for a variety of applications.

Common Applications: Boom lock, drive engagement, remote valve actuation



- 5:1 Mechanical advantage
- For use on LD or MD cable assemblies
- Rugged construction
- Easy grip large molded handle
- Easy mount base

Joystick Multi Axis
165-038-199
Multi axis hand control for use with push-pull controls, allows easy connection to input end for a variety of applications.



Common Applications: Boom lock, drive engagement, remote valve actuation

- 5:1 Mechanical advantage
- For use on LD or MD cable assemblies
- Rugged construction
- Easy grip large molded handle
- Easy mount base

Direct Lever
CH150
An operator to impart light to medium tension or compression (push-pull) loads through flexible or rigid conduits.



Common Applications:
Power transmission, gear selection, valve operation, hand throttle applications, as well as many specialty applications

WARNING *- Since the manufacturer is unable to determine all applications in which a part may be placed, it is the user's responsibility to determine the suitability of the part for its intended use. This is especially true where safety is a factor. Incorrect application or installation may result in property damage, bodily injury, or death. For technical assistance, call 260-749-5105.*

Foot Control Assemblies

Our foot control assemblies are engineered for efficiency and dependability, and complement our wide range of control cables. Standard throttle, and clutch and brake pedals are available in various configurations. Custom pedal systems can be developed for specific applications. Whether it is for commercial, off-road or recreational vehicle applications, we have a foot control assembly designed for ease of installation, operation, and maintenance.



Mechanical, Hydraulic, and Electronic Controls



Throttle Pedal – Heavy Duty



Throttle Pedal – Medium Duty

Foot Control

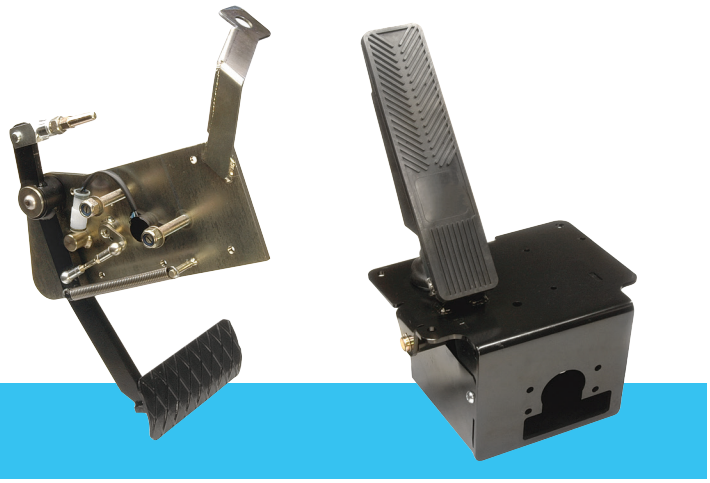
Our foot controls are available in a wide range of materials, processes, and finishes to meet your design requirements.

Common Applications: Medium and heavy-duty trucks, construction equipment, landscaping equipment, warehouse equipment, farm equipment, buses

- Rocker pedals, suspended pedals, integral floor-mounted pedals, and more
- Foot control output can be electronic, hydraulic, solid linkage, flexible cable, or unique to your application
- Hardware designed to meet specific envelope, geometry, load, adjustment, maintenance, and environmental requirements

Material:

- Zinc based die-cast body
- Plated steel internal/external components









WARNING *- Since the manufacturer is unable to determine all applications in which a part may be placed, it is the user's responsibility to determine the suitability of the part for its intended use. This is especially true where safety is a factor. Incorrect application or installation may result in property damage, bodily injury, or death. For technical assistance, call 260-749-5105.*

Throttle Pedal - Heavy Duty

Foot Control

Heavy-Duty Throttle Pedals are available in two configurations:

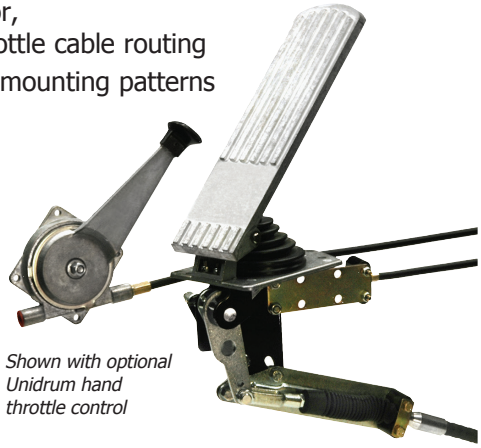
001 – Foot throttle only design
002 – Adds hardware allowing for a manual remote hand operated throttle control

Commons Applications: Medium and heavy-duty trucks, construction and farm equipment, buses

- Torsion spring is incorporated for idle position return
- Environmental contamination is minimized by a plastic boot installed between the pedal and mounting base
- Idle pedal position and throttle travel is adjustable to meet user requirements
- Entire lower portion of assembly can be inserted through a cutout in the floor, and will rotate 360° and down 30° maximum from horizontal to optimize throttle cable routing
- Multiple fastener holes incorporated into the base to accommodate different mounting patterns
- Pedal surface is ribbed to reduce foot slippage, and increase strength

Material:

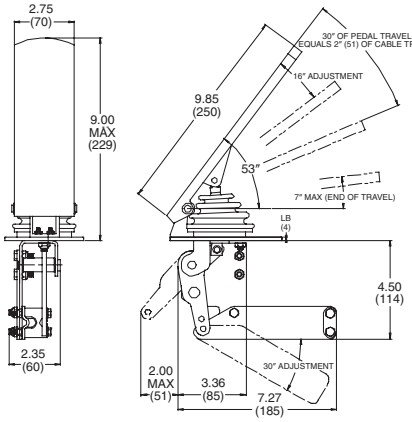
- Corrosion-resistant die cast components
- Plated steel hardware
- Plastic bushings
- Plated steel internal/external components



Shown with optional Unidrum hand throttle control

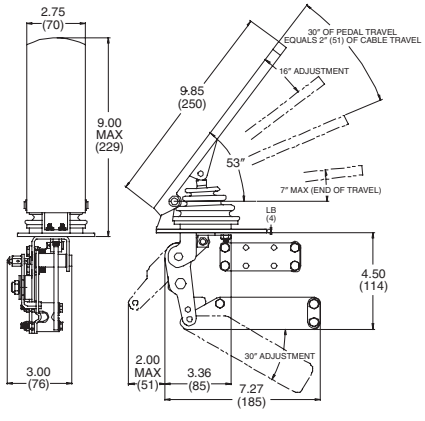
Standard Pedal 165-574-001

For use with one Pull-Only accelerator cable.



Standard Pedal 165-574-002

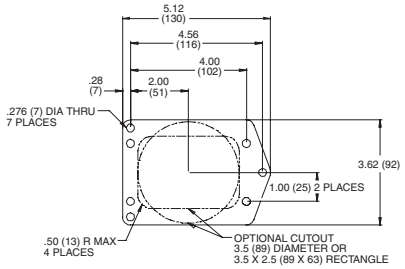
Additional cable mounting bracket for use with a hand throttle (see Unidrum).



Fast and Economical Installation

A throttle cable simplifies the installation, providing a complete system to suit many applications.

The pedal tower mechanism is designed to be dropped through the floor and secured. Cable attachment can then be quickly and easily completed.



Cablecraft® Motion Controls

Throttle Pedal - Medium Duty

Foot Control

Medium-Duty Throttle Pedals are an economical and compact, with a rugged design.

Common Applications: Farm machinery, heavy machinery, landscaping equipment, construction equipment, warehouse equipment

- Two different underfloor configurations allow the throttle interconnect to exit from the rear or the front
- Dual segment torsion spring is incorporated for idle position return
- Environmental contamination is minimized by a plastic boot installed between the pedal and mounting base
- Idle pedal position and throttle travel (3" maximum) are both adjustable
- Multiple fastener holes are incorporated into the base to accommodate various mounting patterns
- Coated sheet metal components and plastic bushings provide years of smooth, trouble-free service
- Embossed pedal surface reduces slippage and increases strength

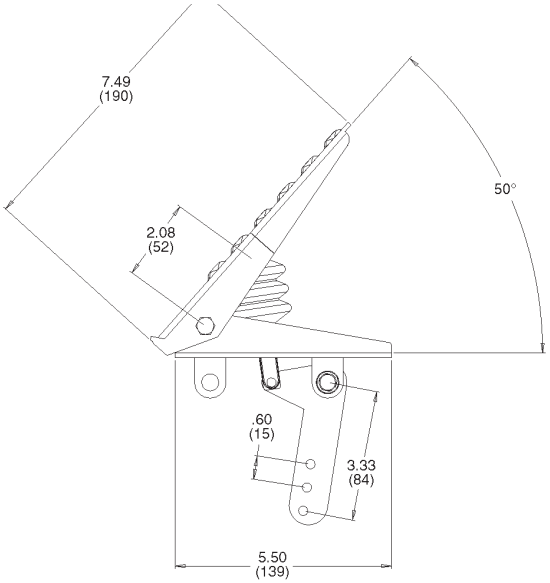


Material:

- Coated sheet metal
- Plastic bushings
- Plastic boot plated steel hardware

Medium-Duty Pedal CH530

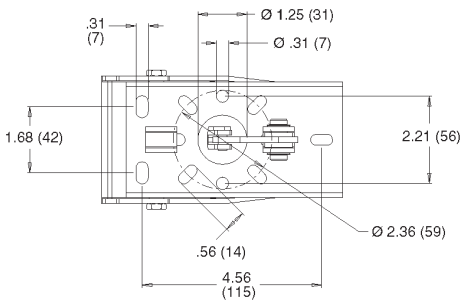
For use with single pull-only throttle (gas) cables.



Fast and Economical Installation

A throttle cable simplifies the installation, providing a complete system to suit many applications.

The pedal tower mechanism is designed to be dropped through the floor and secured. Cable attachment can then be quickly and easily completed.



***WARNING** - Since the manufacturer is unable to determine all applications in which a part may be placed, it is the user's responsibility to determine the suitability of the part for its intended use. This is especially true where safety is a factor. Incorrect application or installation may result in property damage, bodily injury, or death. For technical assistance, call 260-749-5105.*

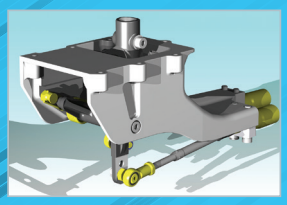
Manual Transmission Assemblies

The Manual Transmission Shifter (MTS) system is an easy-to-operate and maintenance-free approach to remote manual transmission shifting. This system is based on the performance of Cablecraft® low friction control cables and makes remote shifting easier for the operator, while simplifying assembly for the vehicle builder.

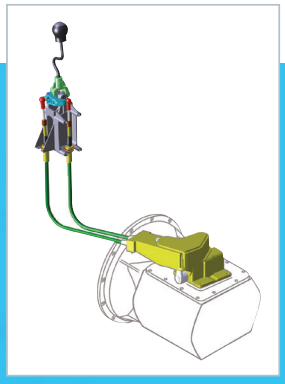
The MTS is ideal for cab-over-engine and rear engine buses, but can be used in other applications like off-highway/heavy equipment (tractors, loaders, agricultural sprayers, telehandlers) and in specialty vehicles such as mobile cranes, fire trucks, garbage trucks, oil field equipment, mining equipment and concrete pumpers.



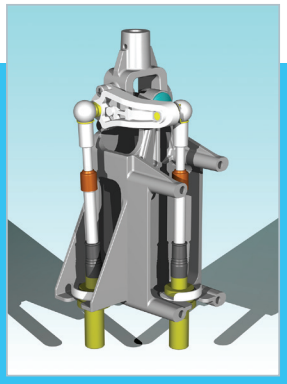
Horizontal Gear Shifter
923 Series



Horizontal Gear Shifter
925 Series



Manual Transmission Shifter
Cab Units



Vertical Gear Shifter
918 Series

Specifications

Series	918 Series	923 Series	925 Series
General Specifications			
Style	Vertical	Horizontal	Horizontal
Mount	Dash / Console	Floor	Console
Configuration	RH	RH / LH	RH / LH
Drive	Small Commercial Vehicle	Truck / Bus	Truck / Bus
Construction			
Housing	Die Cast AL	Die Cast AL	Die Cast AL
Yoke	Die Cast AL	IC Steel	IC Steel
Other Specifications			
Typical Handle Length	6.25″ – 8.25″	24″ – 30″	12″ – 15″
Variable Ratio	—	4:1 to 5:1	4:1 to 5:1
Select Movement	20°	15°	15°
Shift Movement	30°	30°	30°
Normal Working Load	6.6 – 11 lbs.	6.6 – 11 lbs.	6.6 – 11 lbs.
Accidental Overload	220 lbs.	220 lbs.	220 lbs.
Operating Temperatures	-40°F/+248°F	-40°F/+248°F	-40°F/+248°F
Weight	2.4 lbs.	7.0 lbs.	6.6 lbs.
Options			
Full Sealed Unit	Opt	Opt	Opt
Gaiter	Opt	Opt	Opt
Differential End Fitting	Opt	Opt	Opt
Bias Spring	—	Opt	Opt
Adjustable Bias Spring Position	—	Adj	Adj

All line art dimensions are represented as follows: in (mm)

Cablecraft® Motion Controls

Horizontal Gear Shifter – 923 Series

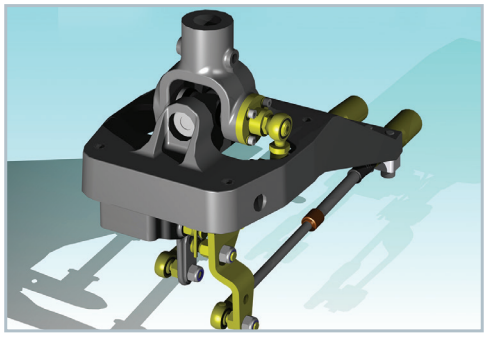
Industrial HGS Systems

This reliable shift system replaces the cumbersome and maintenance-prone rod linkages commonly used in cab over and rear engine bus systems, making remote shifting easier for both the vehicle builder, and the operator.

Common Applications: Floor mounted shifter, bus, coach and truck applications, servo and non-servo assisted transmissions, heavy duty plant and agricultural vehicles, heavy to medium duty cable applications

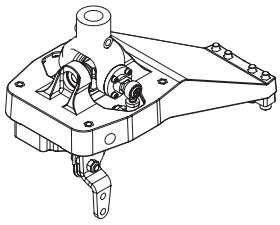
- Easy installation, adjustment free
- Maintenance-free life
- Ends gear jump out
- Clean precise shifts
- No knob-to-cab relative movement in floating cabs
- No action required to tilt cab
- Vibration from drive train is not transmitted
- Reduced cab noise levels
- Installation design to customer requirements
- Flexible capability with different cable end fittings

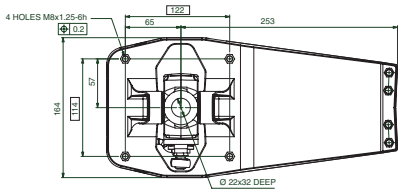


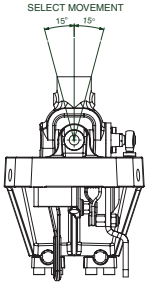


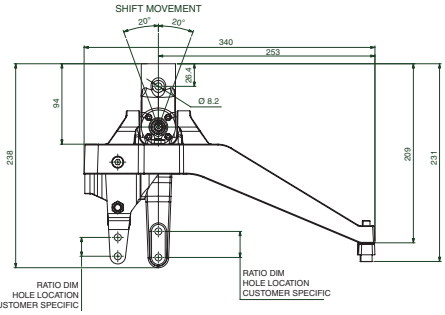
Technical Data

- Recommended handle lengths: 610 mm to 760 mm (24” - 30” approx.)
- Normal working load @ knob = 3 kg (6.6 lb.) to 5 kg (11 lb.)
- Accidental overload @ knob = 100 kg (220 lb.)
- Operating temperatures: -40°C to 120°C (-40°F to 248°F)
- Weight: 3.2 kg (7.0 lb.)









Horizontal Gear Shifter – 925 Series

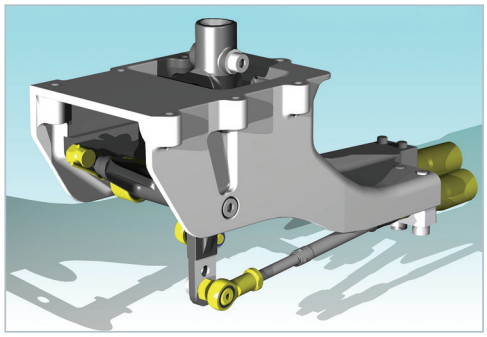
Industrial HGS Systems

Based on the proven quality and performance of Cablecraft® low friction control cables, our manual transmission shifter system provides a maintenance-free, cost-effective approach that makes remote shifting easier to build and use.

Common Applications: Center console mounted shifter, servo and non-servo assisted transmissions, bus, coach and truck applications, heavy to medium duty plant and agricultural vehicles, heavy to medium duty cable applications

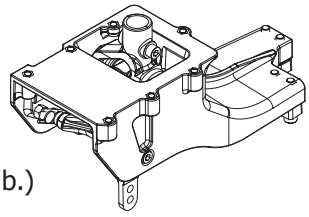
- Easy installation, adjustment free
- Maintenance-free life
- Ends gear jump out
- Clean precise shifts
- No knob-to-cab relative movement in floating cabs
- No action required to tilt cab
- Vibration from drive train is not transmitted
- Reduced cab noise levels
- Installation design to customer requirements
- Flexible capability with different cable end fittings

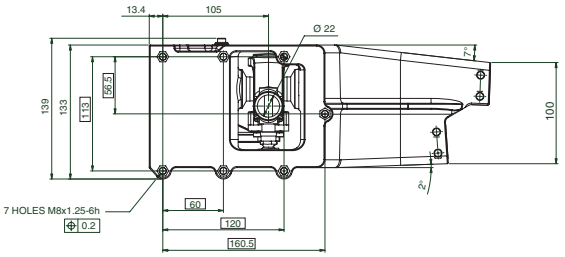


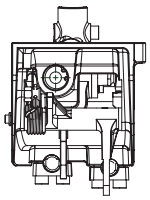


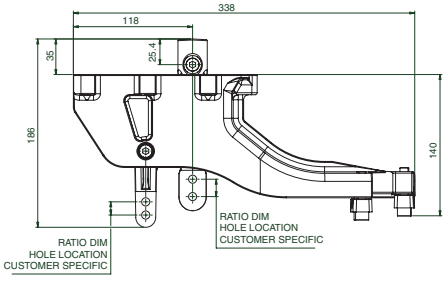
Technical Data

- Recommended handle lengths: 305mm to 380mm (12" - 15" approx.)
- Normal working load @ knob = 3kg (6.6 lb.) to 5kg (11 lb.)
- Accidental overload @ knob = 100kg (220 lb.)
- Operating temperatures: -40°C to 120°C (-40°F to 248°F)
- Weight: 3.0kg (6.6 lb.)









Cablecraft® Motion Controls

Manual Transmission Shifter Cab Units

Industrial HGS Systems

This reliable shift system replaces the cumbersome and maintenance-prone rod linkages commonly used in cab over and rear engine bus systems, making remote shifting easier for both the vehicle builder, and the operator.

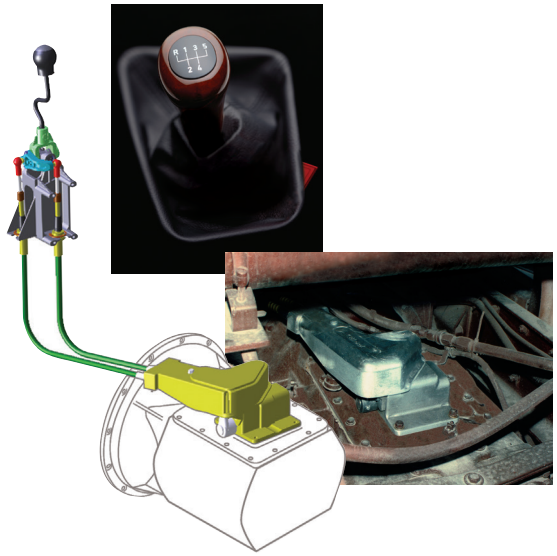
Common Applications:

Bus/truck cabs – On or off road, cab over engine, low cab forward

Heavy equipment – Tractors, loaders, agricultural sprayers, telehandlers

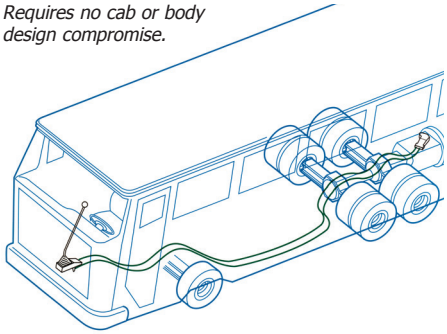
Specialty vehicles – Mobile cranes, fire trucks, garbage trucks, oil field equipment, mining equipment, concrete pumpers

- Easy installation, adjustment free
- Maintenance-free life
- Ends gear jump out
- Clean precise shifts
- No knob-to-cab relative movement in floating cabs
- No action required to tilt cab
- Vibration from drive train is not transmitted
- Reduced cab noise levels
- Installation design to customer requirements
- Flexible capability with different cable end fittings



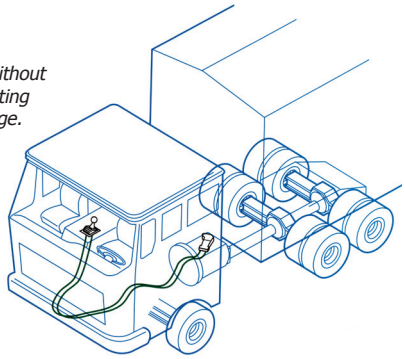
No Maintenance Required.

Requires no cab or body design compromise.

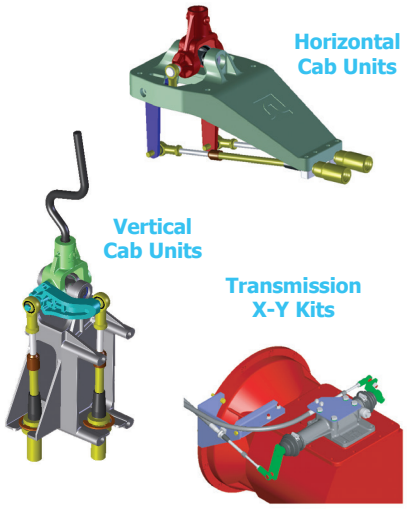


The cables can easily be routed to avoid displacing valuable luggage space.

Tilt cab without disconnecting shift linkage.



Cab sealed around shift linkage.
- *Less Noise*
- *Cleaner Cab*
- *Improved Heating and Air Conditioning*



WARNING *- Since the manufacturer is unable to determine all applications in which a part may be placed, it is the user's responsibility to determine the suitability of the part for its intended use. This is especially true where safety is a factor. Incorrect application or installation may result in property damage, bodily injury, or death. For technical assistance, call 260-749-5105.*

Vertical Gear Shifter – 918 Series

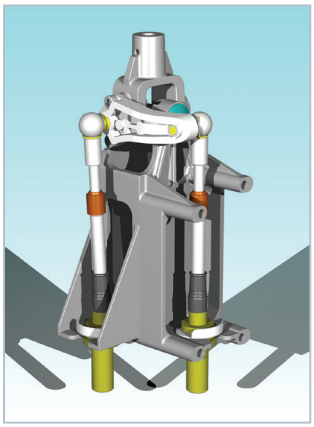
Industrial VGS Systems

Based on the proven quality and performance of Cablecraft® low friction control cables, our manual transmission shifter system provides a maintenance-free, cost-effective approach that makes remote shifting easier to build and use.

Common Applications: Dash or center console mounted shifter, small commercial vehicles, servo assisted transmission – bus and coach applications, light plant and agricultural vehicles, low to medium duty cable applications

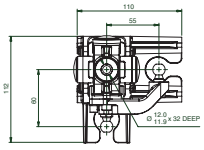
- Easy installation, adjustment free
- Maintenance-free life
- Ends gear jump out
- Clean precise shifts
- No knob-to-cab relative movement in floating cabs
- No action required to tilt cab
- Vibration from drive train is not transmitted
- Reduced cab noise levels
- Installation design to customer requirements
- Flexible capability with different cable end fittings

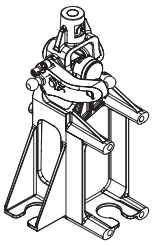


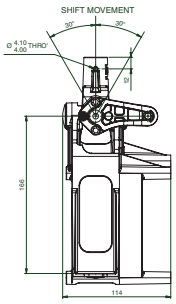


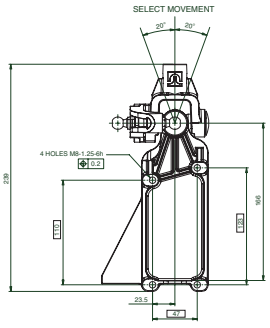
Technical Data

- Recommended handle lengths: 160 mm to 220 mm (6-¼" - 8-¼" approx.)
- Normal working load @ knob = 3 kg (6.6 lb.) to 5 kg (11 lb.)
- Accidental overload @ knob = 100 kg (220 lb.)
- Operating temperatures: -40°C to 120°C (-40°F to 248°F)
- Weight: 1.1 kg (2.4 lb.)









Cablecraft® Motion Controls

Linkages

As a leading designer and manufacturer of motion transfer components we provide rod ends, ball joints, custom linkages, and complete motion transfer assemblies and sub-assemblies to fit your application requirements.



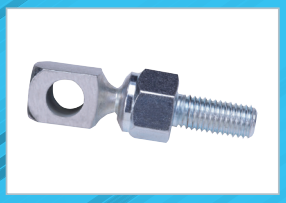
Ball Joints



Rod Ends



Spherical Bearings



Swivels



Linkage Assemblies

Our ball joints, rod ends, and assemblies can be found in the following applications:

- Tie rods
- Operator controls
- Food processing
- Drag links
- Printing and labeling equipment
- Door mechanisms
- Steering controls
- Hydraulic/pneumatic cylinder ends
- Conveying equipment

When ordering linkage products, it is helpful to have the following information:

- Diameter (thread size) of the product
- Race construction: 2-piece, molded nylon, bronze
- Body and ball material: low carbon or stainless steel
- Male or female threads; Right or left hand
- Plain or with an optional stud
- Application
- Actual working load
- Conditions/environment: Dirt, heat, cold, moisture, etc.
- Part number if available
- Usage quantity

WARNING *- Since the manufacturer is unable to determine all applications in which a part may be placed, it is the user's responsibility to determine the suitability of the part for its intended use. This is especially true where safety is a factor. Incorrect application or installation may result in property damage, bodily injury, or death. For technical assistance, call 260-749-5105.*

Cablecraft Linkage Technical/Application Data

Our engineering staff possesses the expertise to provide advice and guidelines regarding nearly all motion transmission applications. There are several factors pertaining to engineering application, including correct installation, that should be taken into consideration to insure optimum performance of your chosen linkage components

1. When mounting ball studs, the hex mounting portion should be properly tightened and flat against its mating surface. Adequate countersinks, counterbores or washers may be necessary to provide a tight, flush joint. Installation torque values for tightening must be within the capacity of the linkage component or breakage may occur from over-tightening. Consult Cablecraft's engineering staff or refer to an appropriate engineering standard for mounting nut torque values associated with each grade of threaded fastener. Looseness in the threaded joint or mounting surface may cause abnormal wear and early failure of the linkage component.
2. When mounting rod ends, care should be used in tightening a fastener against the ball to prevent distortion. The same torque requirements that apply to threaded fasteners also apply to securing the rod end spherical ball. The plated ball may become chipped or distorted by excessive clamping pressure, resulting in increased torque, wear, and premature failure of the rod end.
3. In applications involving vibration where loosening of the linkage components may occur, self-locking nuts or lockwashers should be used to secure the components and prevent loosening. Looseness in the threaded joint or mounting surface may cause abnormal wear and early failure of the linkage component.
4. Ball joints and rod end bearings should be mounted in such a way as to best utilize the design of the joint with respect to gravitational force. For example, a ball joint should be mounted with the housing member on top of the ball stud. Mounting the housing component with its weight and linkage hanging from the ball or ball stud could accelerate wear and lead to detachment of linkage components and sudden loss of control.
5. It is recommended that a separate stop be incorporated in the linkage system to eliminate the possibility of exceeding the misalignment capability of the ball joint or rod end bearing. An overtravel condition of this type may result in breakage and detachment of the ball joint or rod end components and sudden loss of control.
6. Cablecraft® ball joints and rod end bearings are manufactured to commercial standards. If you have questions concerning a particular product for your application, we can offer assistance; however, it is the end user's responsibility to determine if the chosen part is suitable for a specific application.
7. To determine a part's useful life for a particular application, you should test sample parts under actual operating conditions.

Load Definitions

Ultimate Radial Static Load Capacity (Rod Ends)

These loads are the maximum amount of force the part can sustain before complete failure. All loads listed in the catalog are based on rod ends without grease fittings. Due to the removal of material for the fitting, the load rating for such a part is substantially lower. Consult Cablecraft engineering for assistance on these parts.

Radial Static Load Capacity (Spherical Bearings)

These loads are the maximum amount of force the part can sustain before a 2% permanent set occurs in the part. Consult Cablecraft engineering if these numbers don't fit your application.

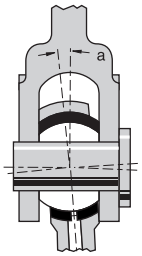
Static Limit Load (Spherical Bearings)

Static limit load is the allowable load that can be applied to a bearing without adversely affecting its performance capabilities.

Cablecraft Linkage Technical/Application Data

Calculations for Misalignment of Rod Ends & Spherical Bearings

B = Bore of ball
C = Chamfer on outer race
D = Head diameter or diameter of outer race
E = Ball diameter
H = Housing width
S = Shoulder diameter (neck ball)
V = $\sqrt{(D - 2C)^2 + H^2}$
W = Ball width

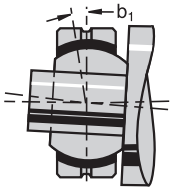


Rod End Angle:
$a = SIN^{-1} \frac{W}{D} - SIN^{-1} \frac{H}{D}$

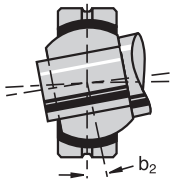
The angle of misalignment in a rod end is controlled by the outside diameter of the head. The maximum degree of misalignment is obtained when the head contacts the side of the fork or clevis in which it is mounted.

The angle of misalignment in a spherical bearing is calculated somewhat differently from that of the rod end because the housing is not spherical. There are four different types of mountings in which these bearings may be used as shown, and the angle of misalignment is governed by the type of mounting adopted.

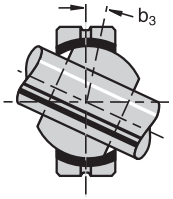
Shown to the right are the common mountings for spherical bearings and the corresponding formula for calculating the angle of misalignment.



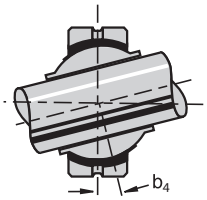
$b_1 = SIN^{-1} \frac{W}{V} - SIN^{-1} \frac{H}{V}$



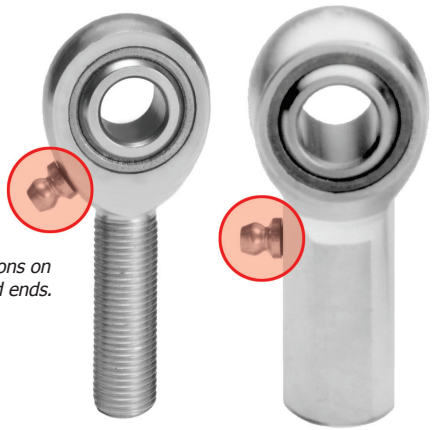
$b_2 = SIN^{-1} \frac{W}{E} - SIN^{-1} \frac{H}{E}$



$b_3 = COS^{-1} \frac{B}{E} - SIN^{-1} \frac{H}{E}$

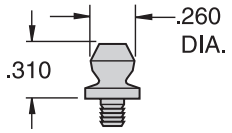


$b_4 = COS^{-1} \frac{S}{E} - SIN^{-1} \frac{H}{E}$

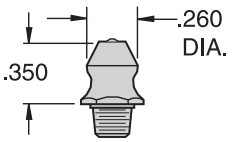


Standard zerk locations on male and female rod ends.

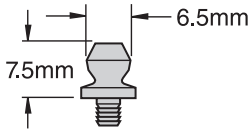
Standard Drive Fit Zerk
Specify by adding suffix "Z" to part number.
Example: MSF8Z



Standard Threaded Zerk
Specify by adding suffix "-28" to part number.
Example: MSF8Z-28



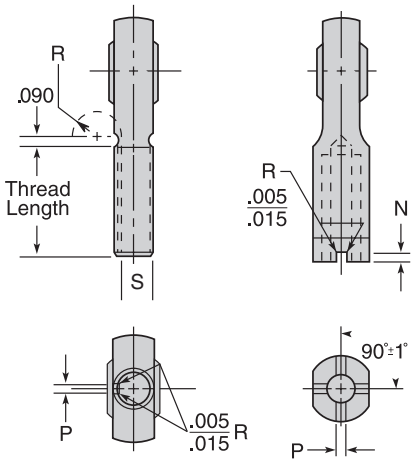
Metric Zerk
Specify by adding suffix "ZM" to part number.
Example: MSF8ZM



WARNING *- Since the manufacturer is unable to determine all applications in which a part may be placed, it is the user's responsibility to determine the suitability of the part for its intended use. This is especially true where safety is a factor. Incorrect application or installation may result in property damage, bodily injury, or death. For technical assistance, call 260-749-5105.*

Cablecraft Linkage Technical/Application Data

Rod End Keyway (Ref NAS 559)



Dimensions in Inches

Thread OD REF	N Max.	P Min.	N Max.	P Min.
.2500	.056	.062	.201	.255
.3125	.056	.062	.260	.255
.3750	.056	.093	.311	.255
.4375	.069	.093	.370	.255
.5000	.069	.093	.436	.255
.5620	.077	.125	.478	.255
.6250	.077	.125	.541	.255
.7500	.077	.125	.663	.255
.8750	.086	.156	.777	.318
1.0000	.094	.156	.900	.318
1.1250	.094	.094	1.010	.382
1.2500	.116	.187	1.136	.382
1.3750	.116	.187	1.236	.445
1.5000	.116	.250	1.361	.445
1.6250	.129	.250	1.477	.445
1.7500	.129	.250	1.589	.508
1.8750	.129	.312	1.714	.508
2.0000	.129	.312	1.839	.508
2.1250	.129	.312	1.955	.508
2.2500	.129	.312	2.080	.508

Rod Ends/Ball Joints: Specifying Tips

Each of our products are specifically designed to perform in even the most extreme conditions. Through this technical guide and the advice of our sales and engineering staff, our goal is to help you identify the most appropriate Cablecraft® product suited to your application. First, a few key considerations…

While the applications are almost limitless, the conditions that the different linkages witness are often very similar. When designing a linkage solution, keep in mind everything from environmental conditions (humidity, dust & temperature) to the range of motion required.

- For example: Rod ends and ball joints are not designed for high rate rotational applications such as holding rotating shafts. However, when repetitive motion is present, one of Cablecraft's many self-lubricated bearings (such as nylon, bronze or PTFE race bearings) should be considered. Our comprehensive catalog provides individual product pages that identify key features such as temperature restraints and descriptions of strength for each product.
- When environmental conditions involving excessive dirt exist, our nylon race bearings help keep the cavity free of excessive dirt build-up (a great alternative to the "tough to reach linkage and often-neglected grease fitting" applications).
- Additionally we provide many specialty alloy designs to prevent corrosion and increase strength.

Why choose a ball joint instead of a rod end? While ball joints are often considered the more economical solution, there are also many cases in which a ball joint is better suited for performance and geometry-based applications. Cablecraft ball joints come in many forms aside from designs in the catalog. A popular and flexible design option includes our 1-piece solid and bent linkages (as seen on many draglinks and tie rods in the lawn and garden industry). The integral ball joint placed directly in the connecting rod creates a low profile linkage that is optimal for minimal clearance applications such as steering and other internal machine controls.

What sets Cablecraft apart from other rod end and ball joint manufacturers? We not only design all of our rod ends, ball joints and sphericals, but also manufacture them in the USA. Since 1920, we have been creating and developing many of the critical and revolutionary methods to manufacture linkages. This has put us in the forefront of product offerings, and to this day we continue to strive to offer the best product, the best delivery and the best value to our customers.

Call us at 260-749-5105 when you need product/technical engineering support.

Cablecraft® Motion Controls

Ball Joints

Our engineers have been responsible for many innovations in ball joint design, manufacture and use of materials. One of the most significant is the two-component ball joint, consisting only of a ball stud and housing, which dramatically reduced cost and increased the application range. Another innovation is the pre-lubricated socket, which prolongs life and assures smooth, reliable operation.


R-G


S, SS, SC


SR-G

Specifications

Part	Construction	Materials			Options	Available Sizes
		Housing	Ball	Race		
SR-G	Retaining Ring	LC Steel	LC Steel	—	RH/LH Thread	10-32, 1/4-28, 5/16-24, 3/8-24, 1/2-20, 5/8-18
R-G	Staked	LC Steel	LC Steel	—	RH/LH Thread	10-32, 1/4-28, 5/16-24, 3/8-24, 7/16-20, 1/2-20
S	Spring Retained	LC Steel	LC Steel	—	RH/LH Thread	10-32, 1/4-28
SS	Spring Retained	LC Steel	LC Steel	—	RH/LH Thread	1/4-28, 5/16-24, 3/8-24
SC	Spring Clip	LC Steel	LC Steel	—	RH/LH Thread	10-32, 1/4-28

Performance Comparison

Part	Economy	Load Capability - Tensile Strength	Load Capability - Ball Pull Out	Corrosion Resistance	Vibration Resistance	Wear Resistance	Lubrication	Break-away Torque	Ball Clearance (Play)
SR-G	→	↑	↑	→	→	↑	↓	→	→
R-G	↑	→	→	→	↓	→	↓	→	→
S	→	→	→	→	→	→	→	→	→
SS	→	→	→	→	→	→	→	→	→
SC	↑	→	↓	→	→	→	→	→	→

WARNING *- Since the manufacturer is unable to determine all applications in which a part may be placed, it is the user's responsibility to determine the suitability of the part for its intended use. This is especially true where safety is a factor. Incorrect application or installation may result in property damage, bodily injury, or death. For technical assistance, call 260-749-5105.*

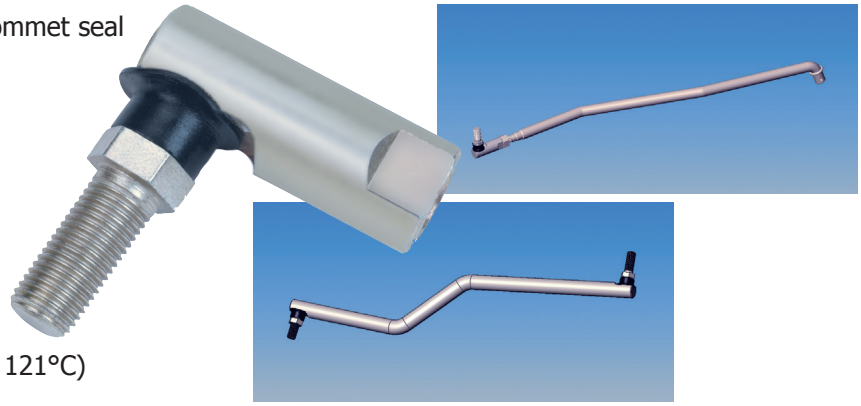
R-G Ball Joints

Steel Housing, Staked Design with Rubber Grommet

R-G ball joints are highly reliable, economical ball joints that can be used in a variety of medium to heavy duty applications.

Common Applications: Lawn and garden equipment, construction, and industrial equipment

- Consistent pull forces due to a proprietary crimping process to form the housing material around the ball
- Corrosion-resistant
- Protected from contaminants via a rubber grommet seal



Material:

Ball Stud –
- Low carbon steel, case hardened
- Zinc plated, clear dichromate treated

Body –
- Low carbon steel, case hardened
- Zinc plated, clear dichromate treated

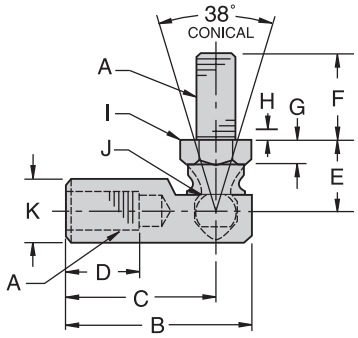
Temperature range: -30°F – 250°F (-34°C – 121°C)

Threads: Right or left-handed

Available in metric sizes

Custom assemblies can be built to specification, including male to male or female to female

Meets SAE specification J490 (Type G/Style2)



R-G Specifications

Part Number		A	B	C	D	E	F	G	H	I	J	K	W.F.	W.F.	Tensile & Shear	Force to Remove
Right Hand	Left Hand	UNF	±.020	±.020	MIN	±.020	±.020	REF	REF	REF	REF	REF	Width	Length	Strength (Pounds)	Ball Stud (Pounds)
R103G	R103GLH	10-32	1.156	.875	.469	.359	.438	.094	.062	.312	.177	.375	.312	.250	295	690
R107G	R107GLH	1/4-28	1.219	.969	.500	.469	.562	.125	.094	.375	.193	.437	.375	.281	882	1,005
R108G	R108GLH	5/16-24	1.406	1.125	.562	.531	.687	.156	.094	.437	.232	.500	.437	.281	1,587	1,282
R-109G	R109GLH	3/8-24	1.687	1.375	.750	.687	.875	.187	.094	.500	.287	.625	.500	.312	2,437	1,700
R-110G	R110GLH	7/16-20	2.375	1.937	1.125	.875	1.125	.250	.125	.625	.412	.750	.625	.375	3,390	2,700
R-111G	R-111GLH	1/2-20	2.375	1.937	1.125	.875	1.125	.250	.125	.625	.412	.750	.625	.375	3,390	2,700

Chart Notes: 1. Ball Joint can be ordered without the grommet by dropping the "G" suffix. Example: R108LH
2. R103G size is supplied with a wrap around grommet, not shown.

S, SS, SC Ball Joints

Quick Disconnect with Spring or Spring Clip

Suitable for light to medium-duty linkage applications requiring quick disconnect capabilities, the S/SS/SC Series offers three styles of fast assembly/disassembly ball joints:

- S Series: Spring loaded sleeve, smaller ball joint sizes
- SS Series: Exposed spring loaded sleeve, larger sized applications
- SC Series: Ball stud is retained by a spring clip, for lower load and fewer disconnection requirements

Common Applications: Cable assemblies, light industrial, agricultural, lawn and garden, and racing throttle links

- S and SS ball joints are designed for an application where quick connect or disconnect is needed at assembly or in field servicing
- The SC spring clip ball joint is designed for low force mechanical linkages such as carburetor or fuel injection applications
- Extended corrosion resistance - Components are produced from low carbon steel, zinc plated, and clear dichromate treated
- Maximum wear resistance - Ball stud is heat treated on all models for extended wear resistance
- Easy access and fast maintenance with quick pull back, "no tools required" disconnect assembly

Material:

Ball Stud –
- Low carbon steel, heat treated
- Zinc plated, clear dichromate treated

Sleeve –
- Low carbon steel
- Zinc plated, clear dichromate treated

Body S and SS –
- Low carbon steel

Body SC –
- Low carbon steel, heat treated
- Zinc plated, clear dichromate treated

Spring S and SS –
- Stainless steel

Spring Clip SC –
- Hardened spring steel

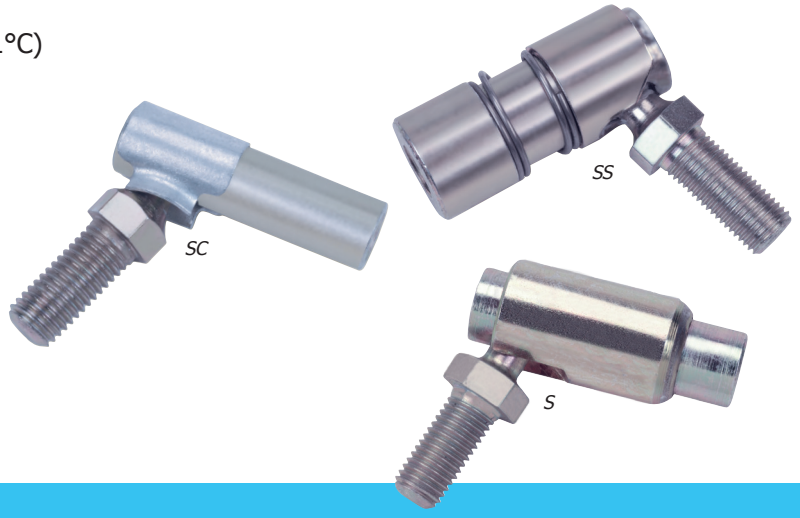
Temperature range: -60°F – 250°F (-51°C – 121°C)

Threads: Right or left-handed

Available in metric sizes

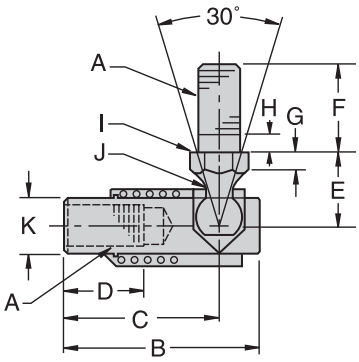
Custom assemblies can be built to specification

S/SS series meets SAE specification J490
(S: type S/style 1 SS: type S/style 2)

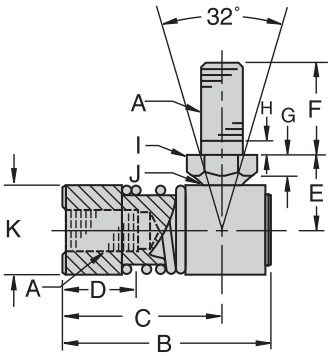


WARNING *- Since the manufacturer is unable to determine all applications in which a part may be placed, it is the user's responsibility to determine the suitability of the part for its intended use. This is especially true where safety is a factor. Incorrect application or installation may result in property damage, bodily injury, or death. For technical assistance, call 260-749-5105.*

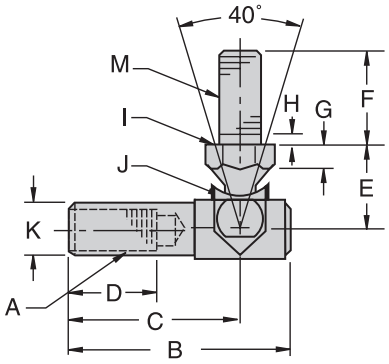
S, SS, SC Ball Joints



Type S



Type SS



Type SC

S, SS, SC Specifications

Part Number	A UNF	B ±.020	C ±.020	D MIN	E ±.020	F ±.020	G REF	H REF	I REF	J REF	K REF	M UNF	Ball Diameter REF
S-103	10-32	1.094	.906	.437	.437	.437	.125	.062	.312	.171	.312	—	253
S107S	1/4-28	1.094	.906	.531	.469	.562	.141	.062	.312	.171	.312	—	.253
SS1002	1/4-28	1.250	.969	.531	.469	.562	.125	.078	.375	.192	.562	—	.345
SS1003	5/16-24	1.453	1.125	.594	.531	.687	.125	.094	.437	.224	.625	—	.403
SS1004	3/8-24	1.750	1.375	.812	.687	.875	.156	.109	.500	.273	.750	—	.491
SC103	10-32	1.156	.875	.484	.437	.437	.187	.078	.312	.135	.312	10-32	.250
SCS103	10-32	1.156	.875	.484	.437	.562	.125	.078	.312	.135	.312	1/4-28	.250
SC107	1/4-28	1.250	.969	.531	.437	.562	.125	.078	.312	.135	.312	1/4-28	.250
SCS107	1/4-28	1.250	.969	.531	.437	.437	.125	.078	.312	.135	.312	10-32	.250

SR-G Ball Joints

Hardened Steel Housing, Retaining Ring Design with Rubber Grommet

The SR-G Series offers many similarities to our metal to metal R-G ball joint design – but with a hardened steel housing and ball stud combination to increase overall wear life. This design is ideal for applications with excessive vibration, shock loads or heavy wear conditions and is an economical solution to medium to heavy-duty applications.

Common Applications: Lawn and garden equipment, construction, and industrial equipment

- All parts are manufactured from low carbon steel and heat-treated for long life and wear resistance
- Corrosion resistant - Zinc plated and clear dichromate treated
- Retaining ring assembly helps to prevent ball stud pull out in higher force applications
- Contaminant proof - Rubber grommet provides a durable seal against outside elements

Material:

Ball Stud –
- Low carbon steel, heat treated
- Zinc plated, clear dichromate treated

Body –
- Low carbon steel, heat treated
- Zinc plated, clear dichromate treated

Retaining Ring –
- Galvanized music wire
- Stress relieved



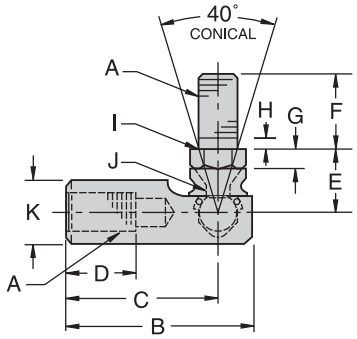
Temperature range: -30°F – 250°F (-34°C – 121°C)

Threads: Right or left-handed

Available in metric sizes

Custom assemblies can be built to specification, including male to male or female to female

Meets SAE specification J490 (Type G/Style 4)



SR-G Specifications

Part Number		A	B	C	D	E	F	G	H	I	J	K	W.F.	W.F.	Tensile & Shear Strength	Force to Remove Ball Stud
Right Hand	Left Hand	UNF	±.020	±.020	MIN	±.020	±.020	REF	REF	REF	REF	REF	Width	Length	(Pounds)	(Pounds)
SR-103G	Inquire	10-32	1.219	.969	.469	.359	.437	.125	.063	.375	.217	.437	.375	.28	420	1,400
SR-107G	SR107GLH	1/4-28	1.219	.969	.531	.469	.562	.125	.063	.375	.217	.437	.375	.28	882	1,400
SR-108G	SR-108GLH	5/16-24	1.406	1.125	.562	.531	.687	.156	.094	.437	.232	.500	.437	.28	1,375	1,575
SR-109G	SR-109GLH	3/8-24	1.687	1.375	.750	.687	.875	.187	.094	.500	.284	.625	.500	.31	1,675	2,000
SR-111G	SR-111GLH	1/2-20	2.375	1.937	1.125	.875	1.125	.250	.125	.625	.382	.750	.625	.38	2.637	2,855
SR-112G	SR-112GLH	5/8-18	2.375	2.062	1.125	1.000	1.125	.312	.125	.750	.417	.875	.750	.50	2,920	3,135

Chart Notes: 1. Ball Joint can be ordered without the grommet by dropping the "G" suffix. Example: SR107

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Rod Ends

Manufactured in either stainless steel or low carbon steel, our rod ends are suitable for use in a wide variety of applications – Construction, industrial, agricultural machinery, trucks and buses, military equipment, medical, race cars, lawn and garden, and more.


DBM/DBF Rod Ends


EM/EF Rod Ends


EM-M/EM-F Rod Ends


EM-T/EF-T Rod Ends


MJ-M/FJ-M Rod Ends


SPM/SPF Rod Ends


SSPM/SSPF Rod Ends

Specifications

Part	Construction	Materials			Options	Available Sizes
		Housing	Ball	Race		
EF-EM	2-Piece	LC Steel	LC Steel	PTFE Liner Optional	RH/LH Thread, Studded	10-32, 1/4-28, 5/16-24, 3/8-24, 7/16-20, 1/2-20, 5/8-18, 3/4-16
EF-M/EM-M	Staked	LC Steel	LC Steel	PTFE Liner Optional	RH/LH Thread	M5x.8, M6x1.0, M8x1.25, M10x1.5, M12x1.75, M14x2.0, M16x2.0
EF-T/EM-T	2-Piece	LC Steel	LC Steel	PTFE Liner Optional	RH/LH Thread, Studded	10-32, 1/4-28, 5/16-24, 3/8-24, 7/16-20, 1/2-20, 5/8-18, 3/4-16
EF-MT/EM-MT	2-Piece	LC Steel	LC Steel	PTFE Liner	RH/LH Thread, Studded	M5x.8, M6x1.0, M8x1.25, M10x1.5, M12x1.75, M14x2.0, M16x2.0
SPF/SPM	2-Piece	LC Steel	LC Steel	PTFE Liner	RH/LH Thread, Studded	10-32, 1/4-28, 5/16-24, 3/8-24, 7/16-20, 1/2-20, 5/8-18, 3/4-16
SPF/SPM	2-Piece	LC Steel	LC Steel	PTFE Liner	RH/LH Thread, Studded	10-32, 1/4-28, 5/16-24, 3/8-24, 7/16-20, 1/2-20, 5/8-18, 3/4-16
FJ-MST/ MJ-MST	2-Piece	LC Steel	LC Steel	PTFE Liner	RH/LH Thread, Studded	M3x.5, M5x.8, M6x1.0, M8x1.25, M10x1.5, M12x1.75, M14x2.0, M16x2.0, M18x1.5, M20x1.5, M22x1.56
SSPF/SSPM	Molded Race	LC Steel	LC Steel	Reinforced Nylon	RH/LH Thread, Studded	10-32, 1/4-28, 5/16-24, 3/8-24, 7/16-20, 1/2-20, 5/8-18, 3/4-16

Performance Comparison

Part	Economy	Load Capability	Operating Temperature	Corrosion Resistance	Vibration Resistance	Wear Resistance	Lubrication	Break-away Torque	Ball Clearance (Play)
EF-EM	↑	↑	↑	→	↓	→	↓	↑	→
EF-M/EM-M	↑	↑	↑	→	↓	→	↓	↑	→
EF-T/EM-T	↑	↑	→	→	→	↑	↑	→	↑
EF-MT/EM-MT	↑	↑	→	→	→	↑	↑	→	↑
SPF/SPM	↑	→	→	→	↑	↑	↑	→	↑
FJ-MST/ MJ-MST	↑	→	→	→	↑	↑	↑	→	↑
SSPF/SSPM	→	→	→	→	↑	↑	↑	→	↑

DBM/DBF Rod Ends

4-Piece, Bronze Race, Oil Impregnated, Metric

Suitable for many high precision, mechanical motion transfer applications, the DBM/DBF Series delivers precise and extremely low friction performance leading to longer wear life, higher temperature performance, and lower maintenance cost.

Common Applications: Industrial equipment, precision machinery

- Precision fit and increased wear performance - Ball materials are produced from bearing quality steel that is thru hardened and finish ground
- Extended corrosion resistance - Body materials are produced from economical low carbon steel and are zinc plated
- Four-piece, bronze race design in metric thread sizing

Material:

Ball –
- 52100 steel Rc 56 min.
- Hard chrome plated

Body –
- Low carbon steel
- Zinc plated, clear dichromate treated

Race –
- Sintered phosphor bronze
- Oil impregnated

Temperature range: -30°F — 300°F (-34°C —149°C)

Thread: Right or left-handed versions

Studded: Optional

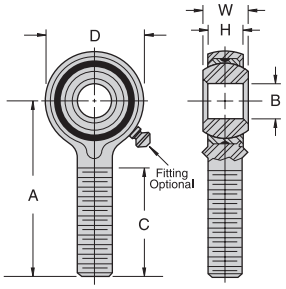
Grease fittings: Optional

Meets ISO 12240 (DIN 648)

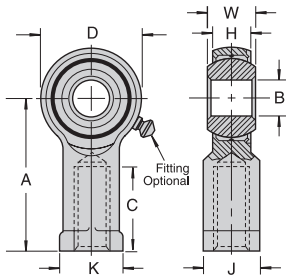


WARNING *- Since the manufacturer is unable to determine all applications in which a part may be placed, it is the user's responsibility to determine the suitability of the part for its intended use. This is especially true where safety is a factor. Incorrect application or installation may result in property damage, bodily injury, or death. For technical assistance, call 260-749-5105.*

DBM/DBF Rod Ends



DBM



DBF

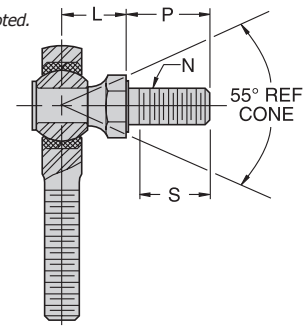
DBM Specifications

Part Number		B +.063 -.013	W ±.13	H ±.05	A ±.25	C MIN.	D ±.13	6g	Ultimate Radial Static Load Capacity (Newtons)	Ball Diameter Ref.	Weight (Grams)
Right Hand	Left Hand	Ball Bore	Ball Width	Body Width	Centerline Length	Thread Length	Head Diameter	Thread Size			
DBM5	DBML5	5	8	6.00	33	20	18	M5x0.8	3,000	13	15
DBM6	DBML6	6	9	6.75	36	22	20	M6x1.0	4,000	16	20
DBM8	DBML8	8	12	9.00	42	25	24	M8x1.25	8,000	19	35
DBM10	DBML10	10	14	10.50	48	29	28	M10x1.5	13,000	22	50
DBM12	DBML12	12	16	12.00	54	33	32	M12x1.75	17,000	26	65
DBM14	DBML14	14	19	13.50	60	36	36	M14x2.0	24,000	29	100
DBM16	DBML16	16	21	15.00	66	40	42	M16x2.0	28,500	32	179
DBM20	DBML20	20	25	18.00	78	47	50	M20x1.5	42,000	40	289

DBF Specifications

Part Number		B +.063 -.013	W ±.13	H ±.05	A ±.25	C MIN.	D ±.13	6H	K ±.2	J +0 -.2	Ultimate Radial Static Load Capacity (Newtons)	Ball Diameter Ref.	Weight (Grams)
Right Hand	Left Hand	Ball Bore	Ball Width	Body Width	Centerline Length	Thread Length	Head Diameter	Thread Size	W.F. Diameter	W.F. Width			
DBF5	DBFL5	5	8	6.00	27	10	18	M5x0.8	18	18	6,000	13	15
DBF6	DBFL6	6	9	6.75	30	12	20	M6x1.0	20	20	7,000	16	19
DBF8	DBFL8	8	12	9.00	36	16	24	M8x1.25	24	24	12,000	19	30
DBF10	DBFL10	10	14	10.50	43	20	28	M10x1.5	28	28	14,500	22	40
DBF12	DBFL12	12	16	12.00	50	22	32	M12x1.75	32	32	17,000	26	75
DBF14	DBFL14	14	19	13.50	57	22	36	M14x2.0	36	36	24,000	29	124
DBF16	DBFL16	16	21	15.00	64	28	42	M16x2.0	42	42	28,500	32	174
DBF20	DBFL20	20	25	18.00	77	33	50	M20x1.5	50	50	45,000	40	358

Chart Notes: 1. For standard lubrication fitting, add "Z" to suffix. Example: DBM10Z
2. This series is also available in a studded configuration.
Specify by adding "S" to suffix. Example: DBM10S
3. All dimensions are listed in millimeters unless otherwise noted.



Studded Dimensions

Rod End Bore Size	L REF	P ±.030	S Min. Thread Length	N 6g
5mm	9.0	13.0	10.0	M5x.8
6mm	10.0	14.0	11.0	M6x1.0
8mm	12.0	17.5	14.0	M8x1.25
10mm	16.5	23.0	19.5	M10x1.5
12mm	19.5	28.5	24.5	M12x1.75
14mm	20.5	33.0	29.0	M14x2.0
16mm	24.0	38.0	34.0	M16x2.0

Cablecraft® Motion Controls

EM/EF Rod Ends

Commercial, 2-Piece, Metal to Metal

The 2-piece metal to metal EM/EF Series offers our most economical design and is suitable for many light to heavy duty industrial/mechanical motion transfer applications.

Common Applications: Construction equipment, lawn and garden, truck and bus

- Extended corrosion resistance - Ball and body materials are produced from a low carbon steel and are zinc plated with clear dichromate treatment
- Ball is case hardened for extended wear
- Wide temperature range
- Suited for higher axial loads where side loading strength is critical

Material:

Ball –
- Low carbon steel
- Case hardened
- Zinc plated, clear dichromate treated

Body –
- Low carbon steel
- Zinc plated, clear dichromate treated

Race –
- Sintered phosphor bronze
- Oil impregnated

Temperature range: -65°F – 250°F (-54°C – 121°C)

Thread: Right or left-handed versions

Studded: Optional

Grease Fittings: Optional

Custom alloy construction: Optional

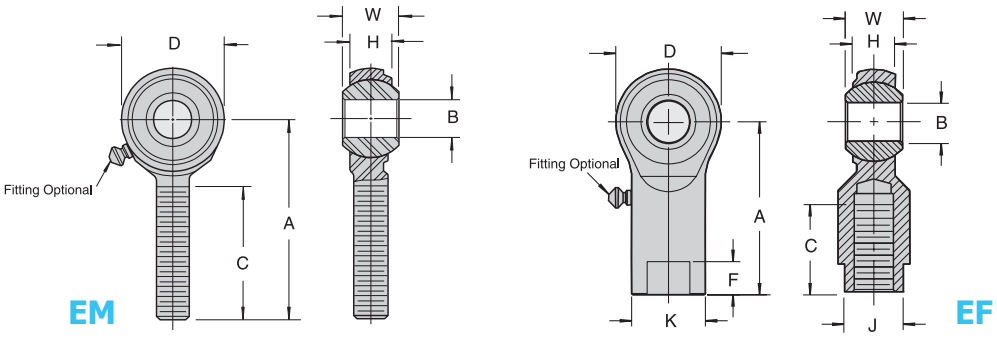
Custom assemblies can be built to specification

Meets SAE specification J1120



WARNING *- Since the manufacturer is unable to determine all applications in which a part may be placed, it is the user's responsibility to determine the suitability of the part for its intended use. This is especially true where safety is a factor. Incorrect application or installation may result in property damage, bodily injury, or death. For technical assistance, call 260-749-5105.*

EM/EF Rod Ends



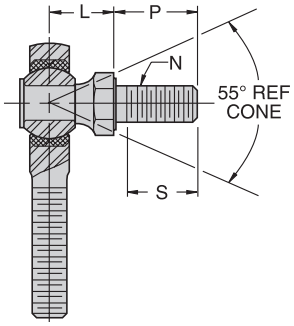
EM Specifications

Part Number		B +.0020 -.0000	W ±.005	H REF	A ±.015	D ±.015	REF	C ±.060	UNF-2A	Ultimate Radial Static Load Capacity (Pounds)	Weight (Pounds)
Right Hand	Left Hand	Ball Bore	Ball Width	Housing Width	Centerline Length	Head Dia.	Ball Dia.	Thread Length	Thread Size		
EM4	EML4	.2500	8	.281	1.562	.750	.516	1.000	1/4-28	2,510	.043
EM5	EML5	.3125	9	.344	1.875	.875	.625	1.250	5/16-24	3,430	.073
EM6	EML6	.3750	12	.406	1.937	1.000	.719	1.250	3/8-24	5,520	.110
EM8	EML8	.5000	14	.500	2.437	1.312	.938	1.500	1/2-20	8,690	.240
EM10	EML10	.6250	16	.562	2.625	1.500	1.125	1.625	5/8-18	10,300	.368

EF Specifications

Part Number		B +.0020 -.0000	W ±.005	H REF	A ±.015	D ±.015	K ±.015	J ±.015	F ±.030	REF	C ±.060	UNF-2B	Ultimate Radial Static Load Capacity (Pounds)	Ball Dia. Ref.	Weight (Pounds)
Right Hand	Left Hand	Ball Bore	Ball Width	Housing Width	Centerline Length	Head Dia.	Shank Dia.	Wrench Flat Width	Wrench Flat Length	Ball Dia.	Thread Length	Thread Size			
EF4	EFL4	.2500	.375	.281	1.312	.750	.469	.375	.250	18	.687	1/4-28	6,000	13	.062
EF5	EFL5	.3125	.437	.344	1.375	.875	.500	.437	.281	20	.687	5/16-24	7,000	16	.081
EF6	EFL6	.3750	.500	.406	1.625	1.000	.687	.562	.312	24	.812	3/8-24	12,000	19	.152
EF8	EFL8	.5000	.625	.500	2.125	1.312	.875	.750	.375	28	1.187	1/2-20	14,500	22	.324
EF10	EFL10	.6250	.750	.562	2.500	1.500	1.000	.875	.500	32	1.406	5/8-18	17,000	26	.473

Chart Notes: 1. For standard lubrication fitting, add "Z" to suffix. Example: EM10Z
2. This series is also available in a studded configuration. Specify by adding "S" to suffix. Example: EM10S



Studded Dimensions

Rod End Bore Size	L REF	P ±.030	S Min. Thread Length	N Thread Size UNF-2A
1/4"	.469	.563	.500	1/4-28
5/16"	.531	.688	.594	5/16-24
3/8"	.625	.875	.781	3/8-24
1/2"	.875	1.125	1.000	1/2-20
5/8"	1.000	1.125	1.000	5/8-18

EM-M/EF-M Rod Ends

Commercial, 2-Piece, Metal to Metal, Metric

Suitable for many light to heavy duty industrial/mechanical motion transfer applications, the 2-piece metal to metal EM-M/EF-M Series offers an economical design in metric sizing.

Common Applications: Construction equipment, lawn and garden, truck and bus

- Long life and low maintenance cost - Oil impregnated bronze raceway delivers high precision and frictionless performance
- Extended corrosion resistance - Ball and body materials are produced from low carbon steel and are zinc plated with clear dichromate treatment
- Ball is case hardened for extended wear
- Wide temperature range
- Optional PTFE liner delivers moisture resistance and self-lubricates, minimizing wear, reducing maintenance, and increasing rod end life (ball on PTFE version is electroless nickel plated)

Material:

Ball and Race –
- Low carbon steel
- Case hardened
- Zinc plated, clear dichromate treated
- Electroless nickel plated (for PTFE version)

Liner (optional) –
- PTFE, bonded to body I.D.

Temperature range: -55°F — 250°F (-54°C —121°C)

Thread: Right or left-handed versions

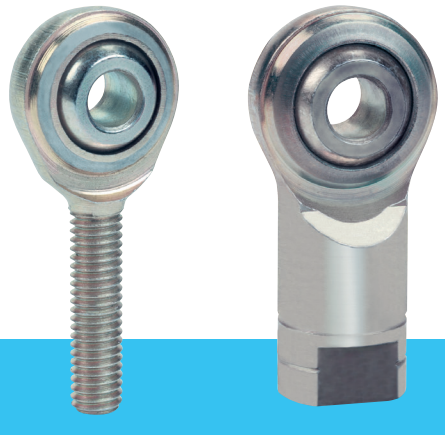
Studded: Optional

PTFE lined: Optional

Grease fittings: Optional on metal to metal series

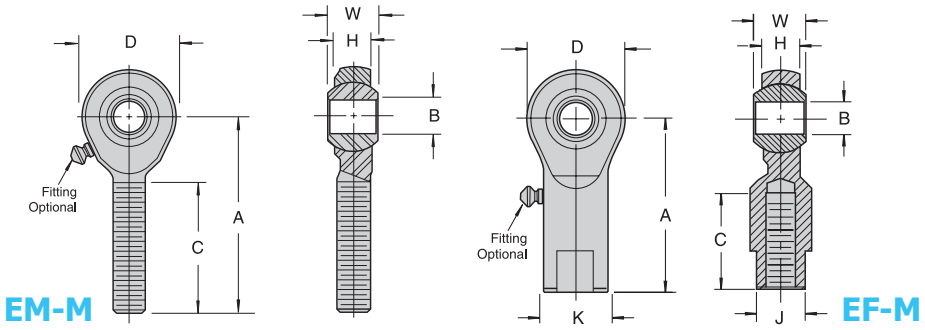
Custom assemblies can be built to specification

Meets SAE specification J1259



WARNING *- Since the manufacturer is unable to determine all applications in which a part may be placed, it is the user's responsibility to determine the suitability of the part for its intended use. This is especially true where safety is a factor. Incorrect application or installation may result in property damage, bodily injury, or death. For technical assistance, call 260-749-5105.*

EM-M/EF-M Rod Ends



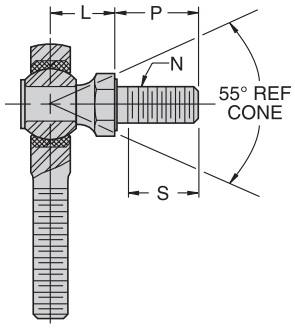
EM-M Specifications

Part Number		B +.07 -.00	W ±.13	H REF	A +1.5 -.08	D ±.13	REF	C ±1.5	6g	Ultimate Radial Static Load Capacity (Newtons)	Weight (Grams)
Right Hand	Left Hand	Ball Bore	Ball Width	Housing Width	Centerline Length	Head Dia.	Ball Dia.	Thread Length	Thread Size		
EM5M	EML5M	5.0	8	6.0	32.0	15.7	11.1	19	M5x.8	7,384	12
EM6M	EML6M	6.0	9	6.7	35.7	18.9	13.1	21	M6x1.0	10,097	19
EM8M	EML8M	8.0	12	9.0	41.7	25.1	15.8	24	M8x1.25	20,950	41
EM10M	EML10M	10.0	14	10.5	47.6	28.3	19.2	29	M10x1.5	27,489	65
EM12M	EML12M	12.0	16	12.0	55.0	33.2	22.3	32	M12x1.75	32,604	104
EM14M	EML14M	14.0	19	13.5	60.0	34.7	25.4	35	M14x2.0	37,586	136
EM16M	EML16M	16.0	21	15.0	66.7	37.9	28.5	40	M16x2.0	42,478	213

EF-M Specifications

Part Number		B +.07 -.00	W ±.13	H REF	A +1.5 -.08	D ±.13	K ±.38	J ±.38	REF	C ±1.5	6H	Ultimate Radial Static Load Capacity (Pounds)	Weight (Pounds)
Right Hand	Left Hand	Ball Bore	Ball Width	Housing Width	Centerline Length	Head Dia.	Shank Dia.	Wrench Flat Width	Ball Dia.	Thread Length	Thread Size		
EF5M	EFL5M	5.0	8	6.0	26.0	15.7	11	8.9	11.1	9.0	M5x.8	10,542	20
EF6M	EFL6M	6.0	9	6.7	29.7	18.9	13	9.9	13.1	12.0	M6x1.0	14,412	31
EF8M	EFL8M	8.0	12	9.0	35.7	25.1	16	12.4	15.8	16.0	M8x1.25	29,935	61
EF10M	EFL10M	10.0	14	10.5	42.8	28.3	19	14.9	19.2	19.5	M10x1.5	34,383	98
EF12M	EFL12M	12.0	16	12.0	49.0	33.2	22	17.4	22.3	21.0	M12x1.75	40,788	145
EF14M	EFL14M	14.0	19	13.5	57.0	34.7	25	20.0	25.4	25.4	M14x2.0	41,766	211
EF16M	EFL16M	16.0	21	15.0	64.0	37.9	27	22.0	28.5	27.0	M16x2.0	47,238	214

Chart Notes: 1. For standard lubrication fitting, add "Z" to suffix. Example: EM10MZ
2. Series is also available in a studded configuration. Specify by adding "S" to suffix. Example: EM10MS
3. PTFE fabric liner optional. Specify by adding "T" to suffix. Example: EM10MT
4. All dimensions are listed in millimeters unless otherwise noted.



Studded Dimensions

Rod End Bore Size	L REF	P ±.75	S Min. Thread Length	N Thread Size 6g
5mm	9.0	13.0	10.0	M5x.8
6mm	10.0	14.0	11.0	M6x1.0
8mm	12.0	17.5	14.0	M8x1.25
10mm	16.5	23.0	19.5	M10x1.5
12mm	19.5	28.5	24.5	M12x1.75
14mm	20.5	33.0	29.0	M14x2.0
16mm	24.0	38.0	34.0	M16x2.0

EM-T/EF-T Rod Ends

Commercial, 2-Piece, PTFE Lined

Suitable for many light to heavy duty industrial/mechanical motion transfer applications, the EM-T/EF-T Series offers our most economical 2-piece, PTFE lined design.

Common Applications: Construction equipment, lawn and garden, truck and bus

- Moisture resistant and self-lubricating, the PTFE liner minimizes wear, reduces maintenance and increases rod end life
- Extended wear resistance – Ball is case hardened and electroless nickel plated
- Operates in a wide range of temperatures
- Suited for higher axial loads where side loading strength is critical

Material:

Ball –
- Low carbon steel
- Case hardened
- Zinc plated, clear dichromate treated

Body –
- Low carbon steel
- Case hardened
- Electroless nickel plated

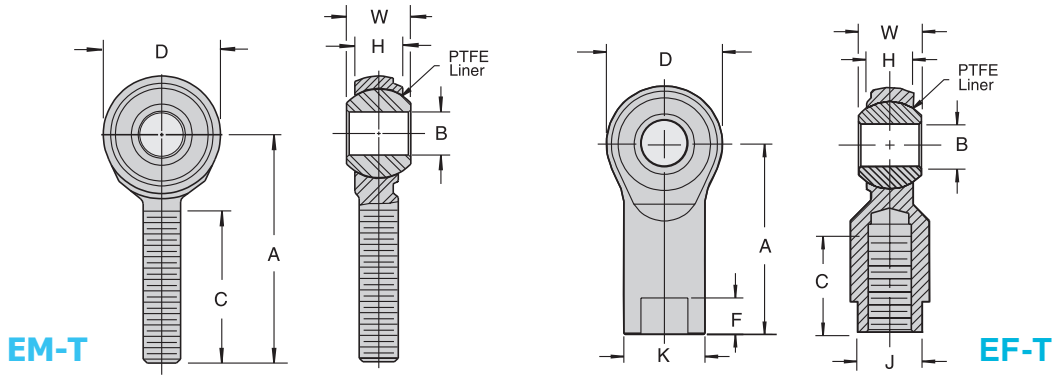
Liner –
- PTFE, bonded to body I.D.

Temperature range: -65°F – 250°F (-54°C – 121°C)
Thread: Right or left-handed versions
Studded: Optional
Custom assemblies can be built to specification
Custom alloy construction available
Meets SAE specification J1120



WARNING *- Since the manufacturer is unable to determine all applications in which a part may be placed, it is the user's responsibility to determine the suitability of the part for its intended use. This is especially true where safety is a factor. Incorrect application or installation may result in property damage, bodily injury, or death. For technical assistance, call 260-749-5105.*

EM-T/EF-T Rod Ends



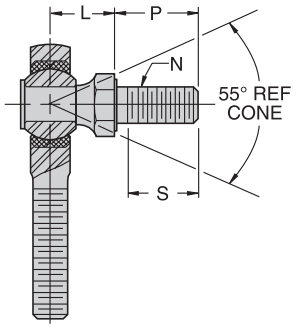
EM-T Specifications

Part Number		B +.0020 -.0000	W ±.005	H REF	A ±.015	D ±.015	REF	C ±.060	UNF-2A	Ultimate Radial Static Load Capacity (Pounds)	Weight (Pounds)
Right Hand	Left Hand	Ball Bore	Ball Width	Housing Width	Centerline Length	Head Dia.	Ball Dia.	Thread Length	Thread Size		
EM4T	EML4T	.2500	.375	.281	1.562	.750	.516	1.000	1/4-28	2,400	.042
EM5T	EML5T	.3125	.437	.344	1.875	.875	.625	1.250	5/16-24	3,100	.071
EM6T	EML6T	.3750	.500	.406	1.937	1.000	.719	1.250	3/8-24	3,800	.108
EM8T	EML8T	.5000	.625	.500	2.437	1.312	.938	1.500	1/2-20	7,900	.237
EM10T	EML10T	.6250	.750	.562	2.625	1.500	1.125	1.625	5/8-18	8,300	.365

EF-T Specifications

Part Number		B +.0020 -.0000	W ±.005	H REF	A ±.015	D ±.015	K ±.015	J ±.015	F ±.030	REF	C ±.060	UNF-2B	Ultimate Radial Static Load Capacity (Pounds)	Weight (Pounds)
Right Hand	Left Hand	Ball Bore	Ball Width	Housing Width	Centerline Length	Head Dia.	Shank Dia.	Wrench Flat Width	Wrench Flat Length	Ball Dia.	Thread Length	Thread Size		
EF4T	EFL4T	.2500	.375	.281	1.312	.750	.469	.375	.250	.516	.687	1/4-28	2,700	.059
EF5T	EFL5T	.3125	.437	.344	1.375	.875	.500	.437	.281	.625	.687	5/16-24	3,900	.079
EF6T	EFL6T	.3750	.500	.406	1.625	1.000	.687	.562	.312	.719	.812	3/8-24	4,600	.151
EF8T	EFL8T	.5000	.625	.500	2.125	1.312	.875	.750	.375	.938	1.187	1/2-20	8,500	.320
EF10T	EFL10T	.6250	.750	.562	2.500	1.500	1.000	.875	.500	1.125	1.406	5/8-18	8,900	.465

Chart Notes: 1. This series is also available in a studded configuration. Specify by adding "S" to suffix. Example: EM10TS



Studded Dimensions

Rod End Bore Size	L REF	P ±.030	S Min. Thread Length	N Thread Size UNF-2A
1/4"	.469	.563	.500	1/4-28
5/16"	.531	.688	.594	5/16-24
3/8"	.625	.875	.781	3/8-24
1/2"	.875	1.125	1.000	1/2-20
5/8"	1.000	1.125	1.000	5/8-18

MJ-M/FJ-M Rod Ends

Molded Race, Self-Lubricating, Metric

The MJ-M/FJ-M Series is suitable for many light and heavy/medium duty industrial mechanical motion transfer applications requiring metric thread sizing. This series has an injection molded, reinforced nylon raceway design that delivers self-lubricating, low friction, and moisture-resistant performance.

Common Applications: Construction equipment, recreational vehicles, truck/off highway.

- Nickel plated and case hardened ball for corrosion resistance and extended wear
- Suited for applications requiring low friction, low moisture absorption, high wear resistance and/or wide operating temperature ranges.
- Design allows for control of breakaway torque, adding to its application versatility

Material:

Ball –
- Low carbon steel
- Electroless Nickel plated

Body –
- Low carbon steel
- Zinc plated, clear dichromate treated

Race –
- Molded, self-lubricating reinforced nylon

Temperature range: -30°F – 220°F (-34°C – 104°C)

Thread: Right or left-handed versions

Studded: Optional

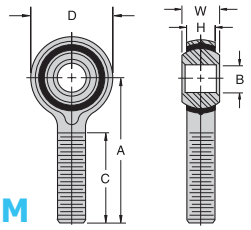
Custom assemblies can be built to specification

Custom alloy construction available

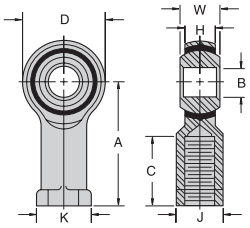


WARNING *- Since the manufacturer is unable to determine all applications in which a part may be placed, it is the user's responsibility to determine the suitability of the part for its intended use. This is especially true where safety is a factor. Incorrect application or installation may result in property damage, bodily injury, or death. For technical assistance, call 260-749-5105.*

MJ-M/FJ-M Rod Ends



MJ-M



FJ-M

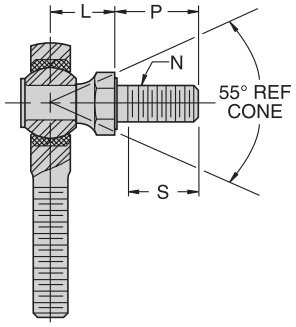
MJ-M Specifications

Part Number		B +.063 -.013	W ±.13	H REF	A ±.25	C MIN.	D ±.13	6g	Ultimate Radial Static Load Capacity (Newtons)	Ball Dia. Ref.	Weight (Grams)
Right Hand	Left Hand	Ball Bore	Ball Width	Body Width	Centerline Length	Thread Length	Head Dia.	Thread Size			
MJ03MST	MLJ03MST	3	6	4.50	27	15	12	M3x0.5	3,038	9.0	10
MJ05MST	MLJ05MST	5	8	6.00	33	20	16	M5x0.8	5,338	11.1	15
MJ06MST	MLJ06MST	6	9	6.75	36	22	18	M6x1.0	7,722	13.1	20
MJ08MST	MLJ08MST	8	12	9.00	42	25	22	M8x1.25	12,775	15.8	35
MJ10MST	MLJ10MST	10	14	10.50	48	29	26	M10x1.5	16,960	19.2	50
MJ12MST	MLJ12MST	12	16	12.00	54	33	30	M12x1.75	22,898	22.3	65
MJ14MST	MLJ14MST	14	19	13.50	60	36	34	M14x2.0	28,948	25.4	100
MJ16MST	MLJ16MST	16	21	15.00	66	40	38	M16x2.0	37,127	28.5	179
MJ18MCST	MLJ18MCST	18	23	16.50	72	43	46	M18x1.5	45,730	31.7	209
MJ20MCST	MLJ20MCST	20	25	18.00	78	46	50	M20x1.5	55,235	34.9	289
MJ22MCST	MLJ22MCST	22	28	20.00	84	50	56	M22x1.5	66,289	38.1	323

FJ-M Specifications

Part Number		B +.063 -.013	W ±.13	H REF	A ±.25	C MIN.	D ±.13	K ±.2	J +0 -.2	6H	Ultimate Radial Static Load Capacity (Newtons)	Ball Dia. Ref.	Weight (Grams)
Right Hand	Left Hand	Ball Bore	Ball Width	Body Width	Centerline Length	Thread Length	Head Dia.	W. F. Dia.	W. F. Width	Thread Size			
FJ03MST	FLJ03MST	3	6	4.50	21	10	12	8	6.50	M3x0.5	3,038	9.0	14
FJ05MST	FLJ05MST	5	8	6.00	27	14	16	11	9.00	M5x0.8	5,338	11.1	20
FJ06MST	FLJ06MST	6	9	6.75	30	14	18	13	11.00	M6x1.0	7,722	13.1	30
FJ08MST	FLJ08MST	8	12	9.00	36	17	22	16	14.00	M8x1.25	12,775	15.8	39
FJ10MST	FLJ10MST	10	14	10.50	43	21	26	19	17.00	M10x1.5	16,960	19.2	75
FJ10MCST	FLJ10MCST	10	14	10.50	43	21	26	19	17.00	M10x1.25	16,960	19.2	75
FJ12MST	FLJ12MST	12	16	12.00	50	24	30	22	19.00	M12x1.75	22,898	22.3	124
FJ12MCST	FLJ12MCST	12	16	12.00	50	24	30	22	19.00	M12x1.5	22,898	22.3	124
FJ14MST	FLJ14MST	14	19	13.50	57	37	34	25	22.00	M14x2.0	28,948	25.4	174
FJ16MST	FLJ16MST	16	21	15.00	64	33	38	27	22.00	M16x2.0	37,127	28.5	229
FJ16MCST	FLJ17MCST	16	21	15.00	64	33	38	27	22.00	M16x1.5	37,127	28.5	229
FJ18MST	FLJ18MST	18	23	16.50	71	35	46	31	27.00	M18x1.5	45,730	31.7	309
FJ20MST	FLJ20MST	20	25	18.00	77	32	50	34	32.00	M20x1.5	55,235	34.9	358
FJ22MST	FLJ22MST	22	28	20.00	84	36	56	37	32.00	M22x1.5	66,289	38.1	423

Chart Notes: 1. This series is also available in a studded configuration. Specify by adding "S" to suffix. Example: FJ20MSTS
2. All dimensions are listed in millimeters unless otherwise noted.



Studded Dimensions

Rod End Bore Size	L REF	P ±.75	S Min. Thread Length	N Thread Size 6g
5mm	9.0	13.0	10.0	M5x.8
6mm	10.0	14.0	11.0	M6x1.0
8mm	12.0	17.5	14.0	M8x1.25
10mm	16.5	23.0	19.5	M10x1.5
12mm	19.5	28.5	24.5	M12x1.75
14mm	20.5	33.0	29.0	M14x2.0
16mm	24.0	38.0	34.0	M16x2.0

SPM/SPF Rod Ends

Molded Race, Self-Lubricating

Our most popular series, SPM/SPF rod ends are suitable for many light and heavy/medium duty industrial mechanical motion transfer applications. They are well suited for applications requiring low friction, low moisture absorption, high wear resistance and/or wide operating temperature ranges.

Common Applications: Construction equipment, recreational vehicles, and truck/off highway.

- Injection molded, reinforced nylon raceway design delivers self-lubricating, low friction, and moisture-resistant performance
- Extended corrosion resistance - Ball and body materials are produced from an economical low carbon steel and are zinc plated with clear dichromate treatment (ball is case hardened for extended wear)
- Design allows for control of breakaway torque, adding to its application versatility

Material:

Ball –
- Low carbon steel
- Zinc plated, clear dichromate treated

Body –
- Low carbon steel
- Zinc plated, clear dichromate treated
- Molded self-lubricating reinforced nylon

Temperature range: -30°F – 220°F (-34°C – 104°C)

Thread: Right or left-handed versions

Studded: Optional

Custom assemblies can be built to specification

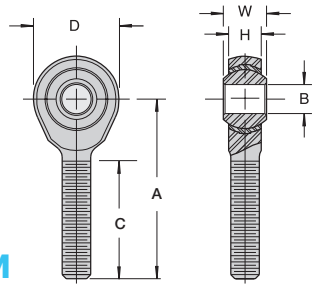
Custom alloy construction available

Meets SAE specification J1120

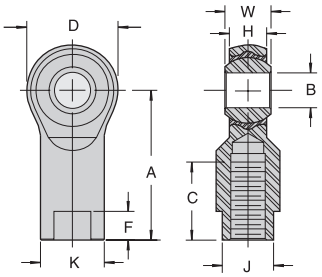


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SPM/SPF Rod Ends



SPM



SPF

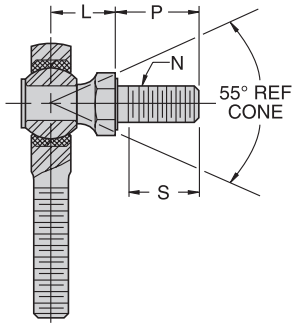
SPM Specifications

Part Number		B +.0020 -.0000	W ±.005	H REF	A ±.015	D ±.015	REF	C ±.060	UNF-2A	Ultimate Radial Static Load Capacity (Pounds)	Weight (Pounds)
Right Hand	Left Hand	Ball Bore	Ball Width	Housing Width	Centerline Length	Head Dia.	Ball Dia.	Thread Length	Thread Size		
SPM3	SPML3	.1900	.312	.250	1.250	.625	.438	.750	10-32	1,210	.023
SPM4	SPML4	.2500	.375	.281	1.562	.750	.516	1.000	1/4-28	2,470	.040
SPM5	SPML5	.3125	.437	.344	1.875	.875	.625	1.250	5/16-24	2,740	.071
SPM6	SPML6	.3750	.500	.406	1.937	1.000	.719	1.250	3/8-24	4,210	.107
SPM7	SPML7	.4375	.562	.437	2.125	1.125	.812	1.312	7/16-20	5,350	.148
SPM8	SPML8	.5000	.625	.500	2.437	1.312	.938	1.500	1/2-20	6,430	.232
SPM10	SPML10	.6250	.750	.562	2.625	1.500	1.125	1.625	5/8-18	8,300	.364
SPM12	SPML12	.7500	.875	.687	2.875	1.750	1.312	1.750	3/4-16	10,900	.568

SPF Specifications

Part Number		B +.0020 -.0000	W ±.005	H REF	A ±.015	D ±.015	K ±.015	J ±.015	F ±.030	REF	C ±.060	UNF-2B	Ultimate Radial Static Load Capacity (Pounds)	Weight (Pounds)
Right Hand	Left Hand	Ball Bore	Ball Width	Housing Width	Centerline Length	Head Dia.	Shank Dia.	Wrench Flat Width	Wrench Flat Length	Ball Dia.	Thread Length	Thread Size		
SPF3	SPFL3	.1900	.312	.250	1.062	.625	.406	.312	.406	.438	.562	10-32	1,210	.036
SPF4	SPFL4	.2500	.375	.281	1.312	.750	.469	.375	.281	.516	.750	1/4-28	2,470	.059
SPF5	SPFL5	.3125	.437	.344	1.375	.875	.500	.437	.281	.625	.750	5/16-24	2,740	.077
SPF6	SPFL6	.3750	.500	.406	1.625	1.000	.687	.562	.312	.719	.937	3/8-24	4,100	.146
SPF7	SPFL7	.4375	.562	.437	1.812	1.125	.750	.625	.625	.812	1.031	7/16-20	5,350	.192
SPF8	SPFL8	.5000	.625	.500	2.125	1.312	.875	.750	.375	.938	1.187	1/2-20	6,430	.313
SPF10	SPFL10	.6250	.750	.562	2.500	1.500	1.000	.875	.500	1.125	1.500	5/8-18	8,300	.464
SPF12	SPFL12	.7500	.875	.687	2.875	1.750	1.125	1.000	1.000	1.312	1.562	3/4-16	10,900	.672

Chart Notes: This series is also available in a studded configuration. Specify by adding "S" to suffix. Example: SPF8S



Studded Dimensions

Rod End Bore Size	L REF	P ±.030	S Min. Thread Length	N Thread Size UNF-2A
3/16"	.437	.438	.375	10-32
1/4"	.469	.563	.500	1/4-28
5/16"	.531	.688	.594	5/16-24
3/8"	.625	.875	.781	3/8-24
7/16"	.844	1.062	.937	7/16-20
1/2"	.875	1.125	1.000	1/2-20
5/8"	1.000	1.125	1.000	5/8-18
3/4"	1.187	1.812	1.625	3/4-16

SSPM/SSPF Rod Ends

Stainless Steel, Molded Race, Self-Lubricating

This stainless steel version of our most popular rod end series is suitable for most industrial mechanical motion transfer applications.

Common Applications: Marine, construction equipment, recreational vehicles, truck/off highway

- Injection molded, reinforced nylon raceway design delivers self-lubricating, low friction, and moisture-resistant performance
- Ball, body and stud materials are produced from stainless steel for extended corrosion resistance.
- Suited for applications requiring corrosion resistance, low friction, low moisture absorption, high wear resistance and/or wide operating temperature ranges.
- Design allows for control of breakaway torque, adding to its application versatility

Material:

Ball –
- Stainless steel

Body –
- Stainless steel

Race –
- Molded self-lubricating reinforced nylon stud (optional)

Temperature range: -30°F – 220°F (-34°C – 104°C)

Thread: Right or left-handed versions

Studded: Optional

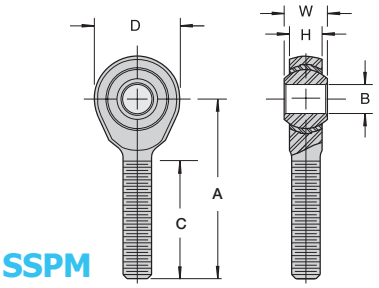
Custom assemblies can be built to specification

Meets SAE specification J1120

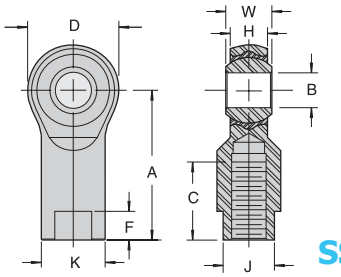


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SSPM/SSPF Rod Ends



SSPM



SSPF

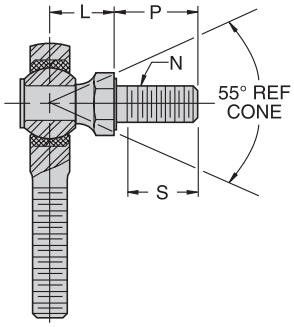
SSPM Specifications

Part Number		B +.0020 -.0000	W ±.005	H REF	A ±.015	D ±.015	REF	C ±.060	UNF-2A	Ultimate Radial Static Load Capacity (Pounds)	Weight (Pounds)
Right Hand	Left Hand	Ball Bore	Ball Width	Housing Width	Centerline Length	Head Dia.	Ball Dia.	Thread Length	Thread Size		
SSPM3	SSPML3	.1900	.312	.250	1.250	.625	.438	.750	10-32	1,210	.023
SSPM4	SSPML4	.2500	.375	.281	1.562	.750	.516	1.000	1/4-28	2,470	.040
SSPM5	SSPML5	.3125	.437	.344	1.875	.875	.625	1.250	5/16-24	2,740	.071
SSPM6	SSPML6	.3750	.500	.406	1.937	1.000	.719	1.250	3/8-24	4,210	.107
SSPM7	SSPML7	.4375	.562	.437	2.125	1.125	.812	1.312	7/16-20	5,350	.148
SSPM8	SSPML8	.5000	.625	.500	2.437	1.312	.938	1.500	1/2-20	6,430	.232
SSPM10	SSPML10	.6250	.750	.562	2.625	1.500	1.125	1.625	5/8-18	8,300	.364
SSPM12	SSPML12	.7500	.875	.687	2.875	1.750	1.312	1.750	3/4-16	10,900	.568

SSPF Specifications

Part Number		B +.0020 -.0000	W ±.005	H REF	A ±.015	D ±.015	K ±.015	J ±.015	F ±.030	REF	C ±.060	UNF-2B	Ultimate Radial Static Load Capacity (Pounds)	Weight (Pounds)
Right Hand	Left Hand	Ball Bore	Ball Width	Housing Width	Centerline Length	Head Dia.	Shank Dia.	Wrench Flat Width	Wrench Flat Length	Ball Dia.	Thread Length	Thread Size		
SSPF3	SSPFL3	.1900	.312	.250	1.062	.625	.406	.312	.406	.438	.562	10-32	1,210	.036
SSPF4	SSPFL4	.2500	.375	.281	1.312	.750	.469	.375	.281	.516	.750	1/4-28	2,470	.059
SSPF5	SSPFL5	.3125	.437	.344	1.375	.875	.500	.437	.281	.625	.750	5/16-24	2,740	.077
SSPF6	SSPFL6	.3750	.500	.406	1.625	1.000	.687	.562	.312	.719	.937	3/8-24	4,100	.146
SSPF7	SSPFL7	.4375	.562	.437	1.812	1.125	.750	.625	.625	.812	1.031	7/16-20	5,350	.192
SSPF8	SSPFL8	.5000	.625	.500	2.125	1.312	.875	.750	.375	.938	1.187	1/2-20	6,430	.313
SSPF10	SSPFL10	.6250	.750	.562	2.500	1.500	1.000	.875	.500	1.125	1.500	5/8-18	8,300	.464
SSPF12	SSPFL12	.7500	.875	.687	2.875	1.750	1.125	1.000	1.000	1.312	1.562	3/4-16	10,900	.672

Chart Notes: This series is also available in a studded configuration. Specify by adding "S" to suffix. Example: SPF8S



Studded Dimensions

Rod End Bore Size	L REF	P ±.030	S Min. Thread Length	N Thread Size UNF-2A
3/16"	.437	.438	.375	10-32
1/4"	.469	.563	.500	1/4-28
5/16"	.531	.688	.594	5/16-24
3/8"	.625	.875	.781	3/8-24
7/16"	.844	1.062	.937	7/16-20
1/2"	.875	1.125	1.000	1/2-20
5/8"	1.000	1.125	1.000	5/8-18
3/4"	1.187	1.812	1.625	3/4-16

Cablecraft® Motion Controls

Spherical Bearings

We offer a complete line of spherical bearings for use in racing, industrial and construction equipment, lawn & garden, agricultural equipment, and more.



COM-P Spherical Bearings



J/JM Spherical Bearings

Specifications

Part	Construction	Materials			Options	Available Sizes
		Housing	Ball	Race		
COM-P	Molded Race	LC Steel	Med Carbon	Reinforced Nylon	Studded	.0019, .2500, .3125, .3750, .4375, .5000, .6250, .7500
J/JM	Molded Race	LC Steel	Low Carbon	Reinforced Nylon	n/a	.0019, .2500, .3125, .3750, .4375, .5000, .6250, M3, M5, M6, M8, M10, M12, M14

Performance Comparison

Part	Economy	Radial Load Capability	Operating Temperature	Corrosion Resistance	Vibration Resistance	Wear Resistance	Lubrication	Break-away Torque	Ball Clearance (Play)
COM-P	→	↑	→	↑	↑	↑	↑	→	↑
J/JM	↑	→	→	→	↑	↑	↑	→	↑

WARNING *- Since the manufacturer is unable to determine all applications in which a part may be placed, it is the user's responsibility to determine the suitability of the part for its intended use. This is especially true where safety is a factor. Incorrect application or installation may result in property damage, bodily injury, or death. For technical assistance, call 260-749-5105.*

COM-P Spherical Bearings

Molded Race, Self-Lubricating, Loader Slot Design

The COM-P Series is our basic precision molded race and metal reinforced offering. This economical version is suitable for a wide variety of OEM and MRO applications requiring press fit or snap ring retained bearing applications.

Common Applications: Industrial equipment, construction equipment, racing, lawn and garden, agriculture

- Enhanced strength - Combines the popular fit and feel of our molded race rod ends with the strength of the loader slot design
- Plated on all surfaces for extra corrosion resistance and requires no machining after assembly
- Stronger radial and axial load capacity than standard molded race products
- Plastic molded raceway delivers self-lubricating low friction and moisture-resistant performance
- Excellent wear resistance
- Design allows for control of breakaway torque, adding to its application versatility

Material:

Ball –
- 52100 Steel
- Rc 56 Min.
- Hard chrome plated

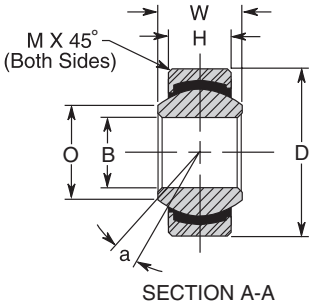
Body –
- Low carbon steel
- Zinc plated, clear dichromate treated
- Body O.D. is ground after plating

Race –
- Molded self-lubricating reinforced nylon

Stud (optional) –
- Stainless steel

Temperature range: -30°F – 220°F (-34°C – 104°C)
Meets SAE specification J1120





COM-P Specifications									
Part Number	B +.0015 -.0005	*D +.0000 -.0002	H ±.005	W ±.005	O REF	M REF	REF	a° REF	Approx. Weight (Pounds)
	Ball Bore	Outside Dia.	Race Width	Ball Width	Ball Flat Dia.	O. D. Chamber	Ball Dia.	Misalign Angle	
COM3P	.2500	.5625	.218	.281	.293	.015	.406	11.3	.011
COM4P	.3125	.6562	.250	.343	.364	.022	.500	13.3	.018
COM5P	.3750	.7500	.281	.375	.419	.032	.562	11.8	.026
COM6P	.5000	.8125	.312	.406	.515	.032	.656	9.8	.033
COM7P	.6250	.9062	.343	.437	.530	.032	.687	9.6	.042
COM8P	.5000	1.0000	.390	.500	.600	.032	.781	9.8	.058
COM10P	.6250	1.1875	.500	.625	.739	.032	.968	9.1	.102
COM12P	.5000	1.4375	.593	.750	.920	.044	1.187	9.2	.186

** Consult Cablecraft Motion Controls sales for full plated body options. Bearing OD tolerance on plated versions (+.001/-.003)*

Cablecraft® Motion Controls

J/JM Spherical Bearings

Metric/Inch, Molded Race, Self-Lubricating

The J/JM Series is made of low carbon steel with an injection molded race design that delivers self-lubricating characteristics, as well as moisture-resistance properties, adding to its overall versatility, lower maintenance, and increased life.

Common Applications: Industrial equipment, construction equipment, lawn and garden, and agricultural.

- Black oxide race coating provides added corrosion protection
- Low carbon steel ball is case hardened and nickel plated
- Suited to numerous non-rotational applications – for mounting into plates or shocks where room for attaching full rod ends is not available

Material:

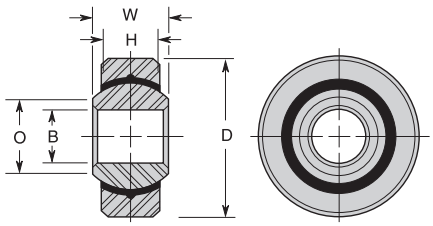
Ball –
- Low carbon steel
- Case hardened
- Nickel plated

Race –
- Low carbon steel
- Black oxide coating

Liner –
- Self-lubricating thermoplastic

Temperature range: -30°F – 220°F (-34°C – 104°C)
Available in inch and metric sizes





J Specifications

Part Number	B +.00205 -.0005 Ball Bore	D +.0000 -.0005 Outside Dia.	H +.0000 -.005 Race Width	W ±.005 Ball Width	O REF Ball Flat Dia.	Ultimate Radial Static Load Capacity (Pounds)
J03ST	.1900	.5625	.218	.281	.293	1,102
J04ST	.2500	.6562	.250	.343	.364	1,607
J05ST	.3125	.7500	.281	.375	.419	2,700
J06ST	.3750	.8125	.343	.406	.475	2,943
J07ST	.4375	.9062	.312	.437	.530	3,619
J08ST	.5000	1.0000	.390	.500	.600	4,328
J10ST	.6250	1.1875	.500	.625	.739	6,800

JM Specifications

Part Number	B +.063 -.013 Ball Bore	D +.000 -.013 Outside Dia.	H +.000 -.100 Race Width	W ±.013 Ball Width	O REF Ball Flat Dia.	Ultimate Radial Static Load Capacity (Newtons)
J03MST	3	12	4.50	6	5.20	3,040
J05MST	5	16	6.00	8	7.50	5,340
J06MST	6	18	6.75	9	9.30	7,720
J08MST	8	22	9.00	12	10.40	12,775
J10MST	10	26	10.50	14	12.90	16,960
J12MST	12	30	12.00	16	15.40	22,900
J14MST	14	34	13.50	19	16.80	28,950
J16MST	16	38	15.00	21	19.30	37,130

Swivels

DC/DH Control Swivels

Our DC/DH Control Swivels were developed specifically for control applications where infinite adjustment is desired along the length of a connecting rod. They are intended for low load applications and offer in-line misalignments that are suited primarily for push applications.

Common Applications: HVAC, linear controls, light industrial applications

- Buna N rubber disc provides smooth and vibration-free operation
- Can be used with either 1/4" or 5/16" diameter control rods
- Special set screws (self-locking and surface hardened for wear resistance) provide increased holding strength

Material:

Ball Joint Head and Base –
- Low carbon steel
- Zinc plated, clear chromate treated
- Buna N rubber disc

Self-locking screw –
- Low carbon steel, heat treated
- Zinc placed, clear chromate treated

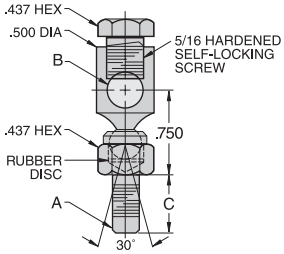
Temperature range: -60°F – 250°F (-51°C – 121°C)

Integral nut and lock washer – Optional

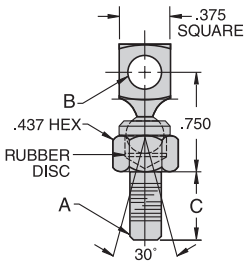
Custom assemblies can be built to specification



Type DC



Type DH



DC/DH Specifications

Part Number		B +.005 -.002	C ±.015	A	Weight Less Integral Nut & Washer (Pounds)	Weight With Integral Nut & Washer (Pounds)
Less Integral Nut & Washer	With Integral Nut & Washer	Ball Dia.	Shank	Thread Size & Length		
DC1005F	DC1005FN	.328	.312	10-32 x .250	.047	.050
DC1207F	DC1207FN	.328	.437	1/4-28 x .328	.050	.057
DC1209F	DC1209FN	.328	.562	1/4-28 x .500	.052	.058
DC1207C	DC1207CN	.328	.437	1/4-20 x .328	.049	.056
DC1209C	DC1209CN	.328	.562	1/4-20 x .453	.051	.057
DC1310F	DC1310FN	.328	.625	5/16-24 x .516	.056	.067
DC1312F	DC1312FN	.328	.750	5/16-24 x .641	.059	.070
DH1209F-2		.257	.562	1/4-28 x .500	.035	

Chart Notes: 1. Swivels can be used with either 1/4" or 5/16" diameter control rods
2. DH Swivel Joint is available with an integral nut and lock washer to ease assembly. Specify by adding "N" to suffix. Example: DC1005FN

Linkage Assemblies

Custom Rod Assemblies

We offer a wide variety of finished assemblies manufactured to specifications and requirements, and supplied as one unit instead of separate linkage components. These assemblies include shift and clutch linkages, throttle and accelerator controls, stabilizing bars, actuators, steering and suspension systems, and more.

Common Applications: Lawn and garden, trucks, buses, construction, agriculture

- Metric and inch sizes
- Solid or tube
- Straight or bent
- Include a rod or tubing in adjustable or fixed lengths
- Wide variety of end fittings such as rod ends, ball joints or clevis
- Self-lubricating thermoplastic

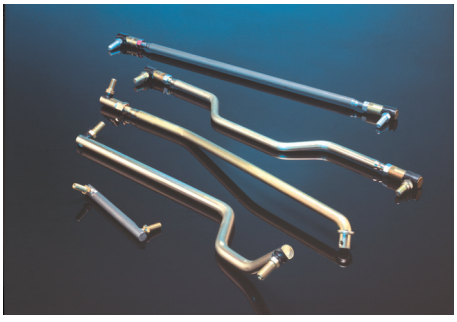




Construction/ Ag Equipment – Throttle control, steering control, bucket control, boom control, shift linkage, and header lift control



Truck and Bus – Clutch linkage, throttle control, radiator supports, accelerator controls, load leveling systems, hood linkage, cargo door support, and door opening mechanisms



Lawn and Garden – Drag links, tie rods, shift linkage, and mower deck height adjustment



Other – Door opening mechanisms, rotary vane controls, stabilizing bars, actuators, steering systems, and suspension systems

WARNING *- Since the manufacturer is unable to determine all applications in which a part may be placed, it is the user's responsibility to determine the suitability of the part for its intended use. This is especially true where safety is a factor. Incorrect application or installation may result in property damage, bodily injury, or death. For technical assistance, call 260-749-5105.*

Controls & Accessories

We offer a wide range of control heads, hardware, and end fittings to create the best motion control solutions for your applications.



Micro Adjust Control Heads



Non Lock Control Heads



Twist Lock Control Heads



Vent Control Industrial

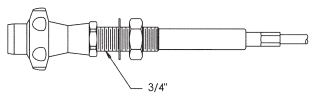
Specifications

Part	Motion	Materials			Specifications						
		Tube	Internal	Rod	Friction Lock	Disconnect	Positive Lock	Threaded Mount	Max Load	Travel	Typical Cable Construction
Micro Adjust	Push/Pull, Twist	Plastic	Plated CS	304 SS	Opt	Opt	Opt	Std	20 lb	3.00″	VLD, LD
Non Lock	Push/Pull	Aluminum	Plated CS	303 SS				Std	50 lb	3.00″	VLD, LD
Twist Lock	Push/Pull	Aluminum	Plated CS	303 SS			Std	Std	100 lb	3.00″	VLD, LD

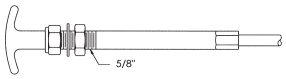
Control Heads Commercial & PTO Cables

Factory assembled, trim-to-length, with stainless steel solid wire innermember.
Up to 3" travel, 5" minimum bend radius and 20 lb. pull load rating.

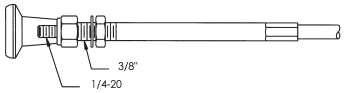
Micro Adjust
Part No. 29V00-L (without Friction Lock)
Part No. 29V000F-L (with Friction Lock)



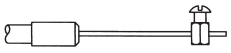
Twist Lock
Part No. 59V00-L



Non Lock (shown with 306 knob)
Part No. 79V00-L



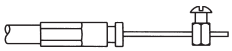
Twist-On Conduit Ends
(Standard for Control Heads on left)
Part No. 161-775 (3/8" Dia.)



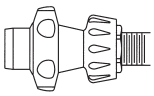
Optional for Control Heads on left
3/8-24 UNF, Part No. 161-581



Optional for Control Heads on left
3/8" Dia., Part No. 161-579

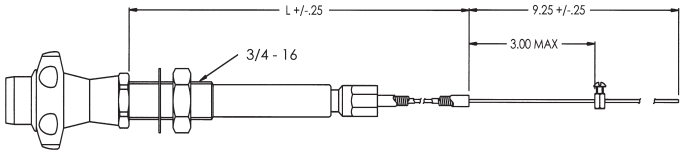


Friction Lock Kit
Part No. 165-510-215



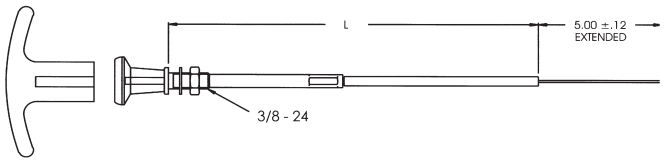
For part number 29V00. Includes adjustment ring and compression washer.

Truck Throttle Control
Part No. 286-009-L ("L" = Length)



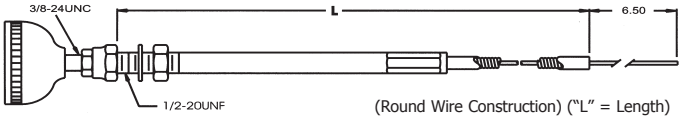
This control allows for precise setting of the engine RPM when the PTO is engaged or as a manual control of the idle position during engine warm up (Friction Lock optional).

Non-Locking, Non-Rotating Control Head
Part No. 165-437-L Black Knob ("L" = Length),
Part No. 165-438-L Black T-Handle ("L" = Length)



Spiral wound flat wire conduit 054" solid stainless innermember

Standard Replacement PTO Control Cable
Part No. 872-507-L



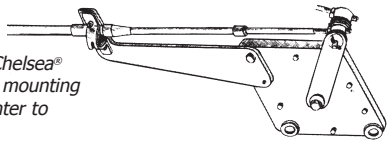
(Round Wire Construction) ("L" = Length)

The quality replacement cable for power take-off control that equals or surpasses original equipment standards. Adaptable to mounting brackets of Muncie®, Chelsea® and similar cable-actuated PTOs.

PTO Cable Attachment Kit
(For use with non lock control head)

Cable and handle sold separately.

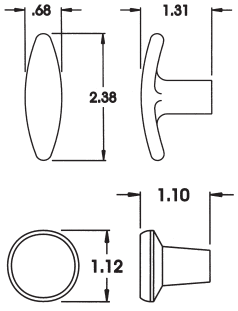
Attach your custom-built cable to Chelsea® or similar PTO units with the same mounting pattern that have a 3 inch hole-center to hole-center lever arm.



Attachment Kit	Cable Size	Cable P/N	Handle Stem	PTO Knob
175-600-004	VLD	86V33-3-Length	1/4-28	165-183-001
175-600-005	LD	96L33-3-Length	5/16-18	165-183-003

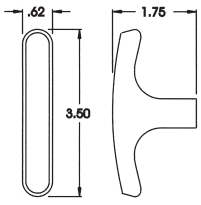
Optional Knobs for Non Lock Control Heads

Part numbers shown below are of reinforced black nylon. Specify knob in part number for all non-locking controls (included in price).



Inscription	Part Number Thread Size 1/4-20	1/4-28	5/16-18
None	005	014	013
STOP	015	016	
SHUTOFF	002	008	018
THROTTLE	019	020	
Inscription	**1/4-20**	**1/4-28**	
None	306	308	
STOP	317	314	
SHUTOFF	318		
THROTTLE		321	
CHOKE	309		
OPEN		324	
CLOSE		326	

Cast aluminum oversize T-handle (not included in price).

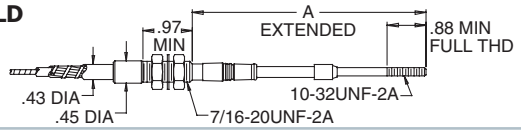
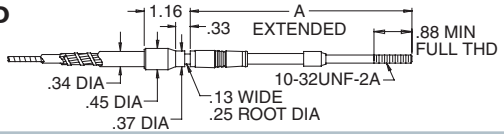
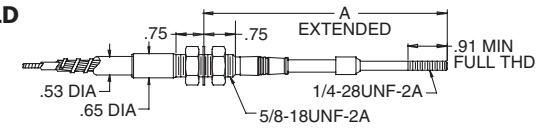
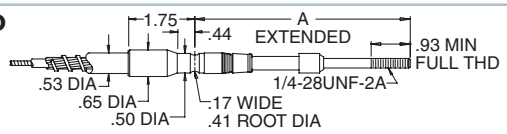
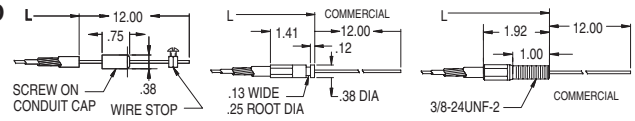


Inscription	Part Number Thread Size 1/4-20	1/4-28	5/16-18
None	201	202	203

Not Shown: Same handle for Twist Lock
Control Head Handle 300-057-008
Set Screw 175-405-144

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Control Head Matrix

		Extended Dimensions	Non Lock VLD	Non Lock LD	Twist Lock	Micro Adjust	
VLD		"A" 1″ 4.94″ 2″ 6.94″ 3″ 8.94″	81V32 81V42 86V32 86V42		51V32 51V42 56V32 56V42	21V32DF 21V42DF 26V32DF 26V42DF	EXT UTL
VLD		"A" 1″ 4.25″ 2″ 6.25″ 3″ 8.25″	81V33 81V43 86V33 86V43		51V33 51V43 56V33 56V43	21V33DF 21V43DF 26V33DF 26V43DF	EXT UTL
LD		"A" 1″ 5.18″ 2″ 7.18″ 3″ 9.18″		91L32 91L42 96L32 96L42	51L32 51L42 56L32 56L42	21L32DF 21L42DF 26L32DF 26L42DF	EXT UTL
LD		"A" 1″ 4.56″ 2″ 6.56″ 3″ 8.56″		91L33 91L43 96L33 96L43	51L33 51L43 56L33 56L43	21L33DF 21L43DF 26L33DF 26L43DF	UTL UTL
VLD **LD**			79V00 79V04 79V05		59V00 59V04 59V05	29V00 29V04 29V05	BRIS

Cablecraft® Ordering Codes

2 - 1 - L - 3 - 2 - DF - (6) - 3 - 120

Control Head Type
2 = Micro Adjust
5 = Twist Lock with 2.38″ Plastic Handle
6 = Twist Lock with 3.5″ Metal Handle
7 = Non Lock with 3/8″-24 UNF Mounting
8 = Non Lock with 7/16″-20 UNF Mounting
9 = Non Lock with 5/8″-18 UNF Mounting

Cable Type
1 = Low Friction-EXT **3** = Low Friction **6** = Utility **9** = Bristow

Cable Size
V = Very Light Duty **L** = Light Duty

Stainless Steel Options
0 = Carbon Steel Fittings
3 = with Stainless Steel End Rod
4 = with Stainless Steel End Rod, Support Tube and Innermember Armor

Output End Fittings
0 = See Illustration **2** = Threaded Swivel **3** = Grooved Swivel

Cable Options
D = Disconnect Feature **F** = Friction Lock Accessory

Seal Options (Use this number only if requesting optional seals)
5 = Improved Model 5 Wiper Seal is Standard on Low Friction-EXT & Utility
6 = Model 6 Wiper Seal, Optional on All Controls

Cable Travel 1″ - 3″ (For output fittings style 2 & 3 only)

Overall Length (See overall length dimension points indicated on each illustration)

Knob Option

Micro Adjust Control Heads

Push-Pull Control Head

Micro Adjust control heads are ideal for remote operation of a throttle, regulating valve, or other applications needing precise adjustment capabilities.

Common Applications: Throttle control, regulating valve

- Depressing the center button allows pushing or pulling the knob to make course travel adjustments
- Flexible dust seal protects internal release mechanism
- Rotating the knob clockwise extends the output in the finite mode, and counter-clockwise retracts
- Four and one-half turns results in 1" of linear travel
- Normal vibration does not affect the micro adjust setting

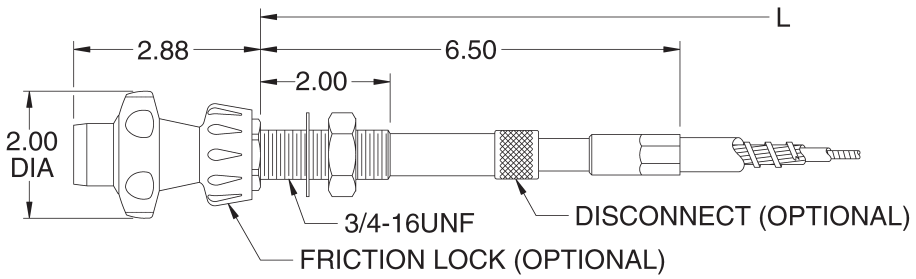
Optional:

- Friction lock accessory for applications where vibration is excessive
- Disconnect feature and various output end configurations to suit a particular application

Technical:

- Load: 20 lb. maximum
- Travel: 3" maximum
- Threaded mount
- Friction lock
- Disconnect





All line art dimensions are represented in inches

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Non-Lock Control Heads

Push-Pull Control Head

These panel or bracket mounted units are intended for light to moderate loads. They are cost effective solutions to mechanically connecting a manual input source to a remote output.

Common Applications: Engine shut down, engine choke, latch operation, valve operation

- Especially effective when space is limited or rod linkage and bell cranks are not suitable choices
- Various T-handles/knobs with or without functional identifications, as well as output end configurations are available

Technical:

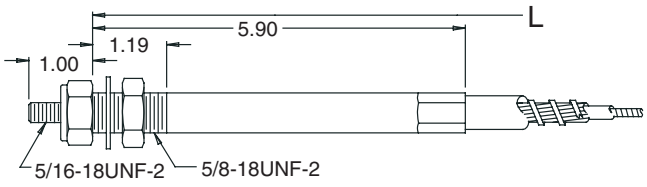
- Load: 50 lb. maximum
- Travel: 3" maximum
- Threaded mount

Material:

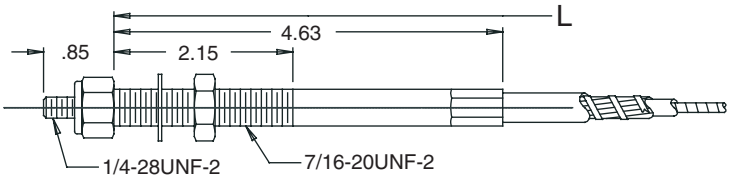
- Plated carbon steel corrosion-proof control heads



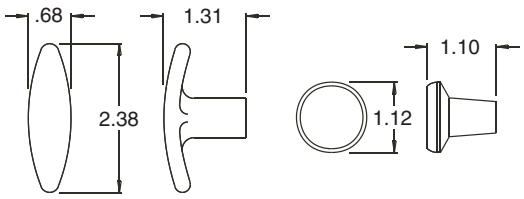
LD



VD



Knob Options



All line art dimensions are represented in inches

Twist Lock Control Heads

Push-Pull Control Head

Twist Lock control heads are a robust and simple design with only one moving part. They are cost effective solutions to mechanically connecting and locking a manual input source to a remote output.

Common Applications: Engine shut down, engine choke, latch operation, valve operation

- T-handle is free to travel the full length of the control until locked
- Rotating the T-handle 1/8 turn in either direction along the travel will secure loads up to 100 lb., yet unlocks with ease
- Especially effective when space is limited or rod linkage and bell cranks are not suitable choices

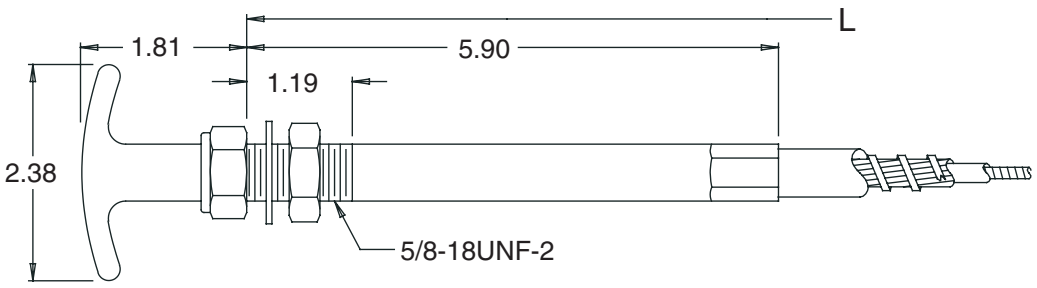
Technical:

- Load: 100 lb. maximum
- Travel: 3" maximum
- Threaded mount

Material:

- Plated carbon steel corrosion-proof control heads





All line art dimensions are represented in inches

***WARNING** - Since the manufacturer is unable to determine all applications in which a part may be placed, it is the user's responsibility to determine the suitability of the part for its intended use. This is especially true where safety is a factor. Incorrect application or installation may result in property damage, bodily injury, or death. For technical assistance, call 260-749-5105.*

Vent Control Industrial

Non-Locking Rotary to Linear

This industrial vent control is a cost effective solution to convert a light manual rotary motion into a push-pull motion, especially when space is limited.

Common Applications: Heater valve control, air conditioning vent control

- Panel or bracket mounted unit
- Custom engineered assembly

Technical:

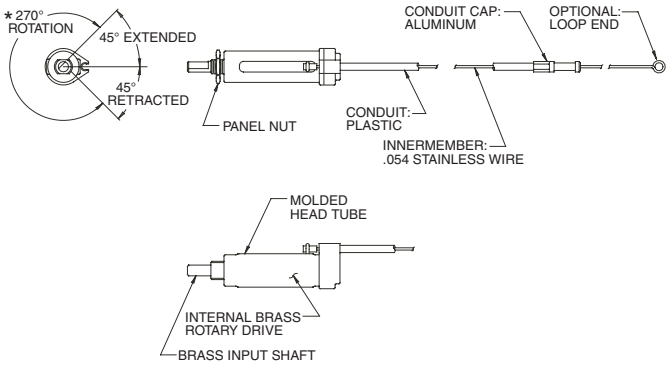
- Travel: 1.5" maximum
- Efficiency: 4" per lb. maximum to push-pull 5 lb.
- -25°F – 160°F temp. range
- 270° rotation
- 7/16" thread with two flats for mounting
- 1/4" diameter input shaft with flat will accommodate various customer supplied or directed knobs
- Flexible conduit with a .054" diameter stainless steel inner w
- Reverse rotation available
- Dust proof cover available

Material:

- Stainless steel
- Inner wire brass
- High performance plastic

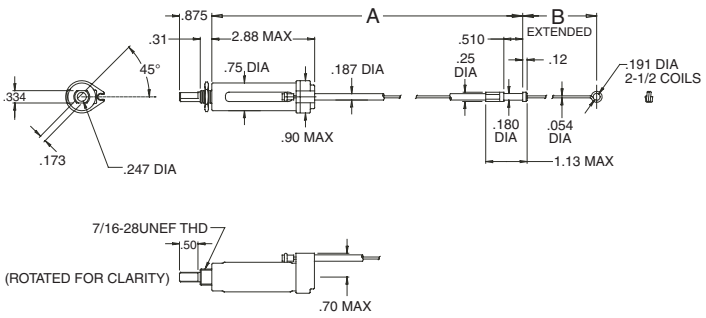


Components and Terminology



** Reverse rotation available*

Specifications



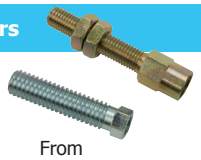
Hardware & End Fittings

Female Threaded Eye Ends



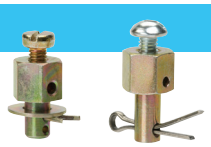
Part Number	Internal Threads	Pin Hole	Thickness
EE9061	5/16 - 24	1/4″	.438
EE9069	10-32	1/4″	.344
EE9151	1/4 - 28	1/4″	.344
185-051-001	5/16 - 24	9/32″	.250

End Rod Thread Adapters



Part Number	From (Internal)	To (External)
161-009-001	1/4-28	3/8-28
161-009-003	10-32	5/16-24
161-009-005	1/4-28	3/8-16
161-009-006	5/16-24	3/8-24
161-009-007	10-32	1/4-28

Wire Stop/Pivot



Part Number	Wire	Pin Dia.	Material Thickness	Set Screw
160-450-001	.075	1/4″	3/16″	10-32 UNF
160-450-002	.075	1/4″	5/16″	10-32 UNF

Threaded Pivots



Part Number	Internal Threads	Pin Dia.	Material Thickness
161-091-000	10-32	1/4″	1/4″
161-093-002	1/4-28	1/4″	1/4″
161-093-003	1/4-28	1/4″	5/16″

U-Bolts (furnished with 2 hex nuts)



Part Number	From (Internal)	To (External)
161-010-001	10-32 UNF	VLD
161-010-002	1/4-28	LD
161-010-003	5/16-24	MD
161-010-004	3/8-24	HD

Wire Stop



Part Number	Hole Size	Set Screw
156-416-001	.138″	8-31 UNC Hex Socket
156-416-002	.093″	8-32 UNC Hex Socket
160-429-001	.138″	8-32 UNC Slotted
160-429-002	.093″	8-32 UNC Slotted

VLD/LD Mounting (fits grooved conduit fitting)



Part Number
ST3652

WARNING *- Since the manufacturer is unable to determine all applications in which a part may be placed, it is the user's responsibility to determine the suitability of the part for its intended use. This is especially true where safety is a factor. Incorrect application or installation may result in property damage, bodily injury, or death. For technical assistance, call 260-749-5105.*

Hardware & End Fittings

Strap Clamps and Shims



Use With	Strap	Shim
VLD	161-011-001	175-435-050
LD	161-011-002	175-435-051

Compression Springs (for brake cables)



Part Number	Inside Dia.	Outside Dia.	Length	Solid Height	Spring Rate
175-923-001	.30	.437	12.0	4.6	3.93lb/inch
175-923-002	.30	.437	6.4	3.20	5.75lb/inch
175-923-006	.30	.437	5.7	2.87	6.23lb/inch
175-924-001	.26	.437	10.0	6.62	15.97lb/inch
175-924-003	.40	.500	4.3	1.00	4.47lb/inch

Bellows (trim to length)

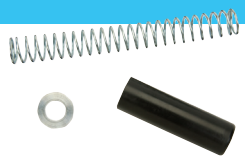


Part Number	For Use With Cable Size	Compressed Length	Extended Length	Max Travel
175-522-001	VLD	3.0″	12.0	4.6″
175-524-002	LD	3.4″	6.4	3.2″
175-525-006	MD	4.5″	5.7	2.87″
175-508-001	HD	3.5″	10.0	6.62″

Maximum recommended is shown, must be trimmed shorter for use on shorter travel cables. See cutting matrix #CC-111. Adapter Rings to mount bellows to conduit fittings.

Part Number	For Use With Cable Size
175-522-072	VLD
175-524-081	LD
175-525-082	MD

Spring Return Kit



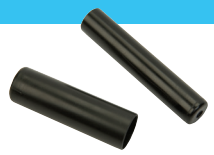
Convert any LD size, 2″ travel threaded swivel end to spring loaded to extended position

Force with end rod extended - 4.6lbs

Force with end rod retracted - 15.2lbs

Part Numbers:		
	Spring	175-930-001
	Collar	175-435-118
	Outer Guide	160-071-025

Umbrella Seal



Part Number	For Use With Cable Size
160-071-005	VLD, 2″
160-071-006	VLD, 3″
160-071-007	VLD, 4″
160-071-008	LD, 2″
160-071-009	LD, 3″
160-071-010	LD, 4″
160-071-011	MD, 2″
160-071-012	MD, 3″
160-071-013	MD, 4″

Knobs/Handles



Part Number	Type	Thread Size
165-183-001	PTO	1/4-28
165-183-003	PTO	5/16-18
165-183-004	PTO	5/16-24
165-103-001	2″ Mushroom	1/4-28
165-103-002	2″ Mushroom	1/4-20
165-103-004	2″ Mushroom	3/8-24
165-103-006	2″ Mushroom	5/16-18
165-038-124	2″ Mushroom	1/2-13
165-038-106	1-3/8″ dia. x 4-3/8″ tall	1/2-13
165-172-201	3-1/2″ Aluminum T	1/4-20
165-172-202	3-1/2″ Aluminum T	1/4-28
165-172-203	3-1/2″ Aluminum T	5/16-28
165-172-206	3-1/2″ Alum./Black T	1/4-20
300-057-008	3-1/2″ Alum. Twist Lock T	N/A

Hardware & End Fittings

Hydroback



Part Number	Travel	Spring Force at Center	For Use With Cable Size
165-073-210	2″	10lb	LD
165-073-220	2″	20lb	LD
165-073-310	3″	10lb	LD
165-073-320	3″	20lb	LD
165-072-210	2″	10lb	MD
165-072-220	2″	20lb	MD
165-072-310	3″	10lb	MD
165-072-320	3″	20lb	MD

Spool Valve Adapters - Open Style Mount



Part Number	For Use On
185-101-001	Comm. Shearing 505
185-101-002	Comm. Shearing D50
185-101-003	Comm. Shearing A35
185-101-004	Comm. Shearing A20
185-101-005	Comm. Shearing VA20
185-101-006	Husco 6000
185-101-007	Husco 7120
185-101-008	Gresen V20, V31P, V42, CP, CT, CPT, CS, 25P, 25PK

Modulator Assemblies and Replacement Cables

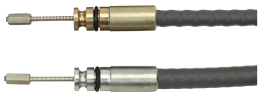


MODULATOR UNIT WITH CABLE

Cable Output End	Pull To Operate	Push To Operate	Cable Only
A. Grooved Mount			
173 Utility	CA 343-3-001-L	CA 343-3-002-L	CA 343-3-L
174 Utility	CA 343-4-001-L	CA 343-4-002-L	CA 343-4-L
B. Threaded Mount			
173 Utility	CA 341-3-001-L	CA 341-3-002-L	CA 341-3-L
174 Utility	CA 341-4-001-L	CA 341-4-002-L	CA 341-4-L

REPLACEMENT CABLES ONLY FOR OTHER USA MANUFACTURED MODULATORS

Cable Output End	173 Utility	174 Utility
Grooved Mount	CA 213 G-L	CA 214 G-L
Threaded Mount	CA 213 T-L	CA 214 G-L



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