Construction with Integrity Since 1968

GENERAL CONTRACTORS
BUILDING SUPPLIES
1-509-276-2229
28308 N. CEDAR RD.
DEER PARK, WA 99006

John Day Avian Array Improvements
W9127N-18-C-0001

Operation & Maintenance Manual

Contractor: Knight Construction & Supply, Deer Park WA

Date of Construction: December 2017 – April 2018

JOHN DAY DAM AVIAN ARRAY IMPROVEMENTS PHASE II

Operation & Maintenance Manual

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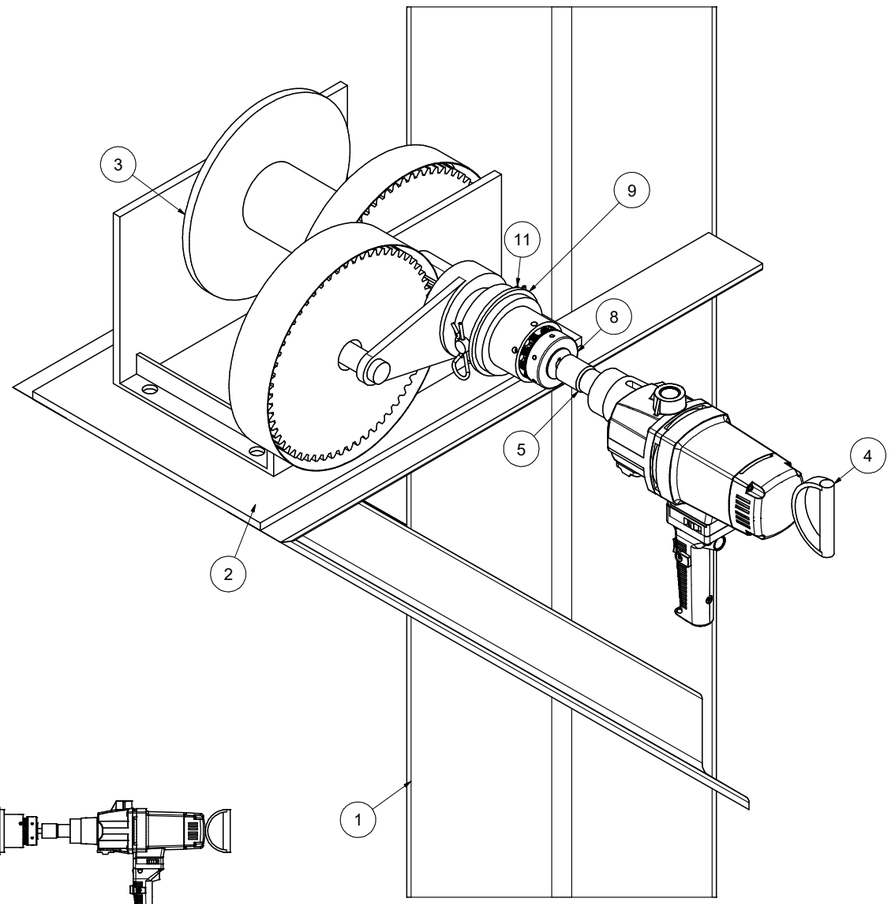
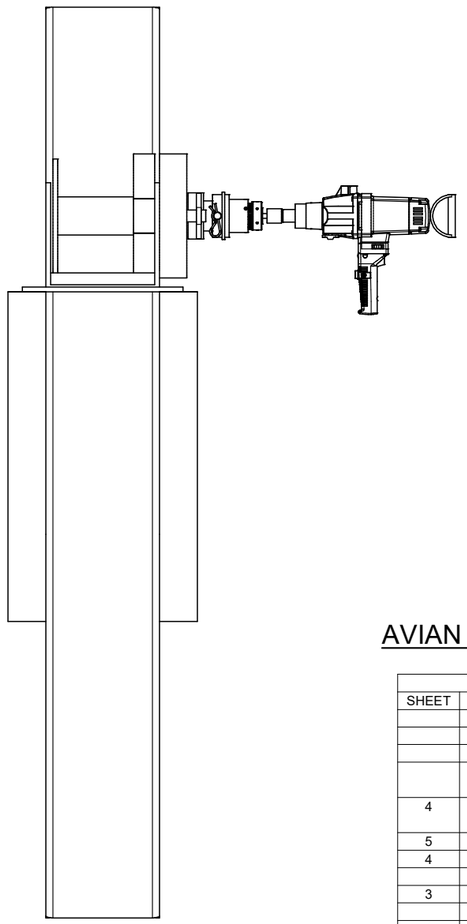
2A.10 Machined Thimbles
2A.11 Spare Parts

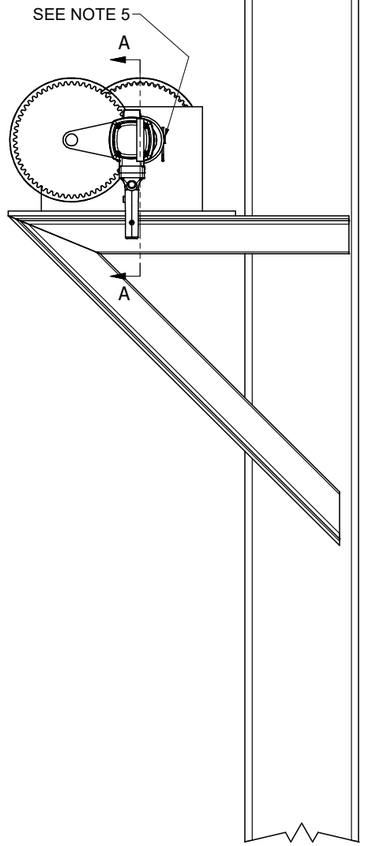
Section 2B. Paint Information

SECTION 1.A

DRAWINGS







NOTES:
1. THE PURPOSE OF THIS DRAWING SET IS TO DETAIL THE SYSTEM USED TO TENSION AVIAN LINES USING CUSTOM WINCH TURNING OPERATION.
2. DYNATECT SLIP CLUTCH USED AS TORQUE LIMITING DEVICE.
3. VERIFY ALL CLEARANCE FITS OF SUPPLIER FURNISHED COMPONENTS PRIOR TO FABRICATING CUSTOM CONTRACTOR PROVIDED ITEMS.
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5. REMOVE WINCH HANDLE AND INSTALL DRIVE BAR PRIOR TO USING DRILL.
6. ALL FABRICATIONS BY WELDER CERTIFIED TO AWS D1.1M.
7. PART NUMBER CALLOUT KEY: (X-A,B, Y-C) = (SHEET #X-ITEM A & B, SHEET #Y-ITEM C)
8. DRAWING SCALES NOTED ARE ACCURATE ON 22X34" PRINT
9. TOLERANCES: UNLESS NOTED OTHERWISE
10. FRACTIONAL: ± 1/16", ± .5, FRACTIONAL MACHINED FEATURES: ±1/32"
11. X.X: ±0.030
12. X.XX: ±0.010
13. X.XXX: ±0.005
14. WELD SIZES: UNLESS NOTED OTHERWISE.
15. 1/8" MATERIAL: 1/8" FILLET, GROOVE OR PJP WELD
16. 1/4" - >1/2" MATERIAL: 3/16, GROOVE FILLET OR PJP WELD
17. 1/2 - >3/4" MATERIAL: 1/4" FILLET, GROOVE OR PJP WELD
18. 3/4 - 1 1/2" MATERIAL: 5/16" FILLET, GROOVE OR PJP WELD
19. BREAK ALL SHARP EDGES

AVIAN TOWER WINCH AND DRILL ASS'Y

SCALE 1/8

BILL OF MATERIALS			
SHEET	ITEM	QTY	DESCRIPTION
	1	1	AVIAN TOWER ASS'Y
	2	1	WINCH BRACKET
	3	1	THERN WINCH ASS'Y, MODEL M492B
	4	1	MILWAUKEE DRILL, MODEL 2404-1 250RPM W/ MORSE TAPER SOCKET
4	5	4	MORSE TAPER-MOUNT SPINDLE, MCMASTER CARR PN 2862A12
5	6	4	1/2" CLUTCH SHAFT ASS'Y
4	7	1	CAPTURE SLEEVE
	8	1	DYNATECT EA0-52 ADJUSTABLE SLIP CLUTCH
3	9	4	CLUTCH DRIVER ADAPTER
	10	4	1" LG. 12-24 SS PHILLIPS FLAT HEAD SCREWS
4	11	4	DRIVE BAR ASS'Y

REVISION HISTORY

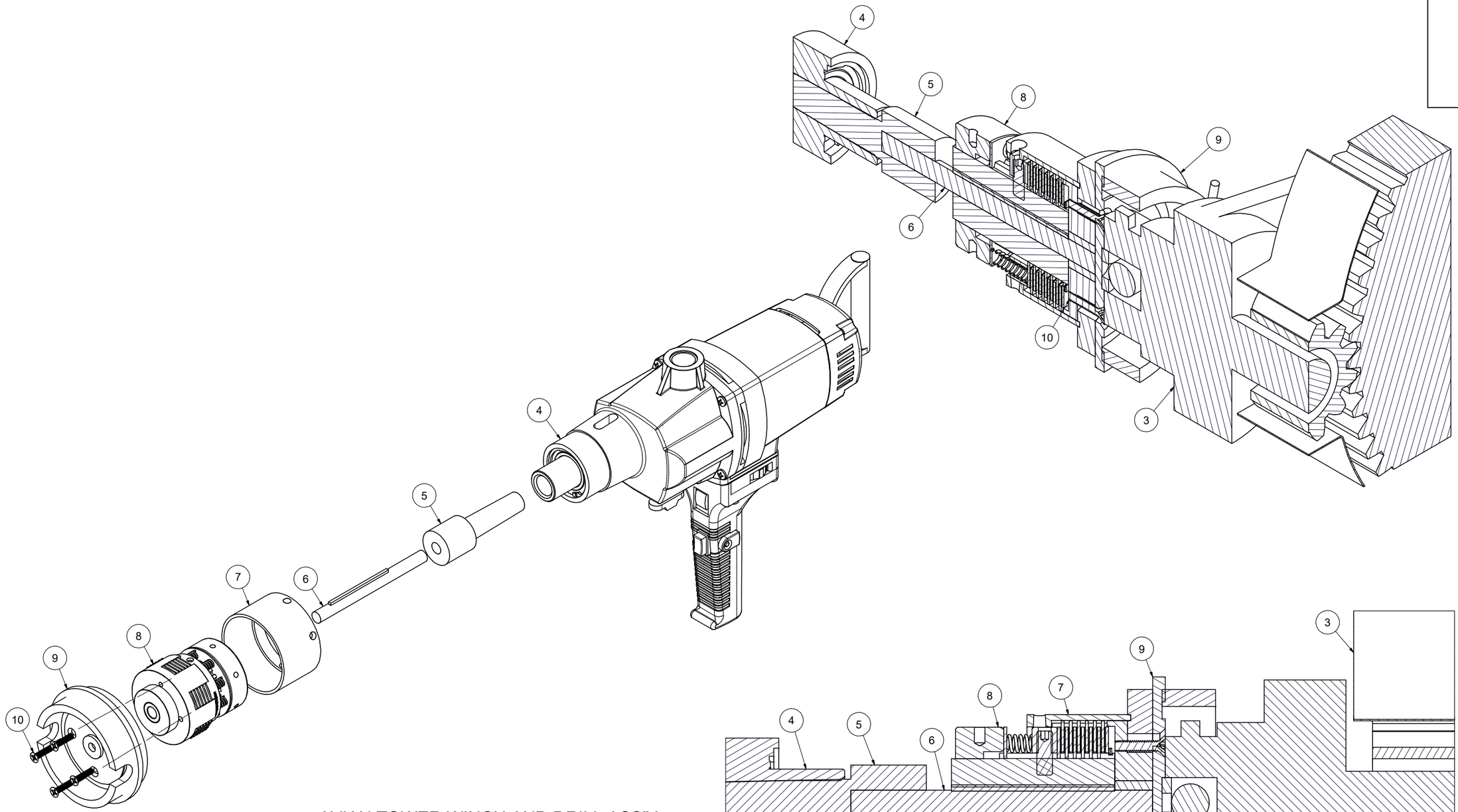
REV.	DATE	DESCRIPTION	CHKD.	APPR.
1	180716	REV. DRILL DESCRIPTION		

JOB TITLE: JOHN DAY AVAIN ARRAY IMPROVEMENTS — JOHN DAY DAM
U.S. ARMY ENGINEER DISTRICT PORTLAND DISTRICT
CONTRACT NO. W9127N-18-C-0001
SPEC. REF.
JOB NO. 37011
DRAWING TITLE: AVIAN TOWER WINCH TURN ASS'Y
DRAWN BY: JDL
DATE: 11/17/2017
REV.
REF. DRAWING NO.

KNIGHT Const. & Supply, Inc. KNIGHCS281ON

DRAWING NO. 37011-001

SHEET NO. 1 OF 5



AVIAN TOWER WINCH AND DRILL ASS'Y

SCALE 1/2

BILL OF MATERIALS		
ITEM	QTY	DESCRIPTION
4	1	MILWAUKEE DRILL, MODEL 2404-1 250RPM W/ MORSE TAPER SOCKET
5	4	MORSE TAPER-MOUNT SPINDLE, MCMASTER CARR PN 2862A12
7	1	CAPTURE SLEEVE
8	1	DYNATECT EA0-52 ADJUSTABLE SLIP CLUTCH
9	4	CLUTCH DRIVER ADAPTER
10	4	1" LG. 12-24 SS PHILLIPS FLAT HEAD SCREWS
11	4	DRIVE BAR ASS'Y
6	4	1/2" CLUTCH SHAFT ASS'Y

SECTION A-A
DRILL AND WINCH ARR.
SCALE 1/1

REVISION HISTORY

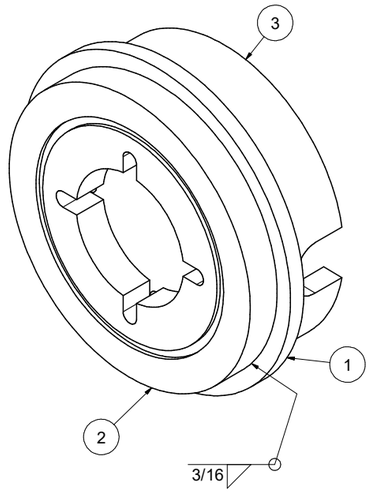
REV.	DESCRIPTION	CHKD.	APPR.	DATE

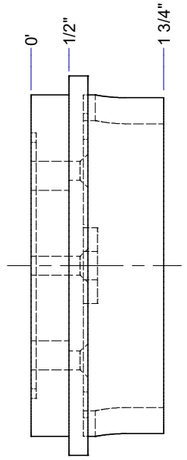
JOB TITLE: JOHN DAY AVAIN ARRAY IMPROVEMENTS
JOHN DAY DAM
U.S. ARMY ENGINEER DISTRICT
PORTLAND DISTRICT
CONTRACT NO. W9127N-18-C-0001
SPEC. REF.
DRAWING TITLE: DRILL ASS'Y
JOB NO. 37011
DATE 11/17/2017
DRAWN BY JDL
REF. DRAWING NO.
REV.

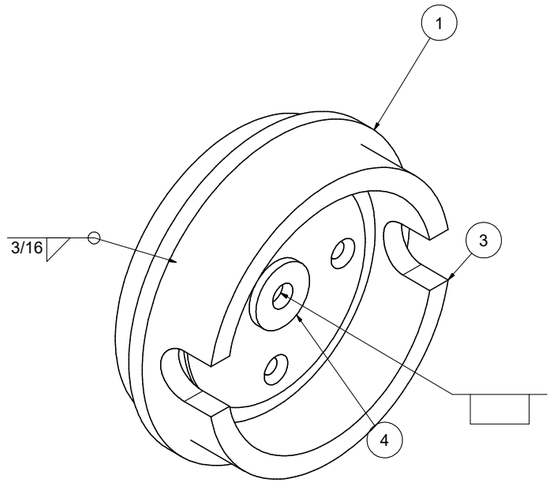
KNIGHT Const. & Supply, Inc. KNIGHCS281ON

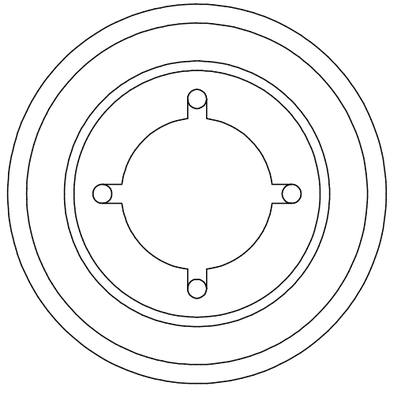
DRAWING NO. 37011-001

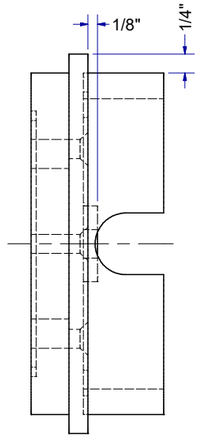
SHEET NO. 2 OF 5

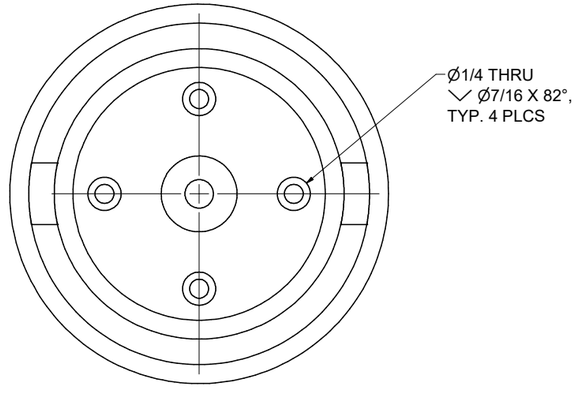












(1-9) CLUTCH DRIVER ADAPTER

4 REQ'D, BOM IS FOR ONE
2 lbmass
SCALE 1/1

BILL OF MATERIALS			
ITEM	QTY	DESCRIPTION	MATERIAL
1	1	AISC - 5x1/4 - 5	Aluminum 6061
2	1	AISC - 4 1/2x1/2 - 4.5	Aluminum 6061
3	1	ANSI - 4 x 0.337 - 1.063	Steel, Mild
4	1	ANSI/AISC Rolled Steel - 1-0.188	Aluminum 6061

REVISION HISTORY

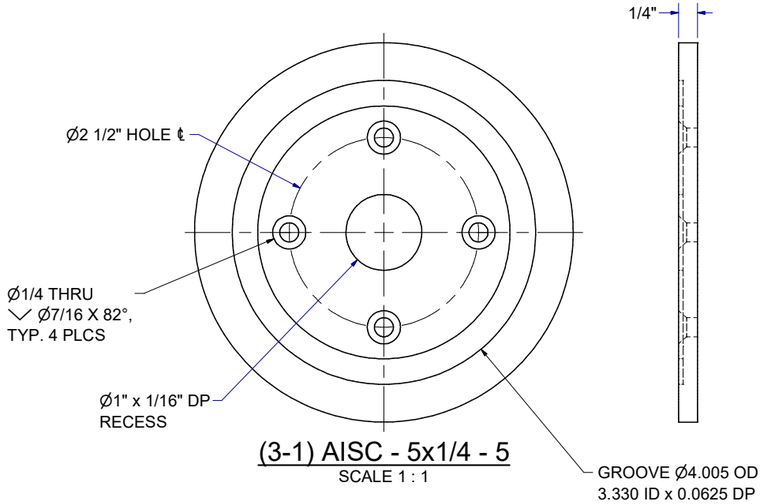
DESCRIPTION	REV.	DATE	CHKD.	APPR.

JOB TITLE: JOHN DAY AVAIN ARRAY IMPROVEMENTS
JOHN DAY DAM
U.S. ARMY ENGINEER DISTRICT
PORTLAND DISTRICT
DRAWING TITLE: COMPONENT DETAIL
JOB NO. 37011
CONTRACT NO. W9127N-18-C-0001
SPEC. REF.
DRAWN BY JDL
DATE 11/17/2017
REV.
REF. DRAWING NO.

KNIGHT Const. & Supply, Inc.
KNIGHTCS2810N

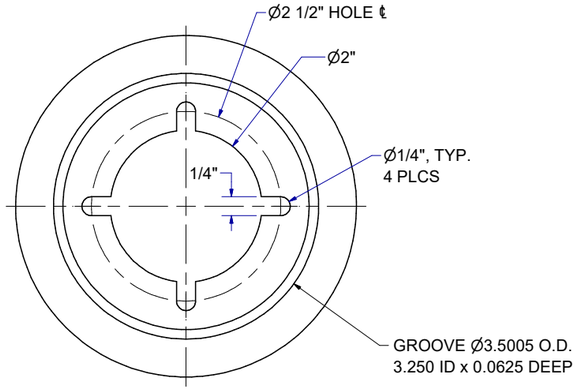
DRAWING NO. 37011-001

SHEET NO. 3 OF 5



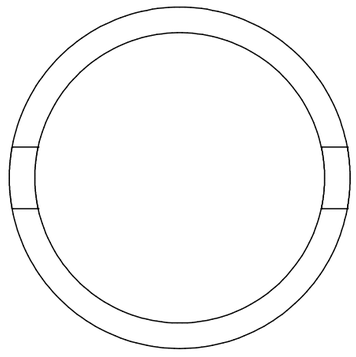
(3-1) AISC - 5x1/4 - 5

SCALE 1 : 1



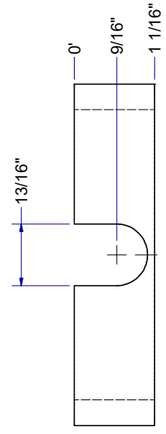
(3-2) AISC - 4 1/2x1/2 - 4.5

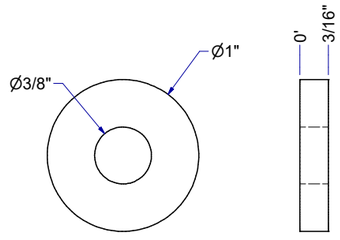
SCALE 1 : 1



(3-3) ANSI - 4 x 0.337 - 1.063

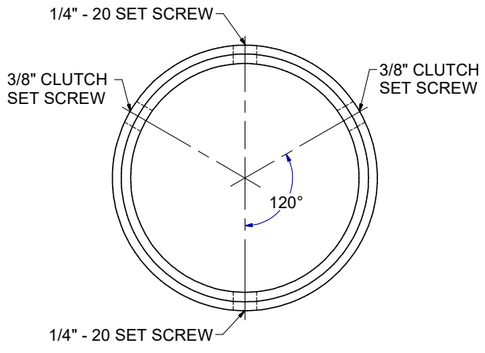
SCALE 1 : 1





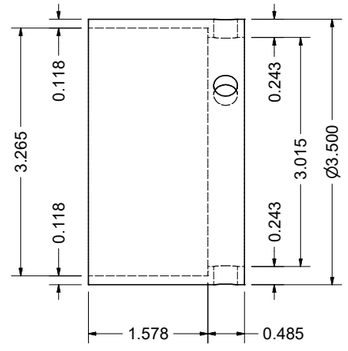
(3-4) ANSI/AISC Rolled Steel - 1-0.188

SCALE 2:1



(1-6) CAPTURE SLEEVE

SCALE 1 : 1



REVISION HISTORY

REV.	DESCRIPTION	DATE	CHKD.	APPR.

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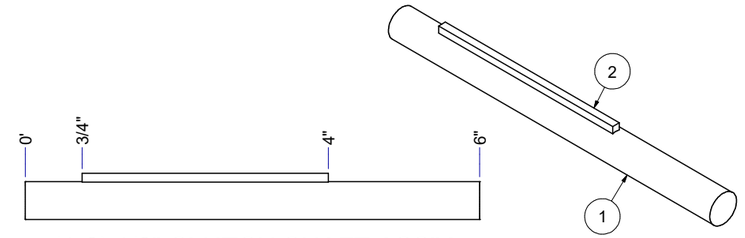
JOHN DAY DAM
U.S. ARMY ENGINEER DISTRICT
PORTLAND DISTRICT
DRAWING TITLE: WINCH DRIVER PART DETAIL
JOB NO. 37011
CONTRACT NO. W9127N-18-C-0001
SPEC. REF.
DRAWN BY JDL
DATE 11/17/2017
REV.
REF. DRAWING NO.

KNIGHT Const. & Supply, Inc.
KNIGHTCS2810N

DRAWING NO. 37011-001

SHEET NO. 4 OF 5



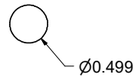
(1-6) 1/2" CLUTCH SHAFT ASS'Y

4 REQ'D, BOM IS FOR ONE
SCALE 1/1

BILL OF MATERIALS			
SHEET	ITEM	QTY	DESCRIPTION
5	1	1	1/2" CLUTCH SHAFT
5	2	1	CLUTCH SHAFT KEY

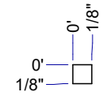
(5-1) 1/2" CLUTCH SHAFT

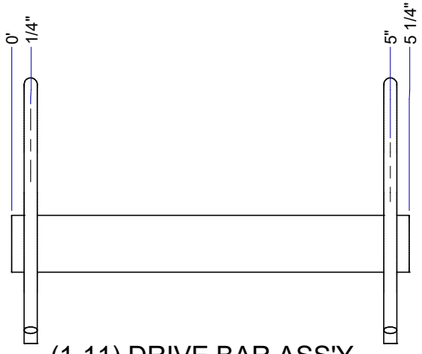
4 REQ'D
SCALE 1/1



(5-2) CLUTCH SHAFT KEY

4 REQ'D
SCALE 2/1

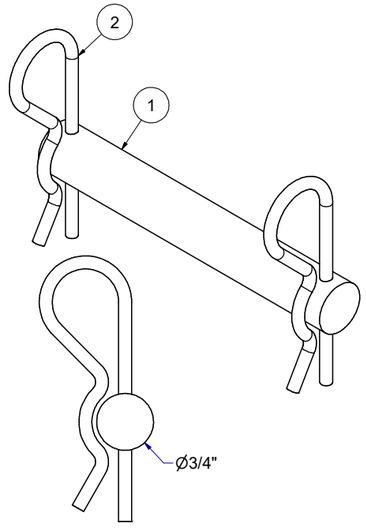


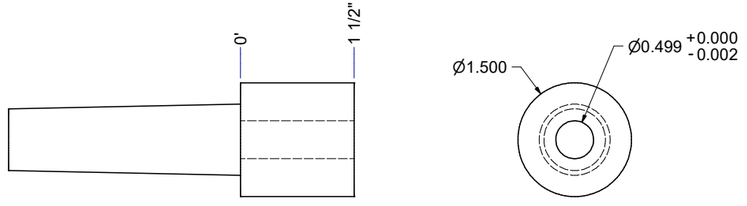


(1-11) DRIVE BAR ASS'Y

4 REQ'D, BOM IS FOR ONE
SCALE 1/1

BILL OF MATERIALS		
ITEM	QTY	DESCRIPTION
1	1	DRIVE BAR
2	2	HAIRPIN COTTER PIN, MCMASTER CARR PN 92391A185





(1-5) MORSE TAPER-MOUNT SPINDLE, MCMASTER CARR PN 2862A12

4 REQ'D
SCALE 1/1

REVISION HISTORY

REV.	DESCRIPTION	CHKD.	APPR.

JOB TITLE: JOHN DAY AVAIN ARRAY IMPROVEMENTS
JOHN DAY DAM
U.S. ARMY ENGINEER DISTRICT
PORTLAND DISTRICT
DRAWING TITLE: DRILL PARTS
JOB NO. 37011
CONTRACT NO. W9127N-18-C-0001
SPEC. REF.
DRAWN BY JDL
DATE 11/17/2017
REV.
REF. DRAWING NO.

KNIGHT Const. & Supply, Inc.
KNIGHTCS2810N

DRAWING NO. 37011-001

SHEET NO. 5 OF 5

SECTION 1.B
MAINTENANCE

1.B.1

WINCH MAINTENANCE CHART

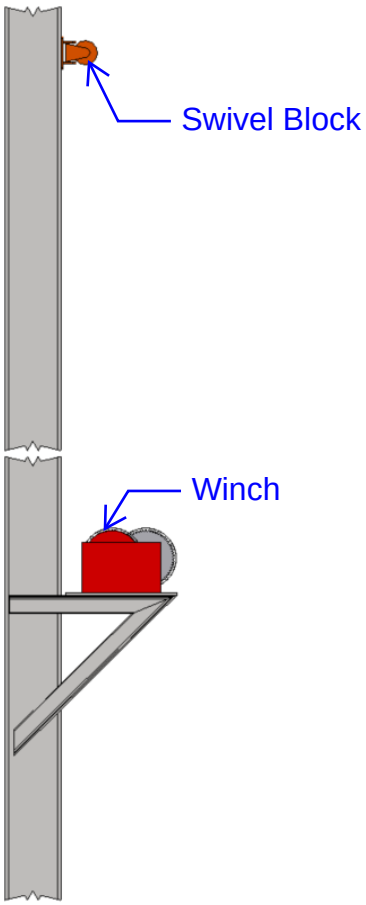
Construction with Integrity Since 1968

GENERAL CONTRACTORS
BUILDING SUPPLIES
1-509-276-2229
28308 N. CEDAR RD.
DEER PARK, WA 99006

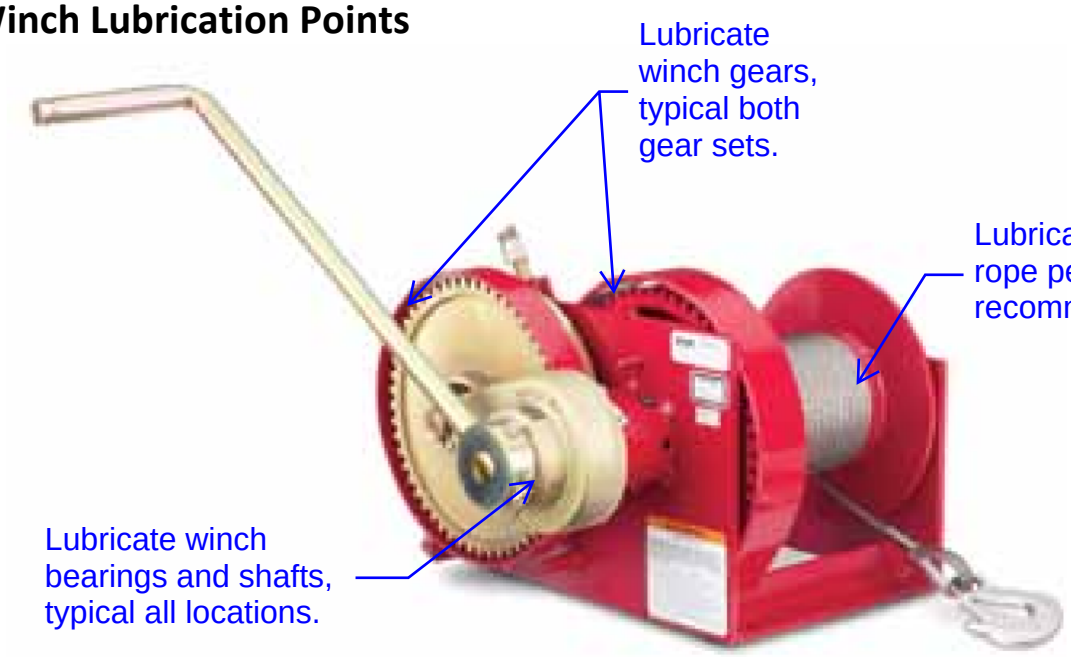
John Day Avian Array Improvements
W9127N-18-C-0001
Lubrication Schematic

For proper lubrication of Winch and Swivel Block components, see also the O&M information contained within the Operations Maintenance Manual and the Lubrication & Maintenance Interval Table.

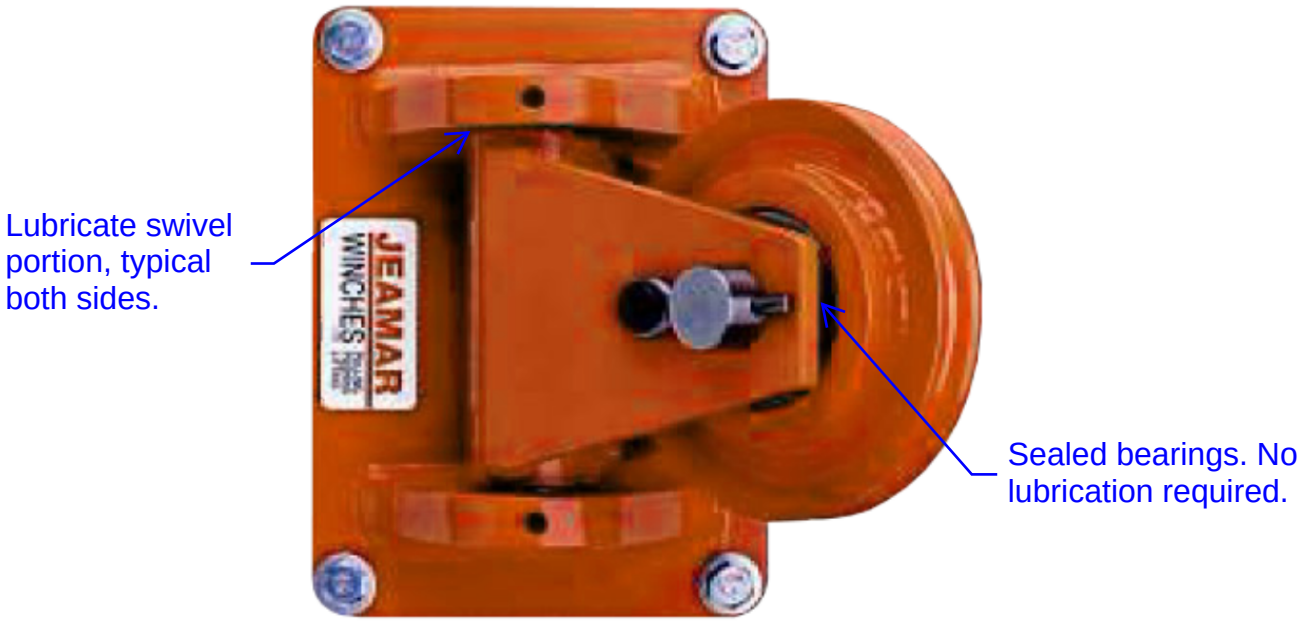
General Avian Tower



Winch Lubrication Points



Swivel Block Lubrication Points



LUBRICATION & MAINTENANCE INTERVAL TABLE

COMPONENT	SUGGESTED LUBRICANT	FLUID CHANGE INTERVAL	AMOUNT REQUIRED	LAST SERVICE
WINCH BEARINGS AND SHAFT	SAE 30WT OIL	6 MONTHS OR UPON INSPECTION PARA 3.2 OF WINCH MANUAL	3-4 DROPS	FEB 2018
SWIVEL BLOCKS	EP2 MOBIL OR CHEVRON	EVERY 2 YEARS OR UPON INSPECTION	1 PUMP WITH GREASE GUN do not overfill	FEB 2018

1.B.1.1

DRILL & WINCH OPERATION

Construction with Integrity Since 1968

GENERAL CONTRACTORS
BUILDING SUPPLIES
1-509-276-2229
28308 N. CEDAR RD.
DEER PARK, WA 99006

John Day Avian Array Improvements
W9127N-18-C-0001
DRILL AND WINCH OPERATION

Prior to operation of the winch by use of the drill motor consult with the Drill and Winch product data in sections, 2A.1 and 2A.2.

CAUTION: Follow all safety precautions outlined in the Thern and Milwaukee operations manuals prior to operating the equipment. Include safety procedures for operating power tools per the EM-385-1-1 2015.

Components:

1. 10,00lb Thern Winch – Consult 2.A.1
    a. The pull required to operate the winch is limited by slipper clutch. This pull will not exceed 500in-lbs; 6000fl/lbs which is below the maximum capacity of the winch.
    b. The winch pull can exceed the maximum load rating of the avian line but is again limited by use of the drill motor and slip clutch.
    c. The winch is supplied with a disc brake. The brake is always engaged and will prevent the winch from free spinning upon release of the handle.
    d. Consult with the Thern Operating Manual in section 2.A.1.
2. 250RPM Milwaukee Drill motor – Consult 2.A.2
3. Clutch Drive Assembly – Consult 2.A.2.1
    a. Dynatect Slip-Ease Clutch is the torque limiting device installed to prevent over torque and tightening of the avian lines past their breaking point. The clutch capacity has a range of zero to 500 in-lbs. The clutch has been set to approximately 400ft-lbs, (34in-lbs).
    b. The clutch is comprised of two parts; a housing and a cartridge. The cartridge contains the friction discs and the adjusting nut. The housing captures the clutch outer plates and is fixed to the drive assembly.
    c. The clutch cartridge is keyed to the output shaft which is attached to a driver assembly that is mounted to the winch handle. The torque is controlled by changing the pressure applied to the clutch pack. That torque level is controlled by compressing the springs with the adjusting

nut. The clutch has been calibrated and set to 400ft/lbs of pull. Set screws are tightened through the adjusting nut to fix the 400ft/lb calibration.

d. Aluminum Drive Assembly – Clutch Housing
   The drive assembly is screwed to the clutch housing and fixed with a sleeve welded to the drive assembly. The sleeve prevents the drive assembly from slipping off the clutch. It is held by small spot welds. The sleeve can only be removed by grinding off the spot welds. The bore of the drive assembly fits over the winch handle housing and is centered to the winch handle by means of a centering pin. The notches of the drive assembly engage the handle pin and will rotate the winch in the desired direction.
e. Morse Taper Bit adapter
   The entire clutch drive assembly is installed on to a shaft inserted into a morse taper bit adapter by interference fit. The morse taper is then chucked into the Drill Motor.

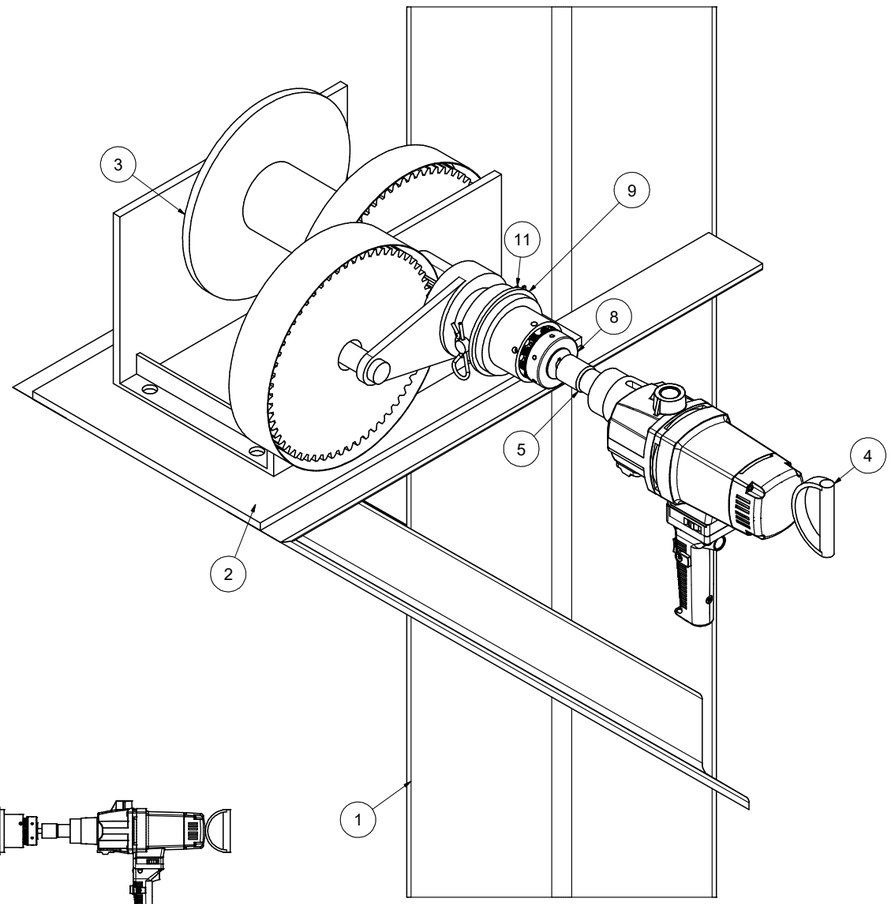
Operation Procedure:

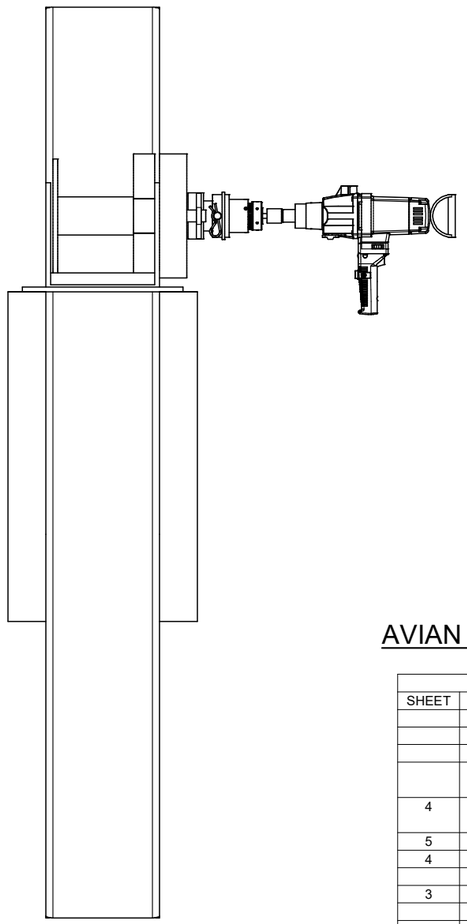
1. Remove the handle from the winch and install the drive bar assembly. Use the cotter pin on each end to hold drive bar in place.
2. The drill motor clutch assembly is calibrated to not exceed 400 ft-lbs. Do not adjust set screw on clutch.
3. Lift drill motor and insert on to winch handle housing.
4. Align the clutch drive housing notches to drive bar and centering pin with the center of the winch handle housing.
5. Drill motor set to “forward” will spin the winch drum clockwise and tighten the avian line tension.
6. Drill motor in reverse will spin the winch drum counterclockwise and loosen the avian line tension.
7. Press drill trigger in forward and tighten the avian lines until the proper elevation is achieved.
8. Line tension will be checked with the Tension Meter during operation for verification. Lines are set by elevation and not tension. The slip clutch is set to free spin at 400 ft-lbs of pull.

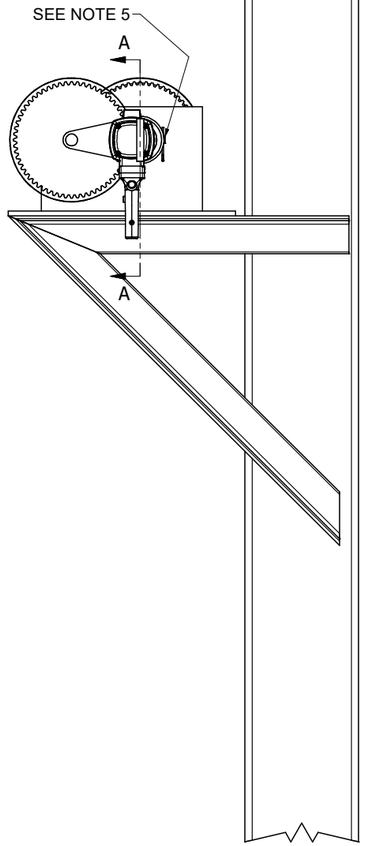
End of Procedure

1.B.1.2

WINCH OPERATION & ASSEMBLY







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2. DYNATECT SLIP CLUTCH USED AS TORQUE LIMITING DEVICE.
3. VERIFY ALL CLEARANCE FITS OF SUPPLIER FURNISHED COMPONENTS PRIOR TO FABRICATING CUSTOM CONTRACTOR PROVIDED ITEMS.
4. PROVIDE GOVERNMENT WITH FOUR (4) ADAPTOR/BITS AND OTHER MISC. DRILL COMPONENTS USED IN WINCH OPERATION.
5. REMOVE WINCH HANDLE AND INSTALL DRIVE BAR PRIOR TO USING DRILL.
6. ALL FABRICATIONS BY WELDER CERTIFIED TO AWS D1.1M.
7. PART NUMBER CALLOUT KEY: (X-A,B, Y-C) = (SHEET #X-ITEM A & B, SHEET #Y-ITEM C)
8. DRAWING SCALES NOTED ARE ACCURATE ON 22X34" PRINT
9. TOLERANCES: UNLESS NOTED OTHERWISE
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12. X.XX: ±0.010
13. X.XXX: ±0.005
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15. 1/8" MATERIAL: 1/8" FILLET, GROOVE OR PJP WELD
16. 1/4" - >1/2" MATERIAL: 3/16, GROOVE FILLET OR PJP WELD
17. 1/2 - >3/4" MATERIAL: 1/4" FILLET, GROOVE OR PJP WELD
18. 3/4 - 1 1/2" MATERIAL: 5/16" FILLET, GROOVE OR PJP WELD
19. BREAK ALL SHARP EDGES

AVIAN TOWER WINCH AND DRILL ASS'Y

SCALE 1/8

BILL OF MATERIALS			
SHEET	ITEM	QTY	DESCRIPTION
	1	1	AVIAN TOWER ASS'Y
	2	1	WINCH BRACKET
	3	1	THERN WINCH ASS'Y, MODEL M492B
	4	1	MILWAUKEE DRILL, MODEL 2404-1 250RPM W/ MORSE TAPER SOCKET
4	5	4	MORSE TAPER-MOUNT SPINDLE, MCMASTER CARR PN 2862A12
5	6	4	1/2" CLUTCH SHAFT ASS'Y
4	7	1	CAPTURE SLEEVE
	8	1	DYNATECT EA0-52 ADJUSTABLE SLIP CLUTCH
3	9	4	CLUTCH DRIVER ADAPTER
	10	4	1" LG. 12-24 SS PHILLIPS FLAT HEAD SCREWS
4	11	4	DRIVE BAR ASS'Y

REVISION HISTORY

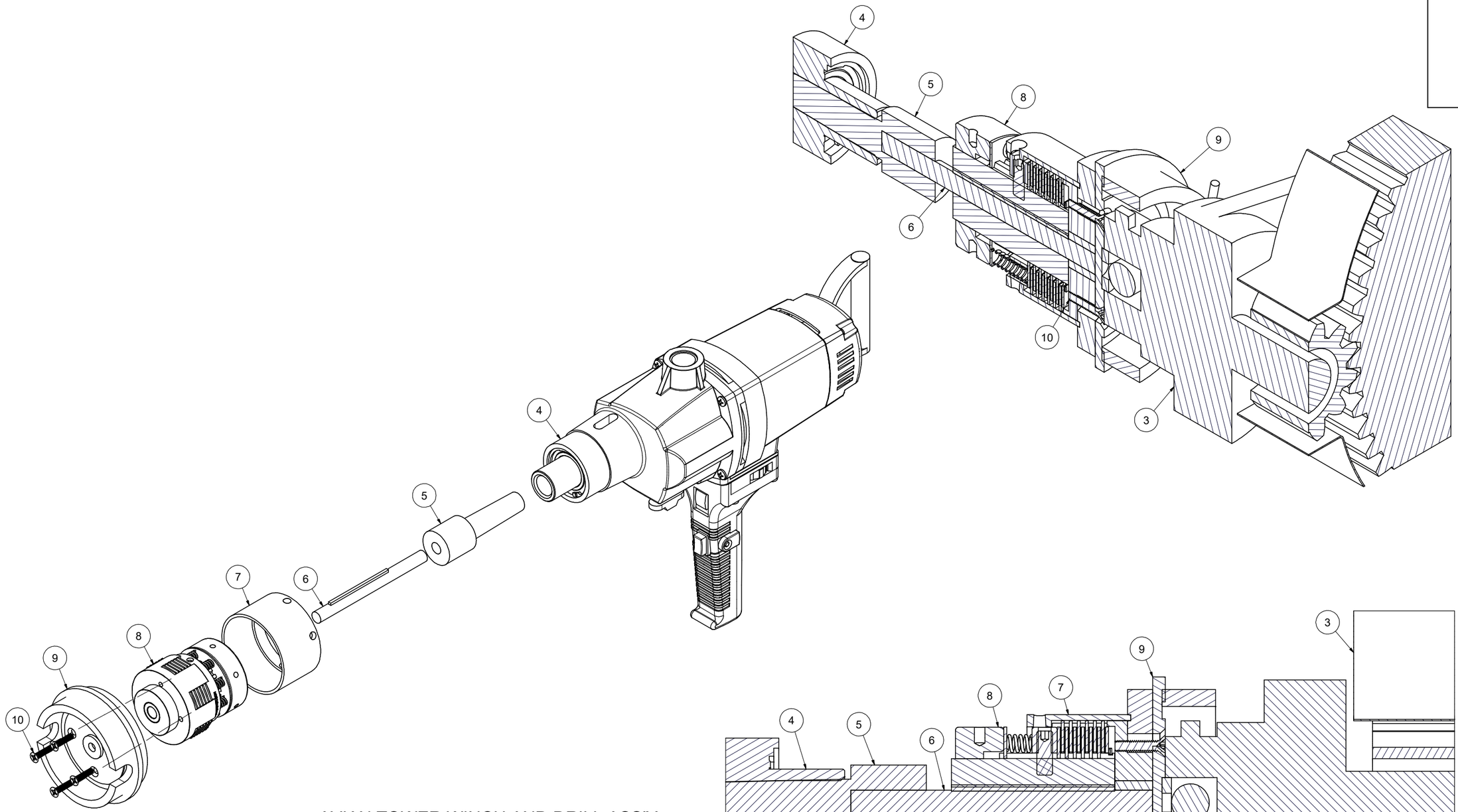
REV.	DATE	DESCRIPTION	CHKD.	APPR.
1	180716	REV. DRILL DESCRIPTION		

JOB TITLE: JOHN DAY AVAIN ARRAY IMPROVEMENTS — JOHN DAY DAM
U.S. ARMY ENGINEER DISTRICT PORTLAND DISTRICT
CONTRACT NO. W9127N-18-C-0001
SPEC. REF.
JOB NO. 37011
DRAWING TITLE: AVIAN TOWER WINCH TURN ASS'Y
DRAWN BY: JDL
DATE: 11/17/2017
REV.
REF. DRAWING NO.

KNIGHT Const. & Supply, Inc. KNIGHCS281ON

DRAWING NO. 37011-001

SHEET NO. 1 OF 5



AVIAN TOWER WINCH AND DRILL ASS'Y

SCALE 1/2

BILL OF MATERIALS		
ITEM	QTY	DESCRIPTION
4	1	MILWAUKEE DRILL, MODEL 2404-1 250RPM W/ MORSE TAPER SOCKET
5	4	MORSE TAPER-MOUNT SPINDLE, MCMASTER CARR PN 2862A12
7	1	CAPTURE SLEEVE
8	1	DYNATECT EA0-52 ADJUSTABLE SLIP CLUTCH
9	4	CLUTCH DRIVER ADAPTER
10	4	1" LG. 12-24 SS PHILLIPS FLAT HEAD SCREWS
11	4	DRIVE BAR ASS'Y
6	4	1/2" CLUTCH SHAFT ASS'Y

SECTION A-A
DRILL AND WINCH ARR.
SCALE 1/1

REVISION HISTORY

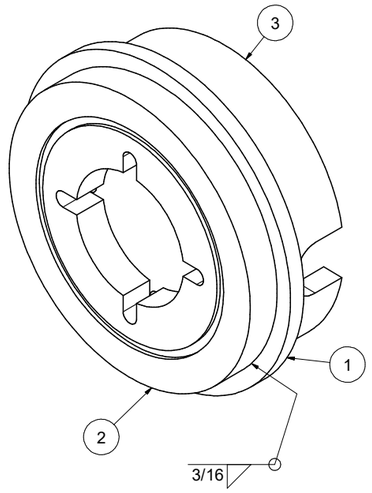
REV.	DESCRIPTION	CHKD.	APPR.	DATE

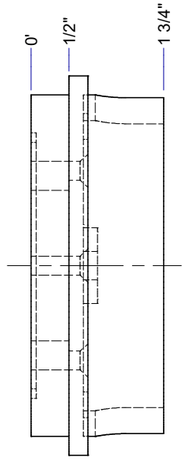
JOB TITLE: JOHN DAY AVAIN ARRAY IMPROVEMENTS
JOHN DAY DAM
U.S. ARMY ENGINEER DISTRICT
PORTLAND DISTRICT
CONTRACT NO. W9127N-18-C-0001
SPEC. REF.
DRAWING TITLE: DRILL ASS'Y
JOB NO. 37011
DATE 11/17/2017
DRAWN BY JDL
REF. DRAWING NO.
REV.

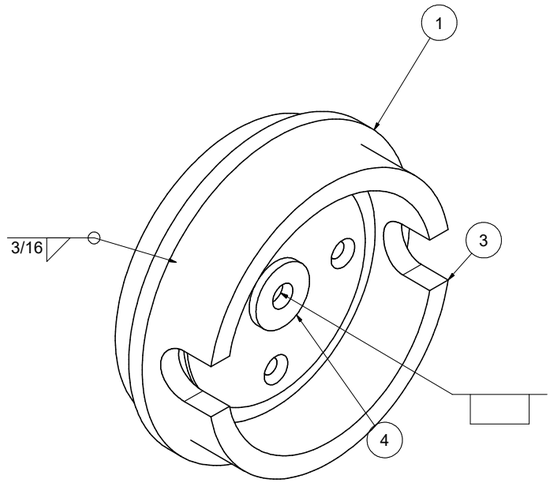
KNIGHT Const. & Supply, Inc. KNIGHCS281ON

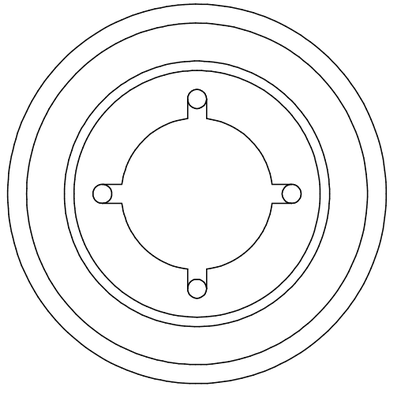
DRAWING NO. 37011-001

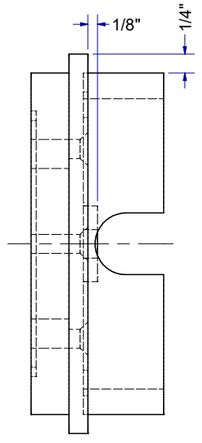
SHEET NO. 2 OF 5

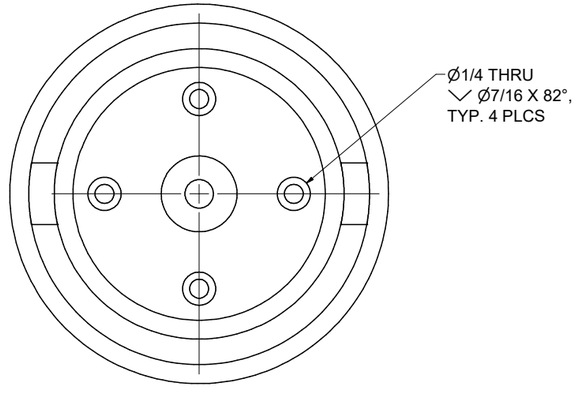












(1-9) CLUTCH DRIVER ADAPTER

4 REQ'D, BOM IS FOR ONE
2 lbmass
SCALE 1/1

BILL OF MATERIALS			
ITEM	QTY	DESCRIPTION	MATERIAL
1	1	AISC - 5x1/4 - 5	Aluminum 6061
2	1	AISC - 4 1/2x1/2 - 4.5	Aluminum 6061
3	1	ANSI - 4 x 0.337 - 1.063	Steel, Mild
4	1	ANSI/AISC Rolled Steel - 1-0.188	Aluminum 6061

REVISION HISTORY

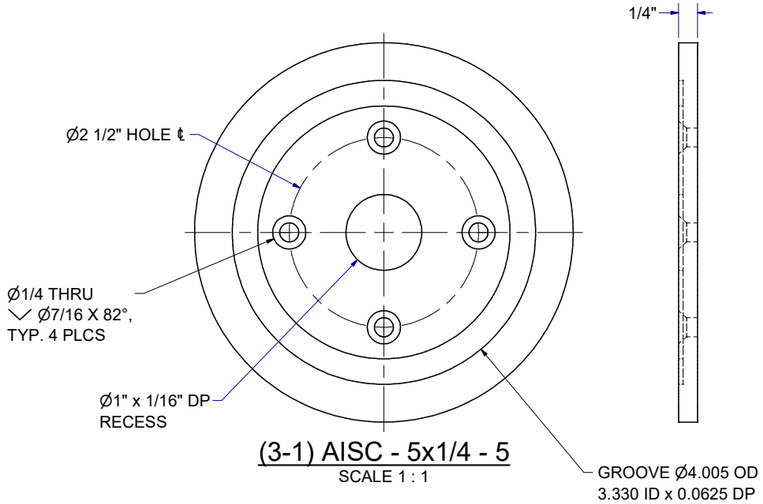
DESCRIPTION	REV.	DATE	CHKD.	APPR.

JOB TITLE: JOHN DAY AVAIN ARRAY IMPROVEMENTS
JOHN DAY DAM
U.S. ARMY ENGINEER DISTRICT
PORTLAND DISTRICT
DRAWING TITLE: COMPONENT DETAIL
JOB NO. 37011
CONTRACT NO. W9127N-18-C-0001
SPEC. REF.
DRAWN BY JDL
DATE 11/17/2017
REV.
REF. DRAWING NO.

KNIGHT Const. & Supply, Inc.
KNIGHTCS2810N

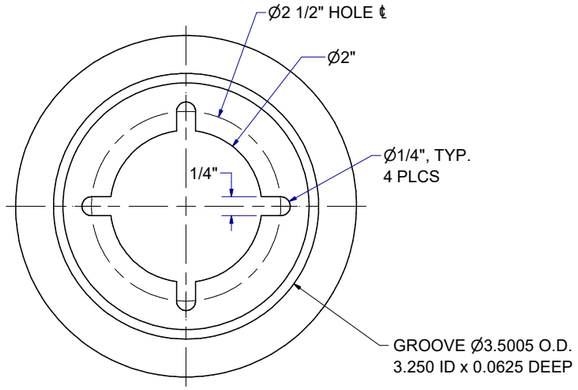
DRAWING NO. 37011-001

SHEET NO. 3 OF 5



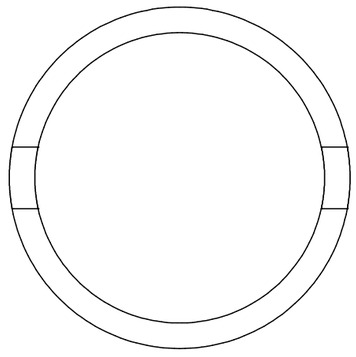
(3-1) AISC - 5x1/4 - 5

SCALE 1 : 1



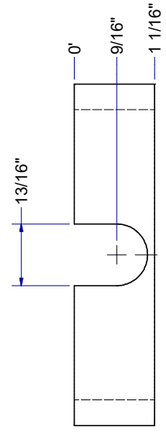
(3-2) AISC - 4 1/2x1/2 - 4.5

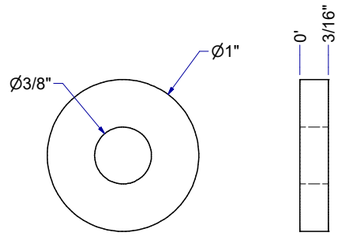
SCALE 1 : 1



(3-3) ANSI - 4 x 0.337 - 1.063

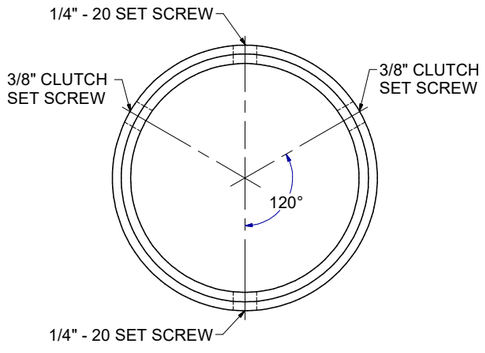
SCALE 1 : 1





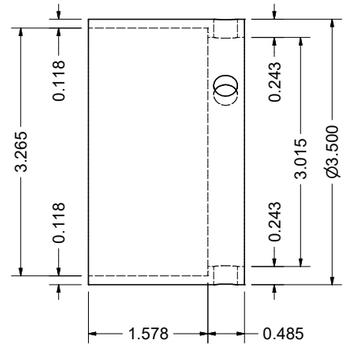
(3-4) ANSI/AISC Rolled Steel - 1-0.188

SCALE 2:1



(1-6) CAPTURE SLEEVE

SCALE 1 : 1



REVISION HISTORY

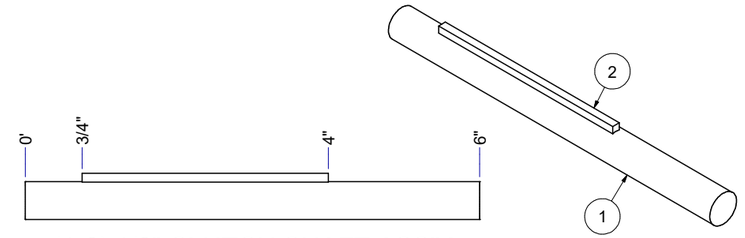
REV.	DESCRIPTION	DATE	CHKD.	APPR.

JOB TITLE: JOHN DAY AVAIN ARRAY IMPROVEMENTS
JOHN DAY DAM
U.S. ARMY ENGINEER DISTRICT
PORTLAND DISTRICT
DRAWING TITLE: WINCH DRIVER PART DETAIL
JOB NO. 37011
CONTRACT NO. W9127N-18-C-0001
SPEC. REF.
DRAWN BY JDL
DATE 11/17/2017
REV.
REF. DRAWING NO.

KNIGHT Const. & Supply, Inc.
KNIGHTCS2810N

DRAWING NO. 37011-001

SHEET NO. 4 OF 5



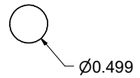
(1-6) 1/2" CLUTCH SHAFT ASS'Y

4 REQ'D, BOM IS FOR ONE
SCALE 1/1

BILL OF MATERIALS			
SHEET	ITEM	QTY	DESCRIPTION
5	1	1	1/2" CLUTCH SHAFT
5	2	1	CLUTCH SHAFT KEY

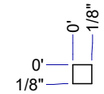
(5-1) 1/2" CLUTCH SHAFT

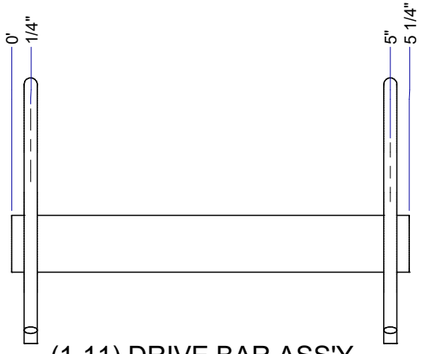
4 REQ'D
SCALE 1/1



(5-2) CLUTCH SHAFT KEY

4 REQ'D
SCALE 2/1

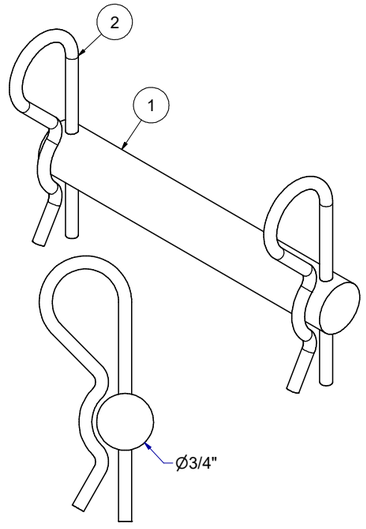


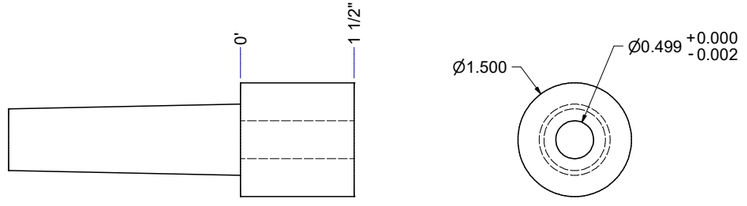


(1-11) DRIVE BAR ASS'Y

4 REQ'D, BOM IS FOR ONE
SCALE 1/1

BILL OF MATERIALS		
ITEM	QTY	DESCRIPTION
1	1	DRIVE BAR
2	2	HAIRPIN COTTER PIN, MCMASTER CARR PN 92391A185





(1-5) MORSE TAPER-MOUNT SPINDLE, MCMASTER CARR PN 2862A12

4 REQ'D
SCALE 1/1

REVISION HISTORY

REV.	DESCRIPTION	CHKD.	APPR.

JOB TITLE: JOHN DAY AVAIN ARRAY IMPROVEMENTS
JOHN DAY DAM
U.S. ARMY ENGINEER DISTRICT
PORTLAND DISTRICT
DRAWING TITLE: DRILL PARTS
JOB NO. 37011
CONTRACT NO. W9127N-18-C-0001
SPEC. REF.
DRAWN BY JDL
DATE 11/17/2017
REV.
REF. DRAWING NO.

KNIGHT Const. & Supply, Inc.
KNIGHTCS2810N

DRAWING NO. 37011-001

SHEET NO. 5 OF 5

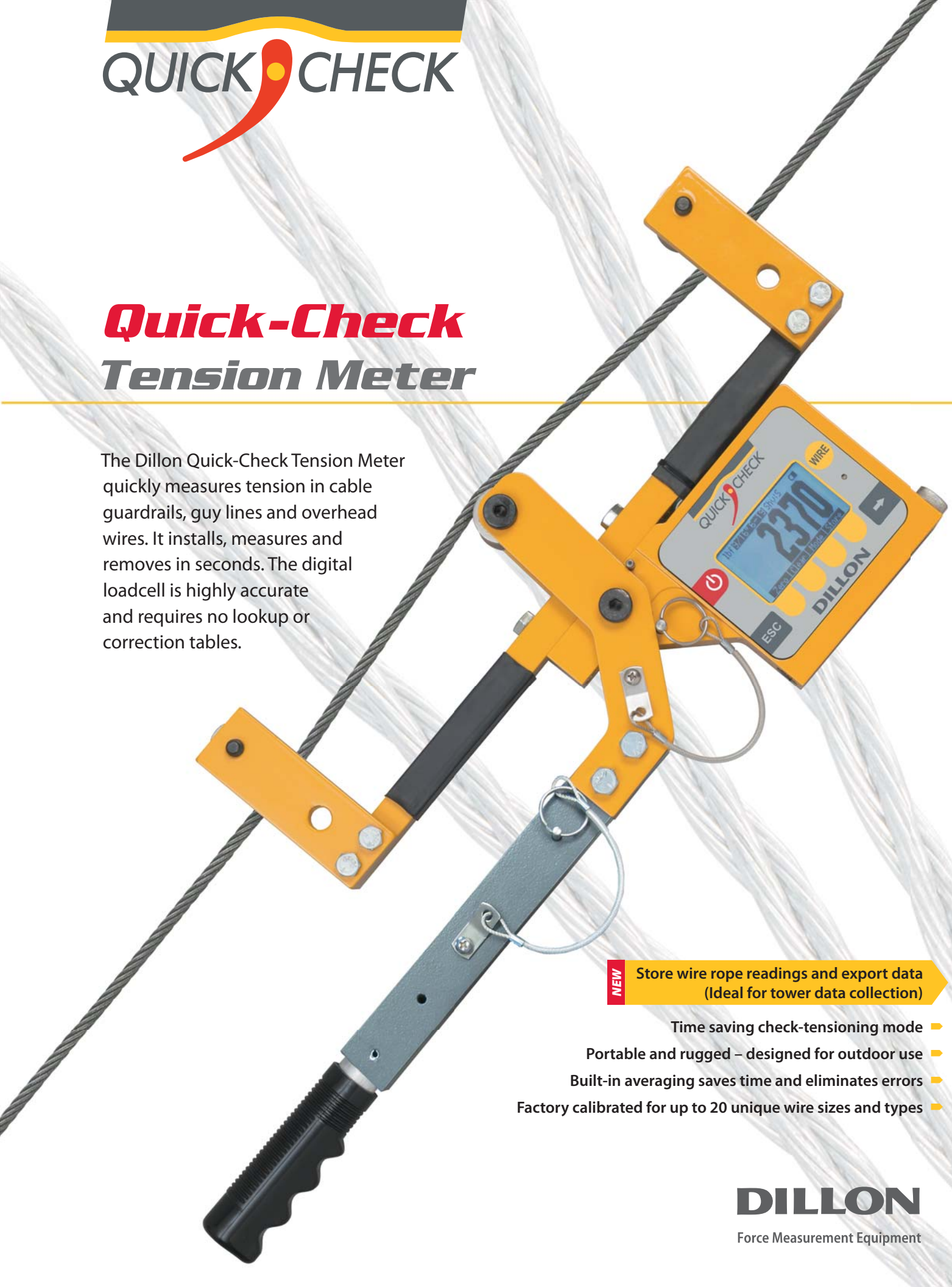
1.B.2

DILLION TENSION METER

QUICK CHECK

Quick-Check Tension Meter

The Dillon Quick-Check Tension Meter quickly measures tension in cable guardrails, guy lines and overhead wires. It installs, measures and removes in seconds. The digital loadcell is highly accurate and requires no lookup or correction tables.



NEW Store wire rope readings and export data (Ideal for tower data collection)

- Time saving check-tensioning mode
- Portable and rugged – designed for outdoor use
- Built-in averaging saves time and eliminates errors
- Factory calibrated for up to 20 unique wire sizes and types

DILLON

Force Measurement Equipment

Sheaves with bearings eliminate friction and provide the best accuracy

Accommodates a wide range of wire sizes and styles

Telescoping handle engages meter quickly with minimal effort

Highly visible yellow finish

Easy-to-read backlit display with full-text prompts

RS-232 Port

Easy to use soft-key interface

Uses popular AA batteries and has long life between changes

The Fastest Cable Tension Meter

The Dillon Quick-Check can be placed on a cable, measure its tension, and removed in under five seconds! There are no complex lookup tables, no conversion charts. The operator can quickly select from 20 different wire sizes and types stored in Quick-Check's memory. The Check-Tensioning mode graphically displays the current and target tensions for extremely quick setting of line tension. Even the infrequent battery changes are quick.

Broad Application

The Quick-Check can be employed in many industries to ensure proper tensioning. Typical applications include tower and stack guy wires, pretensioned cable barriers, bridges, elevators, winch rope, overhead electric transit wires, fall arrest systems, aircraft cables and utilities.

Specifications

Tension capacities:
2000 lb/10 kN/1000 kg
10,000 lb/45 kN/4500 kg

Wire sizes: 3/16 inch through 1 inch (4.75 mm through 25.4 mm)
View helpful ordering tips at dillon-force.com

Accuracy: ± 3% instrument capacity (calibrated to specific wire size and type.)

Loading error: Cable elongation of only 0.08 inch (2mm)

Display: Dot-graphic LCD display supports full text and 1 inch high digits.

Sheave range: Each set accommodates rated wire size and ½" smaller. Multiple sheave sets may be used.

Suggested wire calibrations: Calibrate each wire diameter needed with the most appropriate sheaves. If two wire types are used of the same diameter (e.g. ½" 1x7 and ½" 6x19), calibrate each type independently if accuracy is critical.

Environment protection:
Suitable for continued outdoor use.

Operating range:
-4° F to 158° F (-20° C to 70° C)

Tension units of measure:
pound-force, kilogram force, Newtons

Resolution: Configurable low/med/high

Product dimension: 9 x 24 x 3 inch (22 x 61 x 8 cm)

Product weight: Approx 11 lb (5 kg)

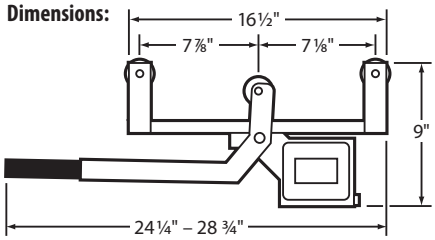
Shipping dimension:
28 x 16 x 8 inch (71 x 41 x 20 cm)

Shipping weight: 27 lb (12 kg)

Recalibration: At user discretion. Commonly 12-24 months; should be more frequent with heavy use. On-site recalibration may be possible through your Dillon distributor.

Approvals: CE

Dimensions:



RS-232 port

Carry case included

Dillon also manufactures highly accurate electronic and mechanical dynamometers and crane scales.

AUTHORIZED DISTRIBUTORS

Ask the experts. Dillon distributors offer complete service capabilities from application assistance to sales and product support. Their experienced representatives are the most knowledgeable experts that you will find in the force measurement industry. We recommend that you consult these capable specialists for all of your measuring needs.

DILLON USA

1000 Armstrong Drive
Fairmont, MN 56031

Toll-Free: (800) 368-2031
Phone: (507) 238-8796
Fax: (507) 238-8258

www.dillonforce.com

DILLON UK

Foundry Lane, Smethwick,
West Midlands B66 2LP

Phone: +44 (0) 845 246 6717
Fax: +44 (0) 845 246 6718
Email: sales@dillon-force.co.uk

www.dillon-force.co.uk

DILLON
Force Measurement Equipment

A division of Avery Weigh-Tronix, LLC

ISO 9001

4/17
Quick-Check_L_09987-0016.indd
AWT 09987-0016

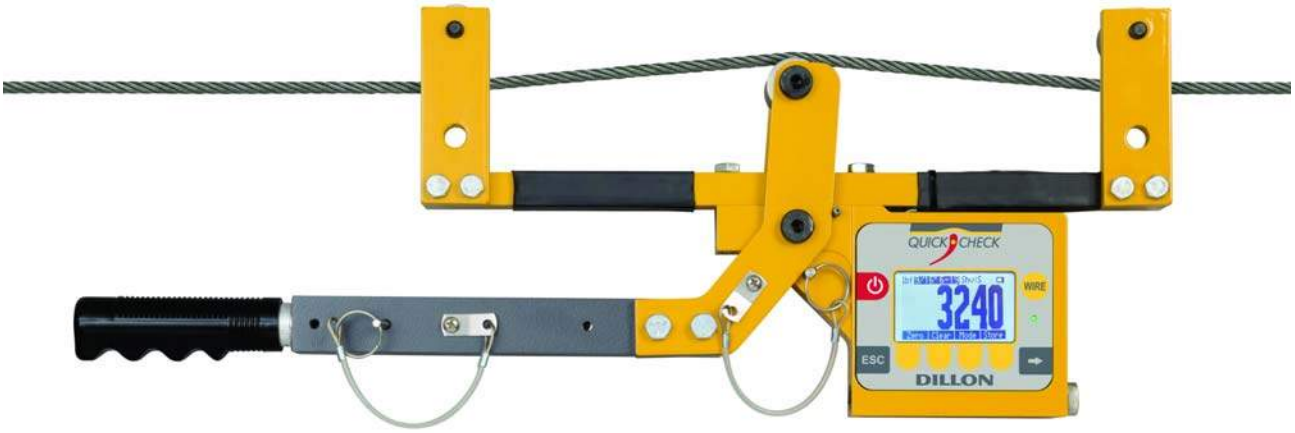
1.B.2.1

TENSION METER OPERATION

DILLON®

Quick Check "Red"

Tension Meter



CE

User Instructions

AWT35-501364
Issue AA

Table of Contents

1 General Information and Warnings

1.1 About this Manual

This manual is divided into chapters by the chapter number and the large text at the top of a page. Subsections are labeled as shown by the 1 and 1.1 headings shown above. The names of the chapter and the next subsection level appear at the top of alternating pages of the manual to remind you of where you are in the manual. The manual name and page numbers appear at the bottom of the pages.

1.1.1 Text Conventions

Key names are shown in **bold** and reflect the case of the key being described. This applies to hard keys and onscreen or soft keys.

Displayed messages appear in ***bold italic*** type and reflect the case of the displayed message.

1.1.2 Special Messages

Examples of special messages you will see in this manual are defined below. The signal words have specific meanings to alert you to additional information or the relative level of hazard.

CAUTION!
This is a Caution symbol.
Cautions give information about procedures that, if not observed, could result in damage to equipment or corruption to and loss of data.

NOTE: This is a Note symbol. Notes give additional and important information, hints and tips that help you to use your product.

1.1.3 Safe Handling of Equipment with Batteries

CAUTION: Danger of explosion if battery is incorrectly replaced. Replace only with the same or equivalent type recommended by the manufacturer. Dispose of used batteries according to the manufacturer's instructions.

ATTENTION: Il y a danger d'explosion s'il y a remplacement incorrect de la batterie, remplacer uniquement avec une batterie du même type ou d'un type équivalent recommandé par le constructeur. Mettre au rebut les batteries usagées conformément aux instructions du fabricant.

1.2 Routine Maintenance

IMPORTANT: This equipment must be routinely checked for proper operation and calibration.
Application and usage will determine the frequency of calibration required for safe operation.

1.3 Cleaning the Machine

Table 1.1 Cleaning DOs and DON'Ts

DO	DO NOT
Wipe down the outside of standard products with a clean cloth, moistened with water and a small amount of mild detergent	Attempt to clean the inside of the machine
	Use harsh abrasives, solvents, scouring cleaners or alkaline cleaning solutions
Spray the cloth when using a proprietary cleaning fluid	Spray any liquid directly on to the display windows

1.4 Training

Do not attempt to operate or complete any procedure on a machine unless you have received the appropriate training or read the instruction books.

To avoid the risk of RSI (Repetitive Strain Injury), place the machine on a surface which is ergonomically satisfactory to the user. Take frequent breaks during prolonged usage.

1.5 Sharp Objects

Do not use sharp objects such as screwdrivers or long fingernails to operate the keys.

1.6 FCC and EMC Declarations of Compliance

United States

This equipment has been tested and found to comply with the limits for a Class A digital device, pursuant to Part 15 of the FCC Rules. These limits are designed to provide reasonable protection against harmful interference when the equipment is operated in a commercial environment. This equipment generates, uses, and can radiate radio frequency energy and, if not installed and used in accordance with the instruction manual, may cause harmful interference to radio communications. Operation of this equipment in a residential area is likely to cause harmful interference in which case the user will be required to correct the interference at his own expense.

Canada

This digital apparatus does not exceed the Class A limits for radio noise emissions from digital apparatus set out in the Radio Interference Regulations of the Canadian Department of Communications.

Le présent appareil numérique n'émet pas de bruits radioélectriques dépassant les limites applicables aux appareils numériques de la Classe A prescrites dans le Règlement sur le brouillage radioélectrique edicté par le ministère des Communications du Canada.

European Countries

WARNING: This is a Class A product. In a domestic environment, this product may cause radio interference in which the user may be required to take adequate measures.

1.7 Declaration of Conformity (Quick Check Red)

DILLON

Dillon is part of Avery Weigh-Tronix
Foundry Lane, Smethwick, West Midlands, B66 2LP, England

CE

Declaration of Conformity | **Konformitätserklärung**
Verklaring van Overeenstemming | **Dichiarazione di conformità**
Déclaration de Conformité | **Declaración de Conformidad**

Manufacturer	Avery Weigh-Tronix
Type	Dillon Quick Check "Red"
corresponds to the requirements of the following EC directives:	
EMC Directive	2004/108/EC
Low Voltage Directive	2006/95/EC
The applicable harmonised standards are:	
EN61000-6-1:2007 EN 60950–1 : 2006 +A2:2013	EN61000-6-3:2007+A1:2011

ITW Ltd trading as Avery Weigh-Tronix
Foundry Lane, Smethwick,
West Midlands, B66 2LP, England

Reg. Office: Admiral House, St Leonards Road,
Berkshire SL4 3BL, England
Registered in England No. 00559693

Fabrikant	Avery Weigh-Tronix
Type	Dillon Quick Check "Red"
is in overeenstemming met de voorschriften van de volgende EG richtlijnen:	
EMC Richtlijn	2004/108/EG
Laagspanningsrichtlijn	2006/95/EG
Toegepaste geharmoniseerde normen:	
EN61000-6-1:2007 EN 60950–1 : 2006 +A2:2013	EN61000-6-3:2007+A1:2011

ITW Ltd trading as Avery Weigh-Tronix
Foundry Lane, Smethwick,
West Midlands B66 2LP,Engeland.

Reg. Kantoor: Admiral House, St Leonards Road,
Berkshire SL4 3BL , Engeland.
Geregistreerd in Engeland nr: 00559693

Fabricant	Avery Weigh-Tronix
Type	Dillon Quick Check "Red"
correspond aux exigences des directives CE suivantes :	
Directive CEM	2004/108/CE
Directive Basse Tension	2006/95/CE
Les normes harmonisées applicables sont :	
EN61000-6-1:2007 EN 60950–1 : 2006 +A2:2013	EN61000-6-3:2007+A1:2011

ITW Ltd trading as Avery Weigh-Tronix
Foundry Lane, Smethwick,
West Midlands, B66 2LP, Angleterre

Siège social : Admiral House, St Leonards Road,
Berkshire SL4 3BL, Angleterre
Enregistré en Angleterre sous le numéro : 00559693

Hersteller	Avery Weigh-Tronix
Typ	Dillon Quick Check "Red"
entspricht den Anforderungen folgender EG–Richtlinien:	
EMV-Richtlinie	2004/108/EG
Niederspannungs Richtlinie	2006/95/EG
Die angewendeten harmonisierten Normen sind:	
EN61000-6-1:2007 EN 60950–1 : 2006 +A2:2013	EN61000-6-3:2007+A1:2011

ITW Ltd trading as Avery Weigh-Tronix
Foundry Lane, Smethwick,
West Midlands, B66 2LP, England

Reg. Office: Admiral House, St Leonards Road,
Berkshire SL4 3BL, England
Registered in England No. 00559693

Produttore	Avery Weigh-Tronix
Modello	Dillon Quick Check "Red"
è conforme alle caratteristiche previste dalle seguenti direttive CE:	
Normativa EMC	2004/108/CE
Normativa per la bassa tensione	2006/95/CE
Le norme standard armonizzate e nazionali applicate sono:	
EN61000-6-1:2007 EN 60950–1 : 2006 +A2:2013	EN61000-6-3:2007+A1:2011

ITW Ltd trading as Avery Weigh-Tronix
Foundry Lane, Smethwick,
West Midlands, B66 2LP, England

Sede legale: Admiral House, St Leonards Road,
Berkshire SL4 3BL, England
N. iscrizione al registro delle imprese inglese: 00559693

Fabricante	Avery Weigh-Tronix
Tipo	Dillon Quick Check "Red"
conforme a las exigencias de las siguientes directivas CE:	
Directiva CME	2004/108/CE
Directiva de baja tensión	2006/95/CE
Las normas armonizadas en vigor son:	
EN61000-6-1:2007 EN 60950–1 : 2006 +A2:2013	EN61000-6-3:2007+A1:2011

ITW Ltd trading as Avery Weigh-Tronix
Foundry Lane, Smethwick,
West Midlands, B66 2LP, Inglaterra.

Reg. Office: Admiral House, St Leonards Road,
Berkshire SL4 3BL, Inglaterra.
Registrado en Inglaterra bajo el n.º: 00559693

Signature/Name Handtekening/Naam Signature/Nom Unterschrift/Name Firma/Nome Firma/Nombre	K. Detert Global Head of R & D	Authorised signatory for Avery Weigh-Tronix Namens van Avery Weigh-Tronix Signataire autorisé d'Avery Weigh-Tronix Unterschriftsberechtigter für Avery Weigh-Tronix Firmatario autorizzato per Avery Weigh-Tronix Firmante autorizado para Avery Weigh-Tronix	Date Datum Date Datum Data Fecha 31 July 2014

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1.8 Declaration of Conformity (EDX PSU)

DILLON

Dillon is part of Avery Weigh-Tronix
Foundry Lane, Smethwick, West Midlands, B66 2LP, England

CE

Declaration of Conformity | **Konformitätserklärung**
Verklaring van Overeenstemming | **Dichiarazione di conformità**
Déclaration de Conformité | **Declaración de Conformidad**

Manufacturer	Avery Weigh-Tronix
Type	Dillon EDx PSU
corresponds to the requirements of the following EC directives:	
EMC Directive	2004/108/EC
Low Voltage Directive	2006/95/EC
The applicable harmonised standards are:	
EN61000-6-1:2007 EN 60950–1 : 2006 +A1:2009	EN61000-6-4:2007
ITW Ltd trading as Avery Weigh-Tronix Foundry Lane, Smethwick, West Midlands, B66 2LP, England Reg. Office: Admiral House, St Leonards Road, Berkshire SL4 3BL, England Registered in England No. 00559693	

Fabrikant	Avery Weigh-Tronix
Type	Dillon EDx PSU
is in overeenstemming met de voorschriften van de volgende EG richtlijnen:	
EMC Richtlijn	2004/108/EG
Laagspanningsrichtlijn	2006/95/EG
Toegepaste geharmoniseerde normen:	
EN61000-6-1:2007 EN 60950–1 : 2006 +A1:2009	EN61000-6-4:2007
ITW Ltd trading as Avery Weigh-Tronix Foundry Lane, Smethwick, West Midlands B66 2LP,Engeland. Reg. Kantoor: Admiral House, St Leonards Road, Berkshire SL4 3BL , Engeland. Geregistreerd in Engeland nr: 00559693	

Fabricant	Avery Weigh-Tronix
Type	Dillon EDx PSU
correspond aux exigences des directives CE suivantes :	
Directive CEM	2004/108/CE
Directive Basse Tension	2006/95/CE
Les normes harmonisées applicables sont :	
EN61000-6-1:2007 EN 60950–1 : 2006 +A1:2009	EN61000-6-4:2007
ITW Ltd trading as Avery Weigh-Tronix Foundry Lane, Smethwick, West Midlands, B66 2LP, Angleterre Siège social : Admiral House, St Leonards Road, Berkshire SL4 3BL, Angleterre Enregistré en Angleterre sous le numéro : 00559693	

Hersteller	Avery Weigh-Tronix
Typ	Dillon EDx PSU
entspricht den Anforderungen folgender EG–Richtlinien:	
EMV-Richtlinie	2004/108/EG
Niederspannungs Richtlinie	2006/95/EG
Die angewendeten harmonisierten Normen sind:	
EN61000-6-1:2007 EN 60950–1 : 2006 +A1:2009	EN61000-6-4:2007
ITW Ltd trading as Avery Weigh-Tronix Foundry Lane, Smethwick, West Midlands, B66 2LP, England Reg. Office: Admiral House, St Leonards Road, Berkshire SL4 3BL, England Registered in England No. 00559693	

Produttore	Avery Weigh-Tronix
Modello	Dillon EDx PSU
è conforme alle caratteristiche previste dalle seguenti direttive CE:	
Normativa EMC	2004/108/CE
Normativa per la bassa tensione	2006/95/CE
Le norme standard armonizzate e nazionali applicate sono:	
EN61000-6-1:2007 EN 60950–1 : 2006 +A1:2009	EN61000-6-4:2007
ITW Ltd trading as Avery Weigh-Tronix Foundry Lane, Smethwick, West Midlands, B66 2LP, England Sede legale: Admiral House, St Leonards Road, Berkshire SL4 3BL, England N. iscrizione al registro delle imprese inglese: 00559693	

Fabricante	Avery Weigh-Tronix
Tipo	Dillon EDx PSU
conforme a las exigencias de las siguientes directivas CE:	
Directiva CME	2004/108/CE
Directiva de baja tensión	2006/95/CE
Las normas armonizadas en vigor son:	
EN61000-6-1:2007 EN 60950–1 : 2006 +A1:2009	EN61000-6-4:2007
ITW Ltd trading as Avery Weigh-Tronix Foundry Lane, Smethwick, West Midlands, B66 2LP, Inglaterra. Reg. Office: Admiral House, St Leonards Road, Berkshire SL4 3BL, Inglaterra. Registrado en Inglaterra bajo el n.º: 00559693	

Signature/Name Handtekening/Naam Signature/Nom Unterschrift/Name Firma/Nome Firma/Nombre	K. Detert Global Head of R & D	Authorised signatory for Avery Weigh-Tronix Namens van Avery Weigh-Tronix Signataire autorisé d'Avery Weigh-Tronix Unterschriftsberechtigter für Avery Weigh-Tronix Firmatario autorizzato per Avery Weigh-Tronix Firmante autorizado para Avery Weigh-Tronix	1 April 2014	Date Datum Date Datum Data Fecha

76501-389 Issue 1

2 Introduction

This manual covers the setup and operation of the Quick-Check Clamp Line Tensiometer from Dillon. The Quick-Check is a simple, accurate strand dynamometer. It is can be clamped onto a cable, accurately determine the wire tension and be removed in seconds.

The Quick-Check can handle multiple wire diameters, it can display live tension, dual live/peak tension, average tension captured from several tests, and a check-tensioning graphical display.

With its battery-powered electronic interface, setup and operation is made simple with on-screen prompts.

This manual covers the following:

- Unpacking
- Setup
- Operation
- Maintenance
- Troubleshooting

2.1 Unpacking

When you receive your Quick-Check, unpack it and inspect the container and the instrument for any damage. Report any problems to the shipping company immediately and save the packing materials.

Insert 2 AA batteries into the battery compartment, shown in Figure 2.1. Your Quick-Check probably comes from the factory with the proper sheave size installed and calibrated for your application. If not, follow the setup directions later in section 3.0 Configuration Mode and section 4.0 Changing Sheaves.

The Quick-Check is shown in Figure 2.1 with the different parts labeled.

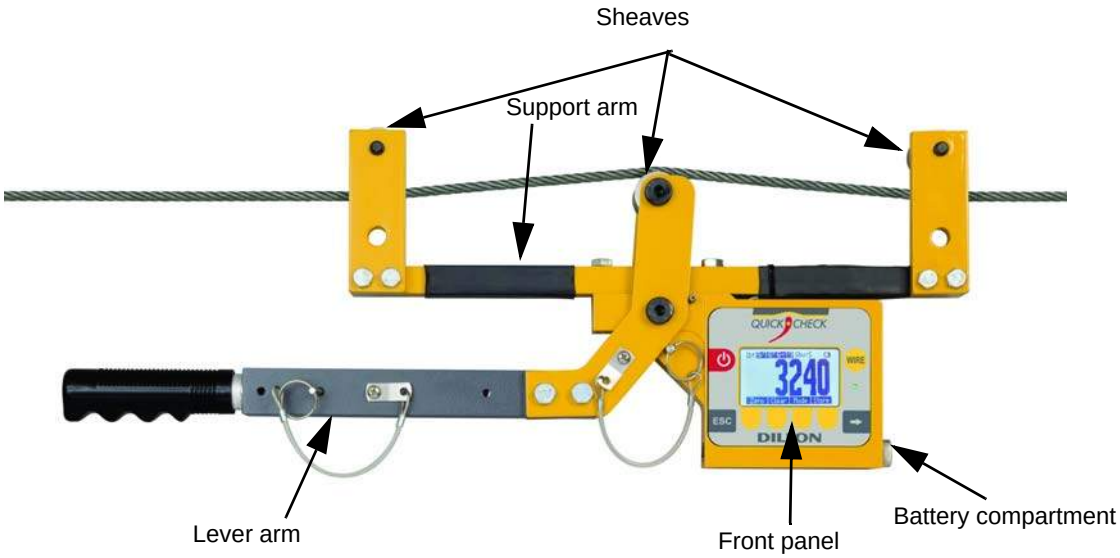


Figure 2.1 Quick-Check Parts

2.2 Front Panel and Keys

The front panel of the Quick-Check is shown in Figure 2.2. The light located under the WIRE button illuminates green when changes in the menu are stored, purple when in diagnostics or uploading firmware and red when powering the unit down.

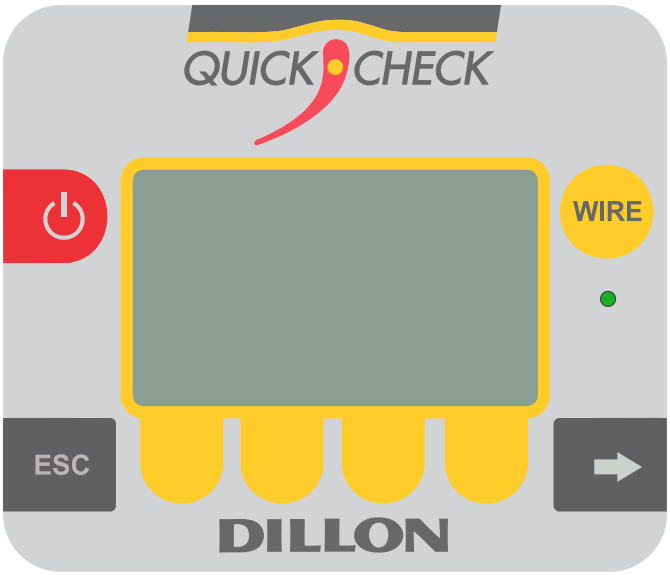


Figure 2.2 Quick-Check Front Panel

Following are descriptions of the keys and their functions:

ON/OFF key. Press this key to power up and turn off the Quick-Check.

ESC key. Press this key to escape an area of the menu or to clear the field when in data entry mode.

WIRE key. Press this key to change the wire diameter you are testing with the Quick-Check. Choose from the listed selection and when the desired size is highlighted, press the ENTER softkey. Up to 20 sizes available.

Soft key. Softkey function changes as needed for different tasks. The soft key labels appear above the keys themselves. You will use these for operation and configuration.

Arrow key. Press this key to reveal more softkeys in a group of softkeys.

2.3 Important Features

Quick to use	Attaches and removes from tensioned line in seconds. Quick-tensioning readout for ultra fast line tensioning.
Direct tension readings	No more complicated lookup charts! Save time and improve accuracy.
Portable & rugged	Designed for outdoor use.
Accurate	Employs Weigh Bar® technology used for precise weighing.
Multiple wire size storage	Stores up to 20 different calibrations.

2.4 Using Quick Check (Red) with EDXtreme PSU

The Quick Check can be connected to the EDX PSU via the Comm Port. This 120VAC/ 240VAC external power supply will supply power to the Quick Check instead of AA batteries.

2.4.1 Quick Check Connector

The connector on the Quick Check is recessed for protection. Lift the protective cap to access the connector. It is used to connect the instrument to a printer, PC or external power supply. See your Dillon distributor for details.

Figure 2.3 Quick Check Connector

2.4.2 External Power Supply

Plug the 4-pin end of the power supply cable into the Quick Check 4-pin connector located on the side of the unit. Plug the power supply adapter into an AC power outlet. Refer to Figure 2.4 for a photo of the external power supply.

Figure 2.4 External Power Supply Connection

Figure 2.5 External Power Supply (EDX PSU) (120 - 240 VAC 50 - 60 Hz)

3 Operation

Typical operation of the Quick-Check is covered below, followed by explanations of the various display modes, how to change wire size, how to change the unit of measure, etc.

3.1 Typical Operation

To perform a typical tension measurement, see the note below and follow these steps:

Take readings at three different places along the cable, moving the tension meter at least four inches for each reading. Take the average of the readings. The built-in average function is ideal for this task.

The handle quick release pin should be used when the Quick-Check is attached to a cable that will be de-tensioned and re-tensioned. The pin prevents the handle from opening once the tension falls to a small level. The pin should also be used if the Quick-Check will be installed for a prolonged period.

1. Turn the unit on by pressing the **ON/OFF** key…

   The display shows ***DILLON*** briefly, then, in this example, the screen shows the following:

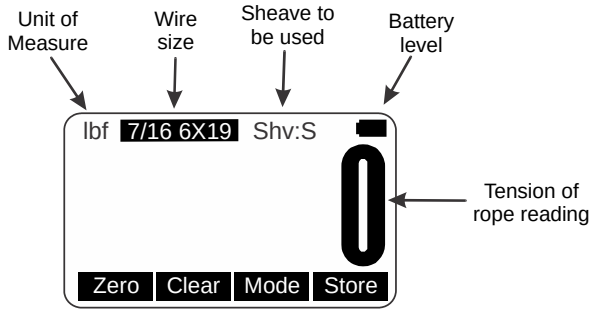


Figure 3.1 Sample Display

*Press the **WIRE** key to list the stored calibrations.*

2. This example shows the wire is a 7/16”, 6X19 stranded cable using the “S” Sheave and the unit of measure is lbf. Place the Quick-Check so the two outside sheaves hang on the wire. Insure that the wire rope is riding in the center groove for all three sheaves. See Figure 3.2. Press the **Zero** softkey to zero the display.

   0 should be displayed.

3. Raise the lever arm until it locks in the upright position to apply tension to the wire. Read the line tension on the display.

4. Release the lever arm and you are ready to perform another measurement.

Figure 3.2 Quick-Check Attached to Cable

3.2 Measurement Practices

For best measurement, install the Quick-Check at least 2 feet (0.6 m) from terminations, clamps or other hardware. Do not install over the top of wire wrappings.

Take readings at three different places along the cable, moving the tension meter at least four inches for each reading. Take the average of the readings. The built-in average function is ideal for this task.

WARNING: Do not apply tension greater than rated capacity of the instrument or overload damage to the sensor may result. Do not use the Quick-Check with cable larger than indicated on the sheaves. Overload and damage to the instrument may result. Do not mix sheave sizes. This will result in inaccurate measurement and possible overload.

Do not use the Quick-Check to measure tension for wires if any of the following are true:

1. No wire calibrations are stored of the same diameter as the wire you are looking to measure, and/or
2. You do not have sheaves of the same diameter.

If both of these conditions exist, contact your Dillon distributor.

Contact your Dillon distributor to improve accuracy for a specific wire type by calibrating to it.

Insure that the wire rope is riding in the center of the groove for all three sheaves.

Insure sheaves installed agree with sheaves noted in the Wire calibration. **Exception:** Sheaves match the wire diameter of the cable to be measured and alternate calibration is selected as per section 5.2.

The Quick-Check has an internal temperature sensor inside the electronics cavity. Dramatic temperature changes (such as moving from a warm vehicle to cooler outdoors) requires time for the sensor to reach the same temperature. Direct sunlight will heat the electronics cavity and cause higher readings than actual ambient temperature. **NOTE: The temperature is only for the Quick Check electronics and does not compensate for the temperature of the wire rope.**

For best tension accuracy, use the exact temperature of the wire along with the cable manufacturer's temperature compensation chart. This may be widely different from the ambient temperature if the cable has been sitting in direct sunlight.

3.3 Softkey Functions

Now that you've seen a simple operation, we'll explain the softkey functions. Figure 3.3 shows the softkeys available during normal operation.

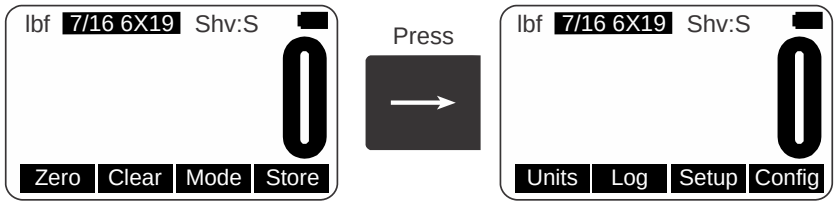


Figure 3.3 Normal Mode Softkeys

3.3.1 Top level Softkeys

At any time, press the **ESC** key to return to the normal operating mode. If changes have been made to the configuration, you will be prompted to save them (Yes) or abort the changes (No) before exiting the configuration mode.

Zero

Press this softkey to zero the force display. You would usually press this at the beginning of a series of tension tests but would not need to do it for every test unless there is some zero drift.

Clear

Press this softkey and you are prompted to clear the Peak reading or the Average. Make your choice by pressing the appropriate softkey and that value is cleared from memory.

Mode

Press the **Mode** key to scroll through the four display modes. These are explained below:

Live Tension Mode: The display shows the live tension.

Dual Peak Mode: The display shows the live tension on the top display and the peak force achieved on the bottom display. To clear the peak, remove any force on the Quick-Check, press the **Clear** softkey and follow the prompts.

Average Capture Mode: This mode shows the live tension in the top display and the average of all captured readings on the bottom display. To capture a reading and add it to the average, press the **Store** softkey when a force is applied to the Quick-Check. Follow the prompts to add (or not) the reading to the average. NOTE: Must set Log>Setup to Disabled for the Average Mode to work.

Check-tensioning Mode: Check-tensioning mode permits quick & easy graphical view of the applied tension versus the desired tension. This mode works well when you are repeatedly tensioning to the same tension range. This mode displays a bar graph representation of the tension being applied. See Figure 3.4. The black bar represents the range of the wire, from zero to ultimate wire rating. The wide white band is the tolerance window based on upper and lower thresholds you can enter. The live force is represented by the arrow and the white line on the black bar. When the force gets within ±5% of the acceptance window, a close-up of the acceptance window is displayed. See bottom example in Figure 3.4.

NOTE: Upper and lower thresholds are set in the Configuration WIRE menu. See page 27.

The Quick-Check has automatic tension targeting. Points may be entered from a linear Tension supplied table for a wire cable.

Display when tension is below the dotted, target box.

Display when tension falls within the dotted, target box.

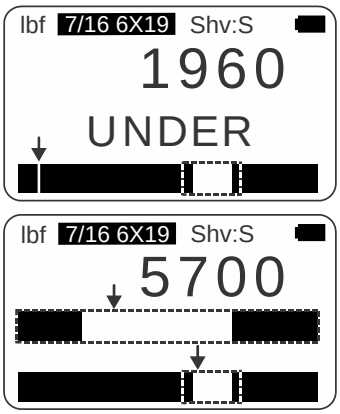


Figure 3.4 Check Tension Display

To exit the check-tension mode, press any softkey to display the softkey labels, then press the **Mode** softkey to scroll to the next mode. The next mode is the first mode that was described, live tension mode.

Store

Press the **Store** softkey to store and add a displayed tension to the average of other entered readings. Follow the onscreen prompts.

When Multi Leg/Wire is enabled in Log>Setup menu, each leg is identified by a letter rather than a number (A - I). Each tension wire (guy wire) is identified by a number. When the **Store** softkey is pressed, leg with be displayed. If more than one leg, use the **Sel** keys to select the desired Leg. Press **Enter** to go to the wire selections. Use the **Num** keys to select the wire number. Press **Enter** to store the tension reading. Refer to page 21 for more details.

Press the  key to move to the next set of softkeys.

Units

Press this key to set the Quick-Check for displaying:

- Force in lbf, kgf or N

Log

Log mode is used to log/record force and peak data. Press this softkey to view the number of records logged. This can be done on each lift, during a timed duration, during an overload or on Print key operation.

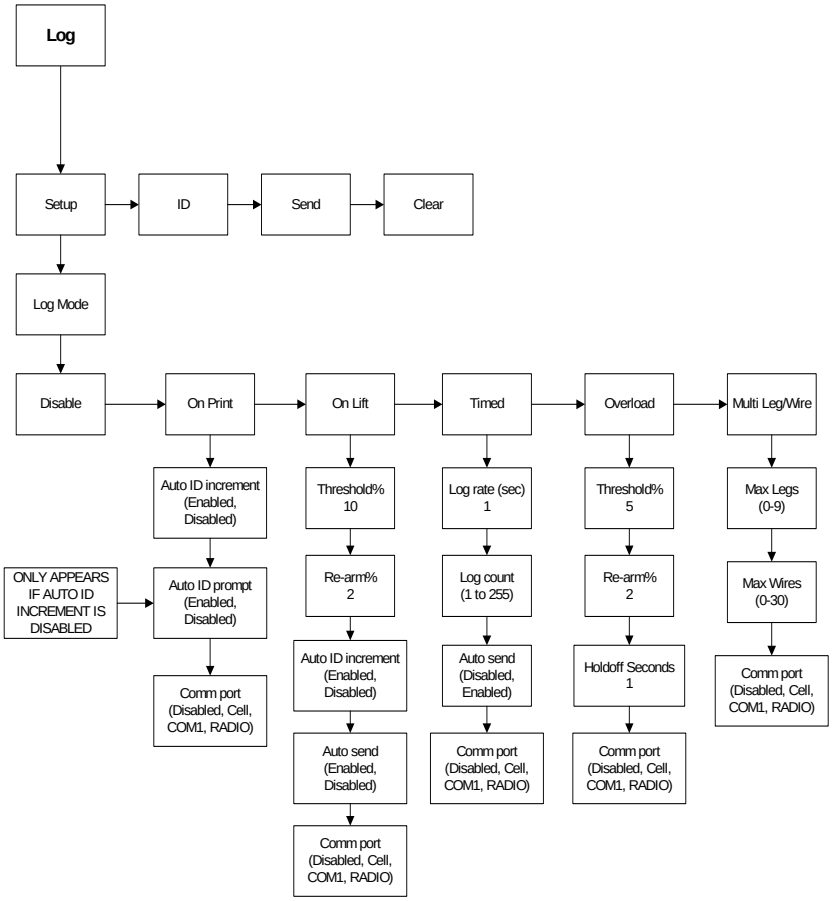


Figure 3.5 Log Menu

Note: All Log Modes will record Date and Time along with it's force and peak reading.

Setup:

Setup allows the user to configure how the Quick Check stores data internally. This stored data can be downloaded via the 4 pin Lemo to a PC via a keyboard wedge or other device.

- Log Mode:

  Disable: Turns the log feature off.

  On Print: Used when the operator wants to do a lift and store of the force and peak.

  Auto ID Increment: Enable/Disable
  This will increment the ID by 1 every time the "PRINT" key is pressed and store it with each force and peak.

  Auto ID Prompt: Enable/Disable (will only appear if Auto ID Increment is Disabled)

  If "Enabled", the operator will be prompted to key in an ID before storing that ID with the force and peak.

  Comm Port:
  This allows you to choose where to export the "ON PRINT" logged data.

  a. Cell = Setup Cell for data export (4 pin Lemo)
  b. Com1 = Not used
  c. RADIO = Future development
  d. Disabled = to turn off

  On Lift: Used when the operator wants the load to be automatically stored, once the load becomes stable. Note: additional filtering may be required, as the load must be steady before the load will be recorded. Maximum Records = 255

  Threshold %: (based on capacity)
  This is the load above where the unit will record the stable load.

  Re-arm: (based on capacity)
  This is the load the force must drop below before the "ON LIFT" will reset (re-arm) and store another load.

  Auto ID Increment: Enable/Disable
  This will increment the ID by 1 every time the "PRINT" key is pressed and store it with each force and peak.

  Auto Send: Enable/Disable
  Can export the readings live if enabled.

Comm Port:

This allows you to choose where to export the "ON PRINT" logged data.

a. Cell = Setup Cell for data export (4 pin Lemo)
b. Com1 = Not used
c. RADIO = Future development
d. Disabled = to turn off

Timed: This is used when the operator wants to record a live load/pull and store it internally. Can store up to 255 force readings.

Log Rate:

The speed at which the logging of force will be recorded. Based on seconds (Example 5 sec = Unit will record the force once every 5 seconds)

Log Count:

This is how many logs the operator wants to record. Range is 0 to 255 recorded readings.

Auto Send: Enable/Disable

Can export the readings live if enabled.

Comm Port:

This allows you to choose where to export the "ON PRINT" logged data.

a. Cell = Setup Cell for data export (4 pin Lemo)
b. Com1 = Not used
c. RADIO = Future development
d. Disabled = to turn off

Overload: This is used when an operator or supervisor wants to know if their equipment is being overloaded. This will be a percentage based on capacity and will be below 100% of the Quick Check. (This not the same as the 120% overload that the Quick Check records based on capacity.) Maximum Records = 255

Threshold %: (based on capacity)

This the percentage above where the unit will record the peak load.

Re-arm %: (based on capacity)

This is the load percentage the force must drop below before the "OVERLOAD" will reset (re-arm) and store another load.

Holdoff Seconds:

Once the unit has recorded this overload, how much time will pass before this unit will re-arm and allow to record the overload again.

Comm Port:

This allows you to choose where to export the "ON PRINT" logged data.

a. Cell = Setup Cell for data export (4 pin Lemo)
b. Com1 = Not used
c. RADIO = Future development
d. Disabled = to turn off

Multi Leg / Wire: This is used to measure tension on tower guyed wires. The readings can be stored (refer to page 18).

Max Legs:

Enter the number of legs the tower has.

Max Wires:

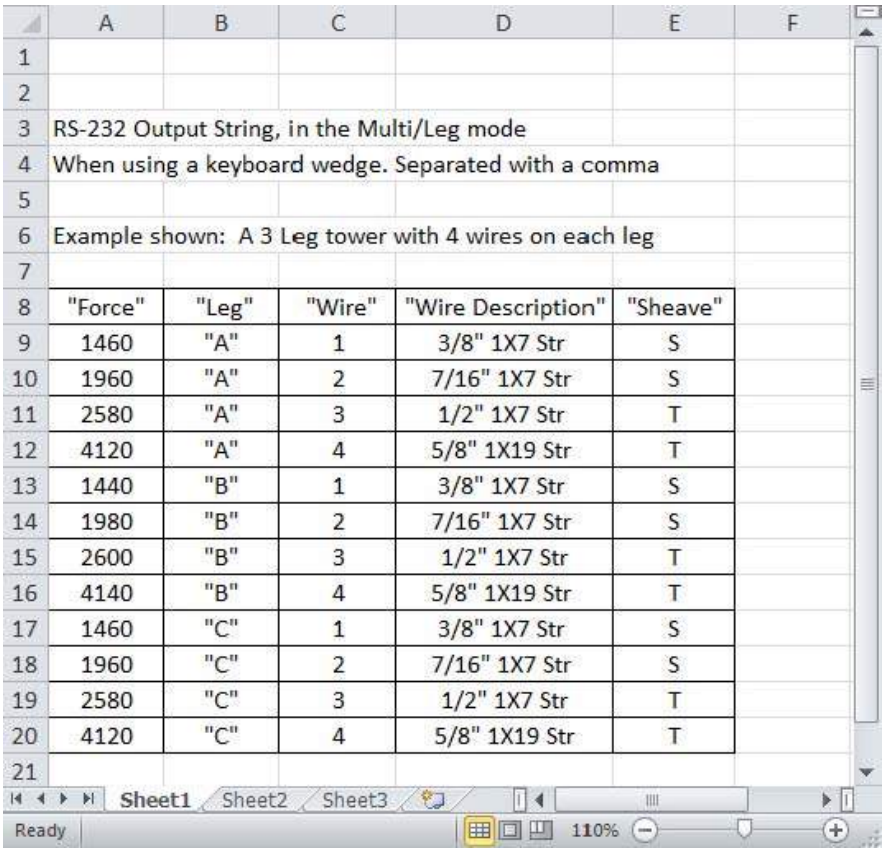
Enter the number of guy wires each leg has.

Comm Port:

This allows you to choose where to export the "ON PRINT" logged data.

a. Cell = Setup Cell for data export (4 pin Lemo)
b. COM1 = Not used
c. RADIO = Future development
d. Disabled = to turn off

The data will be exported to a computer via RS-232. Dillon recommends using “WedgeLink” software as a keyboard wedge. The data needs to be comma delimited and can be exported to an Excel spreadsheet. Refer to Figure 3.6 for an example.



	A	B	C	D	E	F
1						
2						
3	RS-232 Output String, in the Multi/Leg mode					
4	When using a keyboard wedge. Separated with a comma					
5						
6	Example shown: A 3 Leg tower with 4 wires on each leg					
7						
8	"Force"	"Leg"	"Wire"	"Wire Description"	"Sheave"	
9	1460	"A"	1	3/8" 1X7 Str	S	
10	1960	"A"	2	7/16" 1X7 Str	S	
11	2580	"A"	3	1/2" 1X7 Str	T	
12	4120	"A"	4	5/8" 1X19 Str	T	
13	1440	"B"	1	3/8" 1X7 Str	S	
14	1980	"B"	2	7/16" 1X7 Str	S	
15	2600	"B"	3	1/2" 1X7 Str	T	
16	4140	"B"	4	5/8" 1X19 Str	T	
17	1460	"C"	1	3/8" 1X7 Str	S	
18	1960	"C"	2	7/16" 1X7 Str	S	
19	2580	"C"	3	1/2" 1X7 Str	T	
20	4120	"C"	4	5/8" 1X19 Str	T	
21						

Figure 3.6 Example of Tower Data

ID:

An operater can key in either a User ID number or a Lift ID assigned to a particular product. This is a numeric number only and can be any number from 1 to 65,000. (if you want to turn the ID off, key in 0).

Note: ID not used in Multi Leg/Wire mode.

Send:

This will export/send the Log information out the configured port.

Clear:

This will clear any data in the Log mode. Clearing "On Lift", "Timed", "Overload" and Multi Leg/Wire stored data.

Auto-off can preserve battery life.

Setup

Press the **Setup** softkey and you will see these choices; ***Power***, ***PtFmt***, ***Misc***, ***About***, ***Test*** *and* ***Clock***. These are described below:

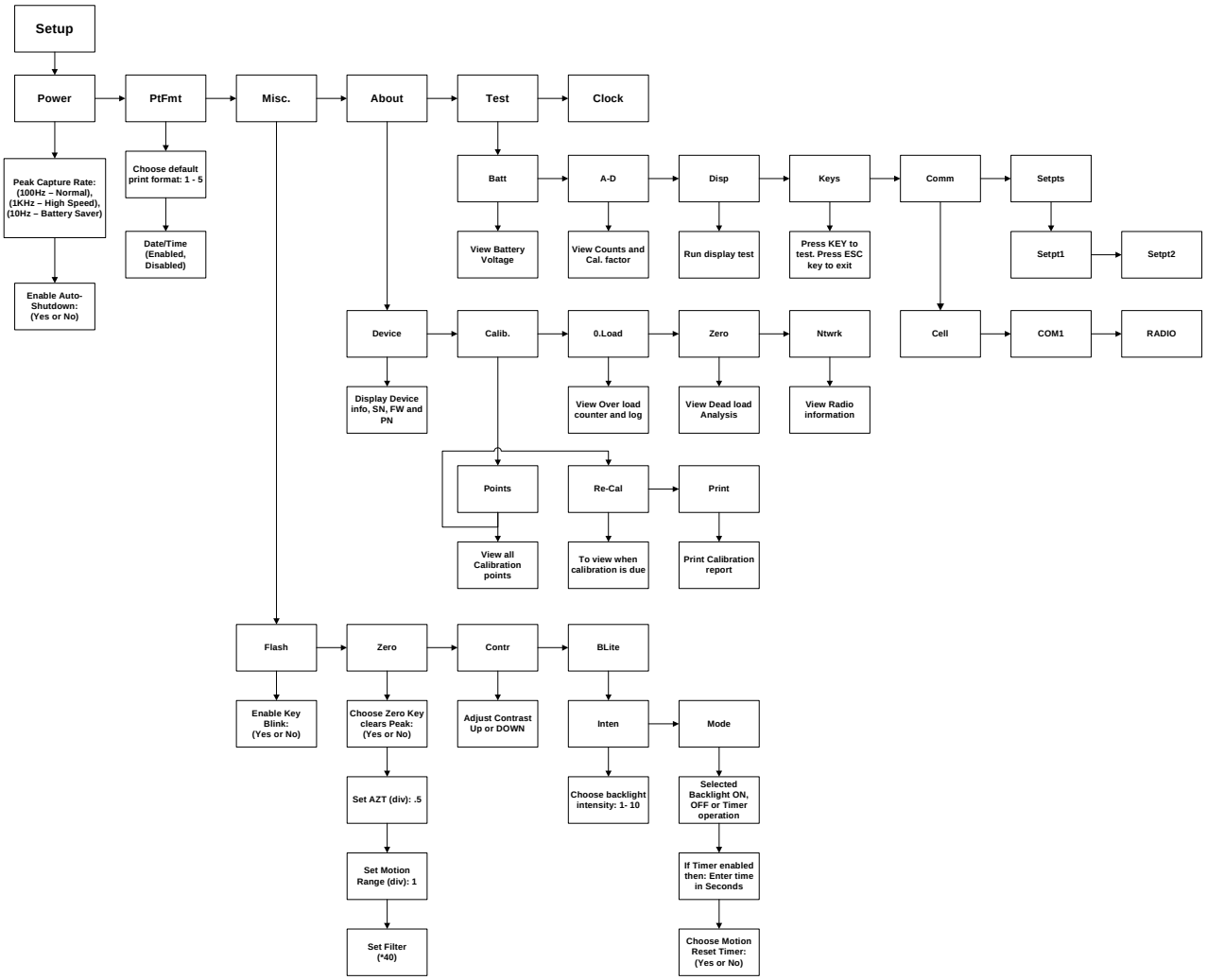


Figure 3.7 Setup Menu

Power:

Use this to set power management features

- **Peak Capture Rate** - Select a Peak Capture Rate by using the **Sel** keys to scroll through the choices. Choices are 100Hz - Normal, 1kHz - High Speed, and 10Hz - Battery Saver (default). Press **Enter** to accept the displayed setting.

Be aware that 1kHz - High Speed mode will consume more battery power.

- **Enable Auto-Shutdown** - Auto-Shutdown powers off the instrument automatically. If Yes is chosen, the following options will be displayed:

  Shutdown Timer (Min): Program to shut down after a period of inactivity.

  Shutdown Type: Select a method of shutdown.

  Fixed: Set the amount of time for the unit to shut off

  No Load: No load of the tension meter

  No Change: No change in weight

PtFmt:

- **Default Print Format**
- **Print time and date**

Misc:

Press this softkey to set the following:

- **Flash** - Enables or disables the momentary blinking of the display to acknowledge a key press.
- **Zero** - Enables the use of the **Zero** softkey to clear a peak tension value.
- **Contr** - Press this key to adjust the contrast of the LCD display. Press the **Up** soft key to lighten the contrast. Press the ***Down*** softkey to darken the contrast.

  There is a keypad shortcut for increasing and decreasing contrast. While in normal display mode press the **Arrow** key and the 2nd softkey simultaneously to increase contrast. Press the **Arrow** key and first softkey simultaneously to decrease contrast.

- **Blite** - Press this key to adjust the backlight brightness and sleep timer functions.

  Inten- Backlight intensity can be set to a value of 1 - 10. Default backlight value is 1.

  Press **Arrow** key and **F4** simultaneously to increase intensity.

  Press **Arrow** key and **F3** simultaneously to decrease intensity

  Mode- Select Backlight to operate as always “On”, “always Off” or the backlight can operate from a configurable “Timer”.

  If set to Timer, the operator will be asked to enter the Time in Seconds, after motion stops that the backlight will shut off.

  The next selection will allow the user to configure if motion resets timer. Choose Yes or No to have motion reset the Timer which turns off the backlight.

Use of the backlight will affect battery life.

About:

Press this softkey to see the following information:

- **Device** - Press this softkey to show a list of information about the Quick-Check; serial number, capacity rating, hardware and software revision levels. Press any key to return to the previous softkey set.
- **Calib** - Press this softkey to show Calibration Points and the calibration information for the current wire size. Follow the on-screen prompts.
- **O. Load** - Press this softkey to show an audit count of the number of times the unit has been overloaded beyond 120% of capacity and the actual hours the unit is on (On Time). Press any key to return to the previous softkey set.
- **Zero** - Press this softkey to show the deadload analysis of the Quick-Check. Press any key to return to the previous softkey set.
- **Ntwrk** - Displays network information (Radio, Name, ID#). Future development.

Test:

Press this softkey and the following softkeys appear:

- **Batt** - Press this softkey to test the battery level.
- **A-D** - Press this softkey to display the A to D counts.
- **Disp**. - Press this softkey to perform a test of the display pixels.
- **Keys** - Press this softkey to test the keypad.
- **Comm** - Press this softkey to test the RS-232 in a loopback test (Cell). Com1 is not used.
- **Setpts** - Not used in the Quick-Check.

Clock

Enter the date and time. Use the **Num** softkeys to enter the correct number and use the **Adv** softkey to advance the cursor. When the entry is correct, press the **Enter** softkey.

Config

This is a password protected menu. See *Configuration Mode* *on page 26*.

4 Configuration Mode

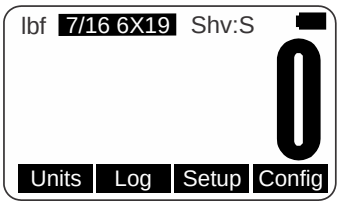
4.1 Accessing the Configuration Mode

You need to access the Configuration mode to perform certain tasks. Access to some of these tasks may be restricted by a supervisor password.

To access Configuration mode:

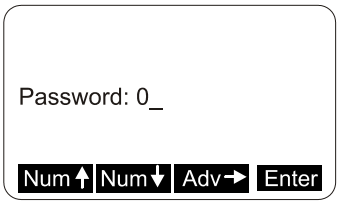
1. From normal operating mode, press the **Right Arrow** softkey…

   A new softkey set, shown below, appears:



2. Press the **Config** softkey…

   The following is displayed:

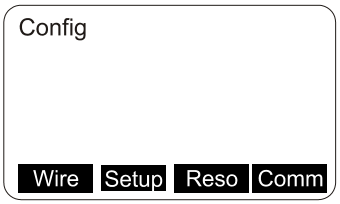


*The **Num** keys increment and decrement the displayed numbers. The **Adv** key moves the cursor to the next digit position.*

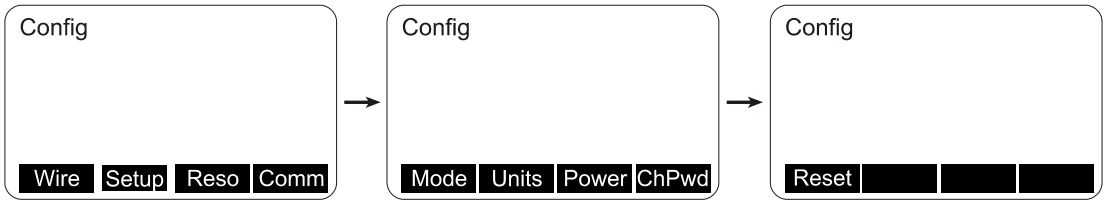
Default Configuration password is 0. If a new password is lost or forgotten, contact your Dillon distributor.

3. Use the **Num** and **Adv** keys to enter the Config password. Default is 0. After the number is displayed, press the **Enter** key…

   The following is displayed:



4. The unit is now in the Configuration mode. To see the rest of the softkeys available in this mode, press the Right Arrow key. All the Config softkeys are shown below.



The softkeys in the Configuration mode are **Wire**, **Setup**, **Reso**, **Comm**, **Mode**, **Units**, **Power**, **ChPwd**, and **Reset**. These are described below:

Wire

Press this softkey and the wire selection screen is displayed. Choose an existing wire to change its defining characteristics.

You have the choice of changing the ***Range***, which is used to set the check-tensioning function, or the ***Rating***, which is the maximum rating of the cable.

- **Range** - Use this item to set the parameters for the check tensioning display. Follow the prompts to set the following:

  Lower tension limit - This is the lowest acceptable force

  Upper tension limit - This is the highest acceptable force

  Units - Unit of measure used in defining the tension limit

- **Rating** - Press this softkey and you are prompted to set the ultimate rating for the cable being used and the unit of measure for that rating.

Setup

Press the **Setup** softkey to view the Setup softkeys. This is the same as the **Setup** softkey described in*Top level Softkeys on page 16*.

Reso

Press the **Reso** softkey and you are prompted to enter a display, or count-by, resolution. Choose from ***Low***, ***Medium*** or ***High***.

Low resolution provides the best stability and makes the display easiest to read. High resolution provides the finest graduations, but sees greater drift from wire creep and non-repeatability. If the reading is decreasing over time or differing between measurements on the same line, lowering the resolution will reduce these effects.

Comm

Communication output (COM1) and RADIO are not supported at this time in the Quick-Check. Press the **COMM** key to select Cell.

- **Cell** - Press this key to configure the RS-232 port (4 pin Lemo)
- COM1 - Not used
- RADIO - For specials and future development

Mode

Press this softkey to set the display mode on power up. Choices are ***Last****, ***Check***, ***Avg***, ***Peak***, and ***Force***. Use the **Sel** keys to display your choice and press **Enter** to accept it.

Units

Press this softkey to set the following:

Unit of measure on power up - Choices are ***Last****, ***C2***, ***C1***, ***N***, ***kgf***, and ***lbf***. Use the **Sel** keys to display your choice and press **Enter** to accept it. C2 and C1 are custom units. If you choose to have custom units, you are prompted to enter the number of pounds in each custom unit. The Quick-Check will then automatically calculate correct display for the applied force.

- **Enable lbf** - Enable or disable the pound-force unit of measure.
- **Enable kgf** - Enable or disable the kilogram-force unit of measure.
- **Enable N** - Enable or disable the N unit of measure.
- **Enable CUST1** - Enable or disable the Cust1 unit of measure.
- **Enable CUST2** - Enable or disable the Cust2 unit of measure.

Custom units of measure are handy when working with multi-part lines.

Power

Press this softkey to set the Peak Capture Rate and enable or disable the Auto-shutdown.

Select a Peak Capture Rate using the **Sel** key to scroll through the choices. Choices are 100Hz - Normal, 1kHz - High Speed, and 10Hz - Battery Saver (default). Press **Enter** to accept the displayed setting.

Be aware that 1kHz - High Speed mode will consume more battery power.

If you enable Auto-shutdown, you are prompted to set a period of time in minutes. Next, press the **Enter** softkey to accept this value. You are then asked to set the shutdown type; ***Fixed***, ***No Load***, or ***No Change***. These are described below;

- **Fixed** - The unit will shutdown after the set number of minutes no matter what happens.
- **No Load** - The unit will shutdown after the set number of minutes only if there is no load on the unit. This prevents shutdown in the middle of line tensioning.
- **No Change** - The unit will shutdown if there has been no keypad activity or change in tension after the set number of minutes.

ChPwd

Press this key and you are prompted to enter a new password to access the configuration menus. Use the softkeys to scroll in a new password and press the Enter softkey to accept it.

Default password is 0. If a new password is lost or forgotten, contact your Dillon distributor.

Reset

Press this key and you are asked if you wish to reset the system. Press the **Yes** softkey only if you want to reset the unit to factory default configuration. Press the **No** softkey to abort this and return to the previous screen.

5 Changing Sheaves

Do not use the Quick-Check with cable larger than indicated on the sheaves. Overload and damage to the instrument may result.

Do not mix sheave sizes. This will result in inaccurate measurement and possible overload.

As you use the Quick-Check on different diameter cables you must change to the correct sheave size. To change sheaves, remove the hex head screws pointed out in Figure 5.1 below. Replace the sheaves with the correct letter sheave and reinsert the screws and tighten.

Insure sheaves installed agree with sheaves noted in the Wire calibration.

Exception: Sheaves match the wire diameter of the cable to be measured and alternate calibration is selected as per the section *Calibration to Specific Wire Type* *on page 31*.

Insure that the wire rope is riding in the groove of all three sheaves.

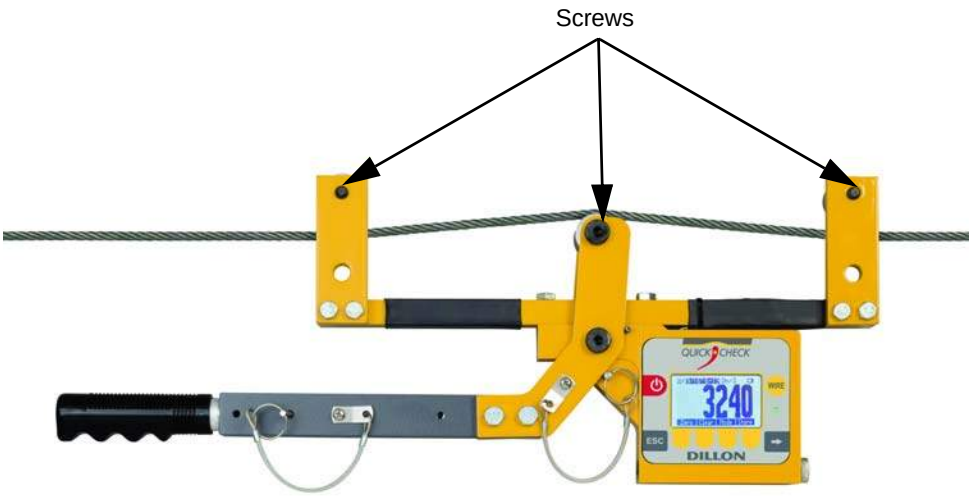


Figure 5.1 Changing Sheaves

6 Achieving Best Accuracy

6.1 Accuracy

The Quick-Check is an instrument designed to give accuracy that typically exceeds normal requirements for wire tensioning. You should have an understanding of what factors affect tension measurement accuracy.

6.2 Calibration to Specific Wire Type

While it is best to have the instrument calibrated to the specific wire size(s) and type(s) used, the Quick-check can often work adequately in other situations. If the best tension accuracy is required, Dillon recommends that a calibration be performed for that specific wire size and type.

Contact your Dillon distributor for any additional calibrations you may need.

Do not use the Quick-Check to measure tension for wires if either of the following are true:

1. No wire calibrations are stored of the same diameter as the wire you are looking to measure, and
2. You do not have sheaves of the same diameter.

If either of these conditions exist, contact your Dillon distributor.

Contact your Dillon distributor to improve accuracy for a specific wire type by calibrating to it.

6.3 Loading Error

A tensiometer works by deflecting the cable, which makes the cable path longer than when a tensiometer is not installed. When the tensiometer is removed, the wire tension decreases as the cable length is restored. This effect is known as loading error. The Quick-Check design elongates the cable by a mere 0.08 inch (2 mm), making loading errors extremely small.

6.4 Non-repeatability

The Quick-Check's sheave with bearing design provides the best mechanical performance. It is also superior at detecting tension that is being added or removed.

6.5 Non-linearity

Most three-point tension meters employ only linear characterization and have large errors at the midpoints (up to 15%). The Quick check uses multi-point segmenting to correct for non-linearity, reducing it to less than 0.2%.

6.6 Wire Characteristics

Creep Every material including steel exhibits creep under load. It will neck down over time, quite quickly over the first few seconds and much slower as time progresses. A wire cable also sees creep from the wire spacing and wind. This effect is seen as a display that drifts lower after it has been clamped in line.

Variations Material that varies in diameter or shape will have different output at the same tension

Strands The best cable assembly is one that is perfectly round, as it will not change contact geometry with the wire twist. The closer the wire cable cross section appears to be round, the better the measurement performance will be.

7 Troubleshooting

7.1 Quick Check

Problem	Possible Cause	Solution
Powers on momentarily and turns off	Low battery	Replace with high quality alkaline batteries
	Bad keypad	Have unit serviced
Does not power on	Low battery	Replace with high quality alkaline batteries
	Batteries installed backwards or no spring contact	Insure that positive terminals of both batteries (nub) face inward – towards the black cap. Check that spring is attached to the battery cap.
	Software reset	Remove battery cap & reinstall after one minute. Attempt to turn power on again.
	Display contrast too light	Hold the Right Arrow key down while pressing the F2 key several times to increase the display contrast. If nothing occurs, release both keys. Press the power button and try again.
	Bad keypad	Have unit serviced
Display is completely dark	Display contrast too dark	Hold the Arrow key down while pressing the F1 key several times to decrease the display contrast.
Display drifts downward once installed	Wire material is creeping and internal friction between wires is relieved.	This is normal behavior of wire. Lower display resolution to mask this effect.

7.2 EDX PSU

Problem	Possible Cause	Solution
Quick Check powers on momentarily and turns off	Low battery Bad keypad	Replace with high quality alkaline batteries. Do not use rechargeable batteries. Have unit serviced.
Quick Check does not power on	Low battery Bad keypad	Replace with high quality alkaline batteries. Do not use rechargeable batteries. Have unit serviced.
	Batteries installed backwards or no spring contact	Insure that positive terminals of both batteries (nub) face inward – towards the black cap. Check that spring is attached to the battery cap.
	Software reset	Remove battery cap & reinstall after one minute. Attempt to turn power on again.
	Display contrast too light	Hold the Right Arrow key down while pressing the F2 key several times to increase the display contrast. If nothing occurs, release both keys. Press the power button and try again.
	EDX PSU Power Supply	Remove Power Supply and install batteries to see if the Quick Check or Communicator II will power up. Return EDX PSU to factory for repair/ troubleshooting.
Display is completely dark	Display contrast too dark	Hold the Arrow key down while pressing the F1 key several times to decrease the display contrast.
Quick Check does not appear accurate	Check installation & system	Insure that shackles are in good working condition and aligned straight. Verify system is applying force directly through the dynamometer with no off center or torsional loads being applied to the instrument.
	Local gravitational variances	If being compared against dead-weights, check your local gravitational constant. Use custom units to compensate or calibrate on-site.
	Check repeatability	Place Quick Check in low-resolution mode. Lift an arbitrary weight several times as close to capacity as possible. Record each weight reading. Do the readings differ from each other? Calculate the standard deviation of the readings using a spreadsheet such as Microsoft Excel. See if the deviation is greater than 0.1% of the instrument capacity.
	Compare against a reference load.	Place Quick Check in low-resolution mode. Apply a known load near instrument capacity. Check calibration date.
Radio communications not working at all	Dead batteries. Distance is excessive, dead radio pocket	Bring remote closer to dynamometer. Allow several seconds to retrain.
	Operating channels mis-matched	Remote and link must be on the same operating channel. See Quick Check and Communicator configurations of COM1 for radio (under Comm menu) and Common Configurations.
	Excessive radio noise or interference in environment	Remove dynamometer and Communicator from the environment. Attempt communications in an area free of local radio signals. See Radio Information section of the manual.
Remote reading changes to dashes	Low batteries, lost communications	See steps above for improving communications.
Display locks up on DILLON marquee	Poor connection between Quick Check and Communicator	Remove batteries from Quick Check and Communicator, replace them and power up.

8 Specifications

Power

2 AA, common alkaline batteries.

Display

Dot graphic LCD display

Operational Keys

Power, Wire, Escape/Clear (ESC), Next () and four softkeys with changing function and label, depending on the specific menu in use

Operational Annunciators

Unit of measure, battery level

Display Resolution

2,000 lbf/ 10 kN/ 1000 kgf Quick-Check instrument:

	Displayed resolution setting		
	Low	Med	High
lbf (pound-force)	10 lbf	5 lbf	2 lbf
kgf (kilogram-force)	5 kgf	2 kgf	1 kgf
N (Newton)	50 N	20 N	10 N
Custom units	between 101 & 200 divisions	between 201 & 500 divisions	between 501 & 1000 divisions

10,000 lbf/ 45 kN/ 4500 kgf Quick-Check instrument:

	Displayed resolution setting		
	Low	Med	High
lbf (pound-force)	50 lbf	20 lbf	10 lbf
kgf (kilogram-force)	20 kgf	10 kgf	5 kgf
N (Newton)	200 N	100 N	50 N
Custom units	between 101 & 200 divisions	between 201 & 500 divisions	between 501 & 1000 divisions

For ease of use, the display always counts by a multiple of 1, 2 or 5.

Available Options

Varied wire sizes

Operating Environment

Suitable for outdoor use

Dimensions

10″ x 23″ x 3″ (25 cm x 59 cm x 8 cm) approximately

Weight

11 lb (5 kg) approximately

8.1 EDX PSU Power Supply Specifications

Enclosure	Designed for indoor use
Input Voltage	100-240 VAC 50-60Hz, 0.55A
Output Voltage	5 VDC
Operating Temperature	-4 F to 158 F (20 to 70 C)
Connector	Sealed connector to be used with Quick Check
Approval	CE

AUTHORIZED DISTRIBUTORS

Ask the experts. Dillon distributors offer complete service capabilities from application assistance to sales and product support. Their experienced representatives are the most knowledgeable experts that you will find in the force measurement industry. We recommend that you consult these capable specialists for all of your measuring needs.

DILLON

a division of
Avery Weigh-Tronix
1000 Armstrong Drive
Fairmont, Minnesota U.S.A.

Toll-Free: (800) 368-2031
Phone: (507) 238-4461
Fax: (507) 238-8258
www.dillon-force.com

1.B.3

SYSTEM SUPPIERS LIST

	JOHN DAY DAM AVIAN ARRAY IMPROVEMENTS SYSTEM COMPONENTS		
ID #	COMPONENT	SUPPLIER	CONTACT INFO
1	VECTRAN ROPE	CORTLAND CABLE	JAUNTIA CARROLL 607-753-8276
2	WINCHES	THERN WINCH THROUGH RASMUSSEN COMPANY OR CONTACT THROUGH THERN MANUAL	RICK RASSMUSSEN 206-762-7300 THERN: 507-454-2996 EMAIL: INFO@THERN.COM
1	SWIVEL BLOCKS	JAEMAR WINCHES	877-884-8118
2	WIRE ROPE AND HARDWARE	CASCADE RIGGING, PORTLAND OR	BOB CUSHMAN 503-722-7500 bcushman@gwestoffice.net
3	MILWAUKEE DRILL MOTOR	CPO OUTLETS, PASADENA CA	866-577-1906 customercare@cpooutlets.com
4	SLIP CLUTCH	DYNATECt MANUFACTURING INC	262-786-1500 sales@dynatect.com
5	MORSE TAPER MOUNT SPINDLE ARBOR	MCMASTER CARR PN2862A12	www.mcmaster.com 562-692-5911
6	MACHINED THIMBLES 7/64 3/16	WAITE SPECIALTY MACHINE LONGVIEW WA	JAKE KELSEY 360-577-0777 jkelsey@waitespecialty.com
7	VIBRATION ISOLATORS	SEATTLE SOUND & VIBRATION INC	DAVE FORREST 425-497-0660
8	PAINT	SHERWIN WILLIAMS THROUGH HANCOCK SANDBLAST AND PAINT PASCO WA	DON GAMMELL 509-545-5005 dongammell@hsbpcoating.com
9	SAND	KLEENBLAST OF PORTLAND	SARA NOKES 503-228-3965
10	DILLON QUICK CHECK TENSION METER	THROUGH JOHNSON SCALE CO	DENNIS CABRAL 973-226-2100 dcabral@johnsonscale.com
11			
12			
13			
14			
15			

SECTION 1.C
WARRANTIES

1.C.1

KNIGHT CONSTRUCTION

Construction with Integrity Since 1968

KNIGHT
Const. & Supply, Inc.

GENERAL CONTRACTORS
BUILDING SUPPLIES
Phone 1-509-276-2229
Fax 1-509-276-6055
28308 N. CEDAR RD.
DEER PARK, WA 99006

JOHN DAY AVIAN ARRAY IMPROVEMENTS
CONTRACT #W9127N18C0001

WARRANTY OF CONSTRUCTION

April 30,2018

Knight Const. & Supply, Inc. (KCS) warrants that work performed under this contract conforms to the contract requirements and is free of any defect in equipment, material, or design furnished, or workmanship performed by the Contractor or any subcontractor or supplier at any tier. This warranty shall continue for 1 year from the earlier of: final acceptance or the date the Government takes possession of the work.

During the warranty period, KCS will remedy, at its expense, any defects or nonconformities, along with any resulting damage to Government-owned or controlled real or personal property. KCS will restore any work damaged in performing warranty work. KCS warrants work repaired or replaced for 1 year from the date of repair or replacement.

The Government's Contracting Officer must notify KCS in writing within a reasonable time after discovery of any failure, defect, or damage. If KCS fails to remedy any failure, defect, or damage within a reasonable time after receipt of notice, the Government will have the right to replace, repair, or otherwise remedy the failure, defect, or damage at the KCS's expense.

KCS will not be liable for the repair of any defects from Government-furnished material or design, or any resulting damage.

KNIGHT CONST. & SUPPLY, INC.

David A. Knight
Vice President

1.C.2

THERN WINCH

Two-Year Limited Warranty

Please record the following:

Date Purchased:

Model No.:

Code No.:

This information is required when calling the factory for service.

Thern, Inc. warrants its products against defects in material or workmanship for two years from the date of purchase by the original using buyer, or if this date cannot be established, the date the product was sold by Thern, Inc. to the dealer. To make a claim under this warranty, contact the factory for an RGA number. The product must be returned, prepaid, directly to Thern, Inc., 5712 Industrial Park Road, Winona, Minnesota 55987. The following information must accompany the product: the RGA number, the date of purchase, the description of the claimed defect, and a complete explanation of the circumstances involved. If the product is found to be defective, it will be repaired or replaced free of charge, and Thern, Inc. will reimburse the shipping cost within the contiguous USA.

This warranty does not cover any damage due to accident, misuse, abuse, or negligence. Any alteration, repair or modification of the product outside the Thern, Inc. factory shall void this warranty. This warranty does not cover any costs for removal of our product, downtime, or any other incidental or consequential costs or damages resulting from the claimed defects. This warranty does not cover brake discs, wire rope or other wear components, as their life is subject to use conditions which vary between applications.

FACTORY AUTHORIZED REPAIR OR REPLACEMENT AS PROVIDED UNDER THIS WARRANTY IS THE EXCLUSIVE REMEDY TO THE CONSUMER. THERN, INC. SHALL NOT BE LIABLE FOR ANY INCIDENTAL OR CONSEQUENTIAL DAMAGES FOR BREACH OF ANY EXPRESS OR IMPLIED WARRANTY ON THIS PRODUCT. EXCEPT TO THE EXTENT PROHIBITED BY APPLICABLE LAW, ANY IMPLIED WARRANTY OF MERCHANTABILITY OR FITNESS FOR A PARTICULAR PURPOSE ON THIS PRODUCT IS LIMITED IN DURATION TO THE DURATION OF THIS WARRANTY.

Some states do not allow the exclusion or limitation of incidental or consequential damages, or allow limitations on how long an implied warranty lasts, so the above limitation or exclusion may not apply to you. This warranty gives you specific legal rights, and you may also have other rights which vary from state to state.

Note: Thern, Inc. reserves the right to change the design or discontinue the production of any product without prior notice.

About This Manual

The Occupational Safety and Health Act of 1970 states that it is the employer's responsibility to provide a workplace free of hazard. To this end, all equipment should be installed, operated, and maintained in compliance with applicable trade, industrial, federal, state, and local regulations. It is the equipment owner's responsibility to obtain copies of these regulations and to determine the suitability of the equipment to its intended use.

This Owner's Manual, and warning labels attached to the equipment, are to serve as guidelines for hazard-free installation, operation, and maintenance. They should not be understood to prepare you for every possible situation.

The information contained in this manual is applicable only to the Thern Model M452 and M492 Spur Gear Hand Winches. Do not use this manual as a source of information for any other equipment.

The following symbols are used for emphasis throughout this manual:

⚠WARNING

Failure to follow 'WARNING!' instructions may result in equipment damage, property damage, and/or serious personal injury.

⚠CAUTION

Failure to follow 'CAUTION!' instructions may result in equipment damage, property damage, and/or minor personal injury.

Important!

Failure to follow 'important!' instructions may result in poor performance of the equipment.

1.C.3

JAEMAR SWIVEL BLOCKS

A A A Select Language

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Terms and Conditions

Our Safety Standards

Our foundation Is built on providing an exceptional product, which is why we conform to worldwide safety standards.

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Warnings

Ensure the correct equipment is obtained and installed for the application.

Ratings shown in Jeamar literature are applicable only to new products.

Working load limits shown are the maximum load the product is authorized to support under normal environmental conditions. Shock loading and abnormal conditions must be taken into account when selecting products.

Working load limits shown are the maximum load the product is authorized to support under normal environmental conditions. Regular inspections must be conducted to ensure the equipment continues to meet the most current revision of the published standard.

Avoid Shock Loads

These are transient loads that exceed the steady-state load. Shock loads are caused by sudden accelerations, usually due to unrestrained loads, swing loads, jerking, or impacting of the load. The working load limit may well be exceeded under these conditions.

Welding to any Jeamar products can be hazardous and should only be implemented after written permission from Jeamar.

Jeamar products are sold on the strict understanding that all product selection is the full responsibility of the purchaser. Jeamar accepts no liability for the use, misuse or incorrect application of its products.

Terms and Conditions

JEAMAR ISO 9002 REGISTERED

Jeamar Winches Warranty

Jeamar Winches warrants its products against defects in material and workmanship for a period of one year from the date its products are available for shipment to the original purchaser. No responsibility will be assumed by Jeamar Winches for repairs or parts other than those provided or supplied by Jeamar Winches.

This warranty is limited to the replacement of parts or repair of parts, if repairs are authorized by Jeamar Winches. All returns for warranty must be returned to the factory freight prepaid. It does not cover damages or defects due to normal wear and tear, misuse, alteration or neglect.

Jeamar Winches warrants that the products shall be delivered free of any claims of any third person by way of infringement, unless specifications are provided by the purchaser in which event the purchaser, holds Jeamar Winches harmless against any claims which arise out of compliance with purchaser's specifications.

No other warranty is expressed or implied and Jeamar Winches assumes no responsibility for consequential damages arising from the failure of the products for any reason whatsoever, nor does it extend any warranty for any damages, whatsoever, for improper storage or handling by purchaser prior to placing into service.

The purchaser shall determine the suitability for the product, for its use, and purchaser assumes all risks and liabilities in connection therewith.

Jeamar Returned Goods Policy

Upon written authorization, Jeamar products can be returned for credit, provided merchandise is unused and complete. The customer pays freight back and a re-stocking charge of 25 percent will be assessed. If merchandise of relatively equal value is purchased in exchange, the re-stocking charge is 15 percent.

These are transient loads that exceed the steady-state load. Shock loads are caused by sudden accelerations, usually due to unrestrained loads, swing loads, jerking, or impacting of the load. The working load limit may well be exceeded under these conditions.

Welding to any Jeamar products can be hazardous and should only be implemented after written permission from Jeamar.

Jeamar products are sold on the strict understanding that all product selection is the full responsibility of the purchaser. Jeamar accepts no liability for the use, misuse or incorrect application of its products.

Definitions

Working Load Limit (WLL)

This is the maximum load that can be imposed on the product under any condition. The working load limit is calculated based on a steady state load applied in a straight-line pull.

Ultimate Load

This is the predicted average load at which the product will fail.

JEAMAR

Jeamar Winches Corporation

Home (http://www.jeamar.com/home/) | About Us (http://www.jeamar.com/about-us/) | Custom (http://www.jeamar.com/custom-winch-solutions/) | Blog (http://www.jeamar.com/news-and-blog/) | Contact Us (http://www.jeamar.com/contact-us/) | Terms and Conditions (http://www.jeamar.com/terms-and-conditions/) | Site Map (http://www.jeamar.com/sitemap/)

Give us a call today! 1 (877) 884-8118 (tel:18778848118) or email us at: sales@jeamar.com (mailto:sales@jeamar.com)

(https://www.facebook.com/Jeamar-Winches-1872122479725446/) (https://twitter.com/JeamarWinches?lang=en) (https://www.youtube.com/channel/UCnZhDNIxB1xQtp1c2VZA3hQ)

IMPORTANT NOTICE

Due to our policy of continuing development, all specifications are subject to change without notice. Users of these products are responsible for ensuring their suitability for the application in which they are being used.

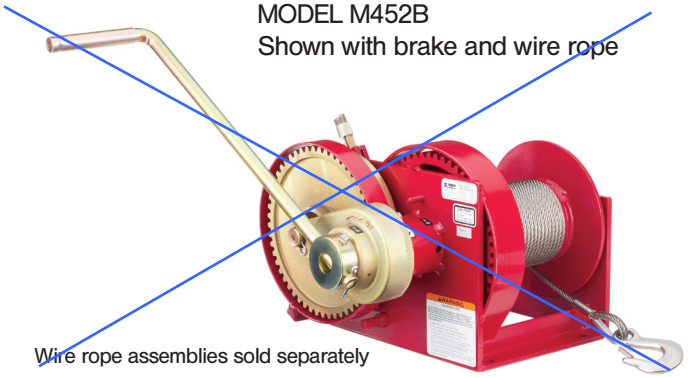
SECTION 2.A
PRODUCT DATA

2.A.1

THERN WINCH

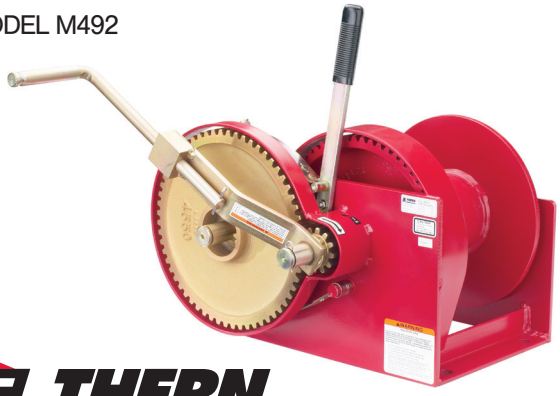
M452 / M492 SERIES SPECS

MODEL M452B
Shown with brake and wire rope



Wire rope assemblies sold separately

MODEL M492



THERN

Spur Gear Hand Winches Double Reduction

Up to 10,000 lb capacity

- **Machine Cut Spur Gears** for accurate and long lasting service.
- **Automatic Brake Models** provide positive load control for lifting and lowering operations. Brake models have B suffix.
- **Corrosion Resistant** durable paint finish combined with trivalent zinc plating protects against corrosion.
- **Bronze and Radial Ball Bearings** provide smooth and efficient operation.
- **Large Diameter Drums** minimize wear to extend wire rope life.
- **Spring Loaded Ratchets** for positive engagement with gear.
- **Steel Gear Covers** protect gears and help prevent injuries.
- **Handles Adjust** in length to change force required to move load.
- **Two-year Limited Warranty**

Spur Gear Hand Winches – Configurations and Performance Characteristics – Section 1

model number	description	load rating (lb) 1st layer	load rating (lb) mid drum	load rating (lb) full drum	wire rope dia. (in)	drum capacity (ft)[1] 1st layer	drum capacity (ft)[1] mid drum	drum capacity (ft)[1] full drum	single gear ratio	double gear ratio	force[2] to lift 1000 lb	approx. ship wt. (lb)
M452	4000 lb – marine duty (for pulling only)	4000	3300	2500	1/4 5/16 3/8	23 18 14	130 89 64	300 200 140	4.42:1	19.54:1	10 lb (double gear)	83
M452B	4000 lb – marine duty with brake (for lifting)	4000	3300	2500	1/4 5/16 3/8	23 18 14	130 89 64	300 200 140	—	19.54:1	10 lb (double gear)	91
M452B-A	4000 lb – marine duty with brake (for lifting) 4 inch drum width	4000	3300	2500	1/4 5/16 3/8	13 9 7	83 56 40	190 120 89	—	19.54:1	10 lb (double gear)	83
M492	10,000 lb – marine duty (for pulling only)	10,000	7400	5400	5/16 3/8 1/2	27 21 15	240 170 100	540 390 230	5.00:1	25.00:1	8 lb (double gear)	166
M492B	10,000 lb – marine duty with brake (for lifting)	10,000	7400	5400	5/16 3/8 1/2	27 21 15	240 170 100	540 390 230	—	25.00:1	8 lb (double gear)	173
M492-12	10,000 lb – marine duty (for pulling only) 12 inch drum width	10,000	7400	5400	5/16 3/8 1/2	46 37 27	380 270 160	850 610 360	5.00:1	25.00:1	8 lb (double gear)	175
M492B-12	10,000 lb – marine duty with brake (for lifting) 12 inch drum width	10,000	7400	5400	5/16 3/8 1/2	46 37 27	380 270 160	850 610 360	—	25.00:1	8 lb (double gear)	190
MB451	disc brake only for M452 (for lifting)											13
MB491	disc brake only for M492 and M492-12 (for lifting)											15
HW452	hand wheel only for M452 (for pulling only)											19
HW492	hand wheel only for M492 and M492-12 (for pulling only)											20

Please contact factory or nearest Thern Distributor for firm fixed price and delivery.

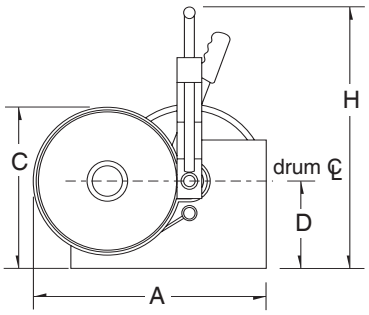
[1] Actual drum capacities may be 25-30% less, due to nonuniform winding. Wire rope tension will also affect drum capacity.

[2] Approximate handle force required to lift 1000 lb with an empty drum, and maximum handle length.

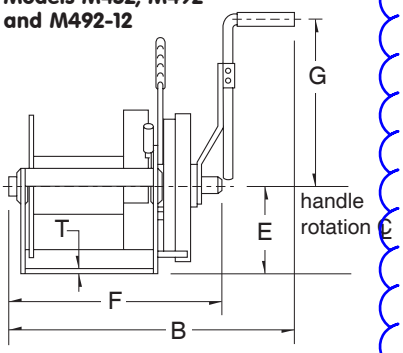
See Dimensions on Next Page

M452 / M492 DIMENSIONS

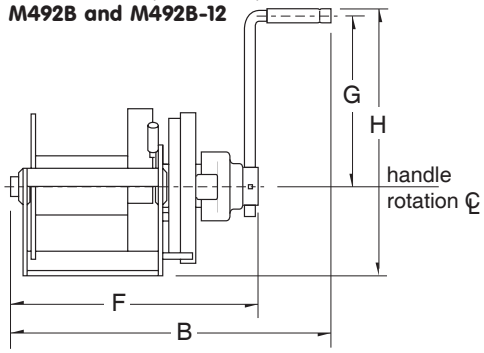
All Models



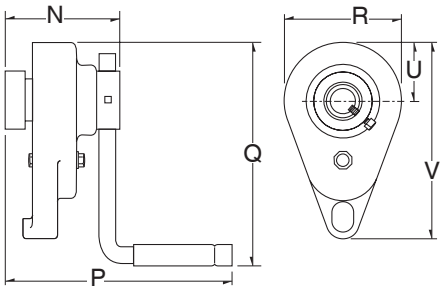
Models M452, M492 and M492-12



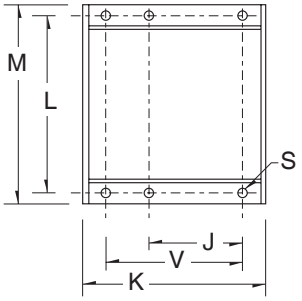
Models M452B, M452B-A, M492B and M492B-12



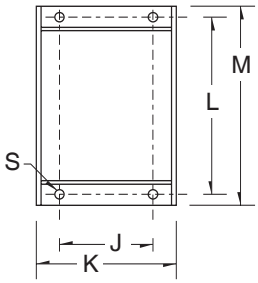
Models MB451 and MB491

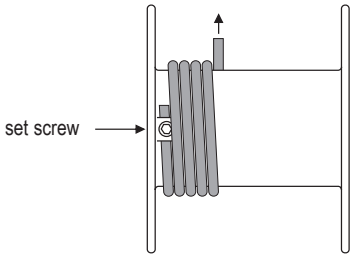


Base for M492-12 and M492B-12



Base for M452, M452B, M452B-A, M492 and M492B Models





Wire Rope Installation - All Models

Disc Brakes – Dimensions (in)

	MB451	MB491
N	4.97	5.15
P	10.44	10.62
Q[1]	21.25	21.38
R	4.87	4.87
U	2.44	2.44
V	8.62	10.56

Dimensions are for reference only and are subject to change without notice.

[1] Handles are adjustable, dimension shown is for maximum handle length.

Important:
It is the owner's or operator's responsibility to determine the suitability of the equipment to its intended use. Study all applicable codes, manuals, and regulations. Be sure to read the Owner's Manual supplied with the equipment before operating it.

Spur Gear Hand Winches – Dimensions (in)

	M452	M452B	M452B-A	M492	M492B	M492-12	M492B-12
drum dia.	4.00	4.00	4.00	5.00	5.00	5.00	5.00
flange dia.	8.50	8.50	8.50	12.38	12.38	12.38	12.38
drum width	6.38	6.38	4.00	7.62	7.62	12.00	12.00
A	15.25	15.25	15.25	20.38	20.38	20.38	20.38
B	22.00	21.90	19.62	25.12	25.00	29.50	29.38
C	10.69	10.69	10.83	14.00	14.00	14.00	14.00
D	5.81	5.81	5.81	7.50	7.50	7.50	7.50
E	5.81	5.81	5.81	7.50	7.50	7.50	7.50
F	14.81	16.43	14.06	18.44	19.53	22.82	23.90
G[1]	18.62	18.38	18.38	22.50	18.50	22.50	18.50
H[1]	24.44	24.19	24.19	30.00	26.00	30.00	26.00
J	6.75	6.75	4.50	8.00	8.00	8.00	8.00
K	9.50	9.50	7.12	12.00	12.00	16.38	16.38
L	11.25	11.25	11.25	15.50	15.50	15.50	15.50
M	12.50	12.50	12.50	17.00	17.00	17.00	17.00
S (hole dia.)	.56	.56	.56	.81	.81	.81	.81
T	.25	.25	.25	.38	.38	.38	.38
V	–	–	–	–	–	12.38	12.38

Dimensions are for reference only and subject to change without notice.

[1] Handles are adjustable, dimension shown is for maximum handle length.

THERN

WINCHES AND CRANES

Read this Owner's Manual thoroughly before operating the equipment. Keep it with the equipment at all times. Replacements are available from Thern, Inc., PO Box 347, Winona, MN 55987, 507-454-2996. www.thern.com

IMPORTANT: Please record product information on page 2. This information is required when calling the factory for service.

ORIGINAL TEXT

Owner's Manual

For
M452 and M492 Series
Spur Gear Hand Winches

A5360H-0516

Two-Year Limited Warranty

Please record the following:

Date Purchased:

Model No.:

Code No.:

This information is required when calling the factory for service.

Thern, Inc. warrants its products against defects in material or workmanship for two years from the date of purchase by the original using buyer, or if this date cannot be established, the date the product was sold by Thern, Inc. to the dealer. To make a claim under this warranty, contact the factory for an RGA number. The product must be returned, prepaid, directly to Thern, Inc., 5712 Industrial Park Road, Winona, Minnesota 55987. The following information must accompany the product: the RGA number, the date of purchase, the description of the claimed defect, and a complete explanation of the circumstances involved. If the product is found to be defective, it will be repaired or replaced free of charge, and Thern, Inc. will reimburse the shipping cost within the contiguous USA.

This warranty does not cover any damage due to accident, misuse, abuse, or negligence. Any alteration, repair or modification of the product outside the Thern, Inc. factory shall void this warranty. This warranty does not cover any costs for removal of our product, downtime, or any other incidental or consequential costs or damages resulting from the claimed defects. This warranty does not cover brake discs, wire rope or other wear components, as their life is subject to use conditions which vary between applications.

FACTORY AUTHORIZED REPAIR OR REPLACEMENT AS PROVIDED UNDER THIS WARRANTY IS THE EXCLUSIVE REMEDY TO THE CONSUMER. THERN, INC. SHALL NOT BE LIABLE FOR ANY INCIDENTAL OR CONSEQUENTIAL DAMAGES FOR BREACH OF ANY EXPRESS OR IMPLIED WARRANTY ON THIS PRODUCT. EXCEPT TO THE EXTENT PROHIBITED BY APPLICABLE LAW, ANY IMPLIED WARRANTY OF MERCHANTABILITY OR FITNESS FOR A PARTICULAR PURPOSE ON THIS PRODUCT IS LIMITED IN DURATION TO THE DURATION OF THIS WARRANTY.

Some states do not allow the exclusion or limitation of incidental or consequential damages, or allow limitations on how long an implied warranty lasts, so the above limitation or exclusion may not apply to you. This warranty gives you specific legal rights, and you may also have other rights which vary from state to state.

Note: Thern, Inc. reserves the right to change the design or discontinue the production of any product without prior notice.

About This Manual

The Occupational Safety and Health Act of 1970 states that it is the employer's responsibility to provide a workplace free of hazard. To this end, all equipment should be installed, operated, and maintained in compliance with applicable trade, industrial, federal, state, and local regulations. It is the equipment owner's responsibility to obtain copies of these regulations and to determine the suitability of the equipment to its intended use.

This Owner's Manual, and warning labels attached to the equipment, are to serve as guidelines for hazard-free installation, operation, and maintenance. They should not be understood to prepare you for every possible situation.

The information contained in this manual is applicable only to the Thern Model M452 and M492 Spur Gear Hand Winches. Do not use this manual as a source of information for any other equipment.

The following symbols are used for emphasis throughout this manual:

⚠WARNING

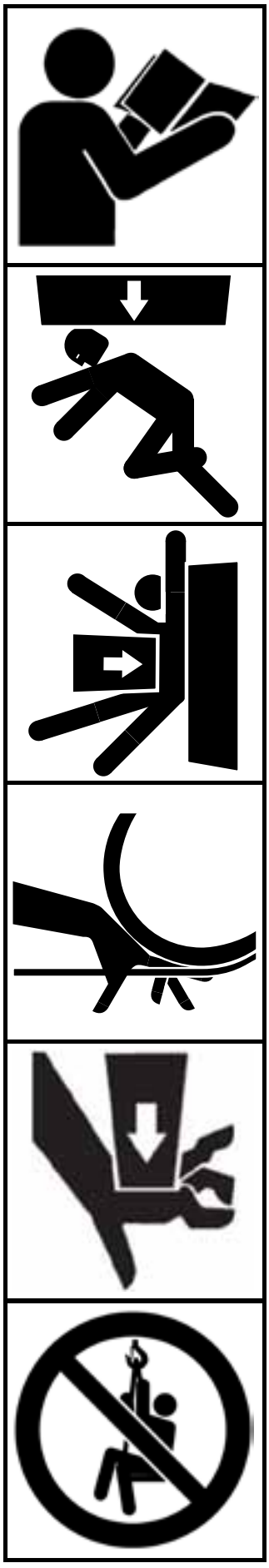
Failure to follow 'WARNING!' instructions may result in equipment damage, property damage, and/or serious personal injury.

⚠CAUTION

Failure to follow 'CAUTION!' instructions may result in equipment damage, property damage, and/or minor personal injury.

Important!

Failure to follow 'important!' instructions may result in poor performance of the equipment.



Suggestions for Safe Operation

⚠WARNING

DO the following:

Read and comply with the guidelines set forth in this Owner's Manual. Keep this manual, and all labels attached to the winch, readable and with the equipment at all times. Contact Thern, Inc. for replacements.

Check lubrication before use.

Install the wire rope securely to the winch drum.

Keep at least 4 wraps of wire rope wound on the drum at all times, to serve as anchor wraps. Failure to do so could cause the load to escape.

Keep hands away from the drum, gears, wire rope, and other moving parts of the equipment.

Keep all unnecessary personnel away from the winch while in operation. Keep out of the path of the load and out of the path of a broken wire rope that might snap back and cause injury.

DO NOT do the following:

Do not lift people, or things over people. Do not walk or work under a load or in the line of force of any load.

Do not exceed the load rating of the winch or any other component in the system.

Do not operate with other than manual power.

Do not use more than one winch to move a load unless each winch was designed for use in a multiple winch system.

Do not use damaged or malfunctioning equipment. To do so could result in failure of the equipment.

Do not modify the equipment in any way. To do so could cause equipment failure.

Do not wrap the wire rope around the load. This damages the wire rope and could cause the load to escape. Use a sling or other approved rigging device.

Do not operate the winch with guards removed or improperly installed.

Do not divert your attention from the operation. Stay alert to the possibility of accidents, and try to prevent them from happening.

Do not jerk or swing the load. Avoid shock loads by starting and stopping the load smoothly. Shock loads overload the equipment and may cause damage.

Do not lift loads or pull loads on an incline unless the winch is equipped with a brake.

Do not leave a suspended load unattended unless specific precautions have been taken to secure the load and keep people away from the winch and from under the load.

1.1 Installing the Winch

Important!

- Inspect the winch immediately following installation according to the Instructions for Periodic Inspection. This will give you a record of the condition of the winch with which to compare future inspections.
- A qualified professional should inspect or design the foundation to insure that it will provide adequate support.
- Locate the winch so it will be visible during the entire operation.

⚠WARNING

Do not install the winch in an area defined as hazardous by the National Electric Code, unless installation in such an area has been thoroughly approved.

Do not install the winch near corrosive chemicals, flammable materials, explosives, or other elements that may damage the winch or injure the operator. Adequately protect the winch and the operator from such elements.

Position the winch so the operator can stand clear of the load, and out of the path of a broken wire rope that could snap back and cause injury.

Attach the winch to a rigid and level foundation that will support the winch and its load under all load conditions, including shock loading.

1.1.1 CONSULT APPLICABLE CODES AND REGULATIONS for specific rules on installing the equipment.

1.1.2 LOCATE THE WINCH in an area clear of traffic and obstacles that could interfere with operation. Make sure the winch is accessible for maintenance and operation.

1.1.3 MAINTAIN A FLEET ANGLE between 1/2 and 1-1/2 degrees. The proper fleet angle minimizes wire rope damage by helping the wire rope wind uniformly onto the drum. See Figure 1.

1.1.4 FASTEN THE WINCH securely to the foundation.

a FOR STANDARD PRODUCTS referred to in this manual, use 1/2 inch coarse thread fasteners, grade 5 or better, torque dry to 75 ft lb without lubrication for the M452 series. Use 3/4 inch coarse thread fasteners, grade 5 or better, torque dry to 260 ft lb without lubrication for M492 series. Make sure the winch is secured to a solid foundation based on accepted engineering practices.

b NON-STANDARD PRODUCTS that vary from the original design may have different fastening requirements. Contact structural engineer or Thern, Inc. for this information.

TO COMPLY WITH LOCAL CODES, CONTACT A QUALIFIED PROFESSIONAL TO OBTAIN PROPER STRUCTURE OR FOUNDATION SPECIFICATIONS FOR THE MOUNTING OF THERN PRODUCTS.

1.2 Installing the Wire Rope

Important!

- Use wire rope and other rigging equipment rated for the size of the largest load you will be moving.
- Do not drag the wire rope through dirt or debris that could cause damage, or poor operation.
- Always wear protective clothing when handling wire rope.

⚠WARNING

Install the wire rope so it is wound correctly as shown, or the winch will not work properly, and the load could escape. See Figure 3.

Install the wire rope securely to the winch drum. A poorly secured wire rope could come loose from its anchor and allow the load to escape.

Do not operate the winch unless the hairpin clip is assembled to the shaft.

1.2.1 PURCHASE THE PROPER WIRE ROPE for your application. Keep the following in mind when selecting a wire rope. Contact a repuTable wire rope supplier for help.

a BREAKING STRENGTH of new wire rope should be at least 3 times greater than the largest load placed on the winch. If loads are lifted or pulled on an incline, the breaking strength must be at least 5 times greater than the largest load. These are minimum values and will vary with the type of load and how you are moving it.

b WIRE ROPE LAY must agree with the winding direction of the drum to help insure proper winding.

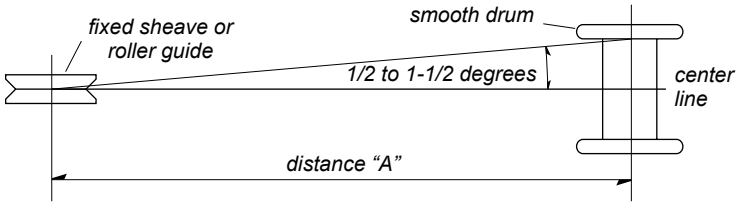
c WE RECOMMEND 7 x 19 galvanized aircraft cable for diameters up to 5/16 inch, and 6 x 37 IWRC improved plow steel wire rope for diameters of up to 3/4 inch. (A maximum rope diameter of 1/2 inch is recommended due to the drum diameter.)

Important!

- Use a sheave or roller guide to direct the wire rope to the drum whenever possible.
- Install sheaves, tracks and other equipment so they will remain fixed under all load conditions. Follow the recommendations of the equipment manufacturer.
- Use sheaves of proper diameter to minimize wear on the wire rope. Follow the recommendations of the sheave manufacturer.

Figure 1 – Maintaining the Fleet Angle

When wire rope travels over a sheave or through a roller guide – maintain fleet angle by locating the sheave or guide an appropriate distance from the drum, shown as distance "A".



When wire rope travels directly to the load – maintain fleet angle by controlling side-to-side movement of the load with tracks or guide rails. Allowing the load to move too far to one side causes stress on the drum flange which may cause damage.

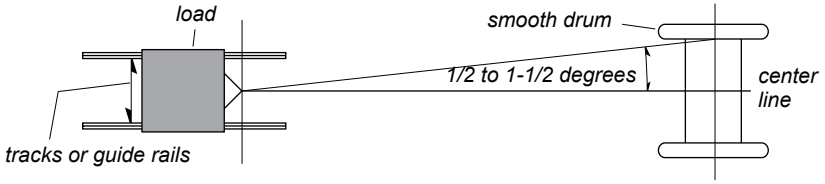


Figure 2 – Cotter Pins

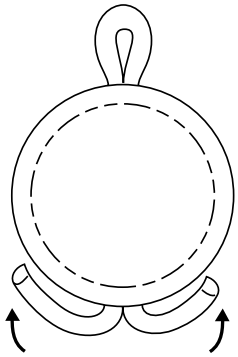
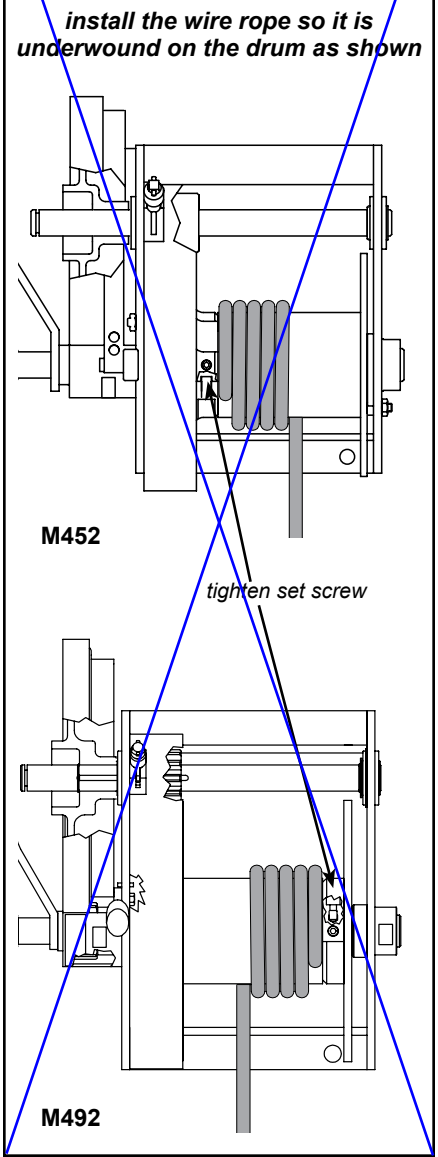


Figure 3 – Wire Rope Installation



1.2.2 INSTALL THE HANDLE.

a PLACE THE HANDLE WELDMENT on the drum shaft and install the hair pin clip to hold it in place. The hair pin clip fits in the groove in the drum shaft.

b LOOSEN THE SET SCREWS in the handle weldment, remove the cotter pin from the end of the handle assembly and insert it in the handle weldment. Adjust handle length to suit the operation and tighten the set screws.

- SHORTEN HANDLE LENGTH for light loads or quick operation.
- INCREASE HANDLE LENGTH for heavy loads or slow operation.

c INSERT THE COTTER PIN in the end of the handle and bend the arms back to secure it in place. See Figure 2.

1.2.3 INSTALL THE HAND WHEEL (Optional line item offered by Thern).

a REMOVE THE HAIRPIN CLIP from the end of the drum shaft.

b REMOVE THE HANDLE ASSEMBLY and the flat handle weldment from the drum shaft.

c SLIDE THE HAND WHEEL onto the shaft until the gear teeth are completely meshed.

d REPLACE THE HAIRPIN CLIP.

e KEEP THE HAIRPIN CLIP in place at all times to prevent the Hand Wheel from accidentally becoming disengaged from the winch.

1.2.4 ANCHOR THE WIRE ROPE to the winch drum. See Figure 3.

a PASS THE END OF THE WIRE ROPE through the anchor hole, until at least 1/2 inch of rope extends out the other side.

b TIGHTEN THE SET SCREW until it flattens the wire rope against the anchor hole. Use enough force to drive the point of the set screw securely into the wire rope.

1.2.5 TURN THE HANDLE CLOCKWISE to wind wire rope onto the drum. If wire rope unwinds from the drum when the handle is rotated clockwise, the wire rope is installed incorrectly. **Install the wire rope correctly before continuing.**

1.2.6 WIND FOUR FULL WRAPS of wire rope onto the drum by operating the winch while holding the wire rope taught. **These wraps serve as anchor wraps and must remain on the drum at all times.**

2.1 General Theory of Operation

Important!

- Limit nonuniform winding by keeping tension on the wire rope and by maintaining the proper fleet angle.
- It is your responsibility to detect and account for different factors affecting the condition and performance of the equipment.

2.1.1 THE PULL REQUIRED to move the load must not exceed the load rating of the winch. Consider the total force required to move the load, not the weight of the load.

2.1.2 THIS EQUIPMENT CAN develop forces that will exceed the load rating. It is the responsibility of the equipment user to limit the size of the load. Inspect the equipment regularly for damage according to the instructions contained in this manual.

2.1.3 USE A DISC BRAKE on all hand winches used to lift loads or pull loads on an incline.

2.1.4 PERFORMANCE RATINGS of the equipment are affected by the amount of wire rope wound on the drum, the way in which it is wound, and the way the winch is used.

a DRUM CAPACITY depends on how tightly and evenly the wire rope is wound on the drum. Actual drum capacities are usually 25-30% less than values shown in performance Tables, due to loose winding and overlapping.

b FORCE REQUIRED TO LIFT the load increases with each additional layer of wire rope wound onto the drum. The value shown in performance Tables is based on an empty drum, and maximum handle length.

c LOAD RATING represents the maximum pull that can be placed on new equipment. Load ratings are assigned values for specific amounts of load travel or wire rope accumulation. The load rating decreases as layers of wire rope accumulate on the drum.

2.1.5 DUTY RATINGS refer to the type of use the equipment is subject to. Consider the following when determining duty rating.

a ENVIRONMENT: harsh environments include hot, cold, dirty, wet, corrosive, or explosive surroundings. **Protect the equipment from harsh environments when possible.**

b MAINTENANCE: poor maintenance, meaning poor cleaning, lubrication, or inspection, leads to poor operation and possible damage of the equipment. **Minimize poor maintenance by carefully following the instructions contained in this manual.**

c LOADING: severe loading includes shock loading and moving loads that exceed the load rating of the equipment. **Avoid shock loads, and do not exceed the load rating of the equipment.**

d FREQUENCY OF OPERATION: frequent or lengthy operations increase wear and shorten the life span of gears, bearings, and other components. **Increase maintenance of the equipment if used in frequent operations.**

CONTACT THE FACTORY FOR MORE INFORMATION.

2.3 Breaking-In the Winch

2.3.1 BREAK-IN OCCURS during the first 10 hours of normal operation. During break-in, mating surfaces become polished, and clearances increase. This is desired for efficient operation of bearings and gears.

2.3.2 INSPECT THE WINCH following break-in according to the Instructions for Periodic Inspection.

2.4 Preparing for Operation

Important!

- When determining whether the load will exceed the load rating, consider the total force required to move the load.

2.4.1 CONSIDER THE OPERATION. Do not begin until you are sure you can perform the entire operation without hazard.

2.4.2 INSPECT ALL COMPONENTS of the system.

a INSPECT THE WINCH and other equipment according to the Instructions for Frequent Inspection.

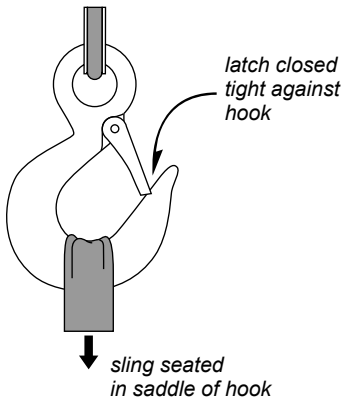
b OPERATORS must be in good health, alert, thoroughly trained in operating the equipment, and properly clothed (hard hat, safety shoes and safety glasses, no loose clothing).

c THE LOAD must be clear of other objects and free to move. Make sure the load will not tip, spin, roll away, or in any way move uncontrollably.

2.4.3 KNOW YOUR LOAD and make sure you do not exceed the load rating of the winch or any other equipment in the system.

2.5 Attaching the Load

Figure 4 – Attaching Load



⚠WARNING

Do not wrap the wire rope around the load. This damages the wire rope and could cause the load to escape. Use a sling or other approved lifting device.

2.5.1 CLEAR OBJECTS from the path of the load so you can move it freely and observe it at all times during the operation.

2.5.2 ATTACH THE LOAD using a nylon sling, or other approved lifting device. Follow the recommendations of the sling manufacturer.

a SEAT THE SLING in the saddle of the hook with the hook latch completely closed. See Figure 4.

b CENTER THE LOAD on the hook so it will remain balanced and not tip or rotate to one side.

2.6 Moving the Load

Important!

- Obey a stop signal from anyone.
- Maintain tension on the wire rope to keep it tightly and evenly wound on the drum.
- If the winch and load are not visible during the entire operation, get help from another person.
- Appoint a supervisor if more than one person is involved in the operation. This will reduce confusion and increase safety.
- When lifting a load, use a tag line to keep the load from swinging or twisting, while keeping yourself away from the load.
- Remove the winch handle when the winch is not in use, to help avoid unauthorized use.

⚠WARNING

Do not use the handle or hand wheel as a brake or anchor for a load.

2.6.1 ENGAGE THE RATCHET when winding wire rope onto the drum, disengage the ratchet to unwind the wire rope.

a **DO NOT ENGAGE THE RATCHET while the winch gears are turning.** Stop the winch before engaging the ratchet.

b DISENGAGE THE RATCHET by moving the load slightly to remove pressure from the ratchet, then pull out and turn the ratchet knob 90 degrees.

2.6.2 TURN THE HANDLE OR HAND WHEEL CLOCKWISE to wind wire rope onto the drum. If wire rope unwinds from the drum when the handle is rotated clockwise, the wire rope is installed incorrectly. **Install the wire rope correctly before continuing.**

2.6.3 MOVE THE LOAD slowly and smoothly, only a small distance at first. Make sure the load is balanced and securely attached before continuing.

a MAKE SURE YOU ARE NOT IN LINE with cable movement.

b GRIP THE HANDLE TIGHTLY at all times during operation. When using the wheel, grip the wheel rim tightly using both hands. **Do not grab the spokes or reach between the spokes.**

c IF YOU RELEASE THE HANDLE or hand wheel on units not equipped with a disc brake, the load may backdrive causing it to spin. **Do not try to stop a spinning handle or wheel, step clear until the spinning stops.**

2.6.4 OBSERVE THE WIRE ROPE as it winds onto the drum. If it becomes loose, uneven, or overlapped, stop the operation and rewind the wire rope before continuing. **Continued operation with overlapped or uneven wire rope can damage the wire rope and shorten its life.**

2.6.5 TO QUICKLY WIND OR UNWIND unloaded wire rope, move the handle to or install the hand wheel on the countershaft.

a **DO NOT ATTEMPT to move a load with the handle or hand wheel installed on the countershaft.**

b WHEN USING THE HAND WHEEL, the hairpin clip cannot be assembled to the winch. To prevent losing the clip, leave it attached to the drum shaft until you are ready to reposition the hand wheel back to the drum shaft.

3.1 Cleaning the Winch

Important!

Increase the frequency of maintenance procedures if the winch is:

- Operated for long periods.
- Used to pull heavy loads.
- Operated in wet, dirty, hot, or cold surroundings.

Clean the winch to remove dirt and help prevent rust and corrosion.

3.1.1 CLEAN THE WINCH every six months or whenever it is dirty.

a WIPE ALL EQUIPMENT to remove dirt and grease.

b LEAVE A LIGHT FILM of oil on all surfaces to protect them against rust and corrosion.

c WIPE OFF excessive amounts of oil to avoid the accumulation of dirt.

3.1.2 REMOVE ALL UNNECESSARY OBJECTS from the area surrounding the winch.

3.2 Lubricating the Winch

Important!

- Make sure lubricant has a temperature rating appropriate for the ambient temperatures of the operation.

⚠WARNING

Lubricate the spur gears before each operation, and periodically during operation. Failure to lubricate the gears will cause damage or deformation of gear teeth.

Lubricate the winch properly to help protect it from wear and rust. Read the following instructions carefully.

3.2.1 CONSULT MANUFACTURER'S RECOMMENDATIONS for specific information on lubricating the wire rope and other equipment.

3.2.2 LUBRICATE WINCH BEARINGS AND SHAFTS at least every 6 months.

a APPLY 2 TO 3 DROPS of SAE 30 non-detergent oil to bearings and shafts at all friction points.

b ROTATE THE DRUM several times to allow the oil to penetrate, and wipe off excess oil to avoid accumulation of dirt.

c DO NOT LUBRICATE the hand wheel when in use. You need it dry for a secure grip.

3.2.3 LUBRICATE WINCH GEARS before every operation and at least every 10 hours during operation.

a APPLY A LIGHT FILM of open gear lubricant to the gear teeth on all gears.

b USE SPRAYON® S00201 or equivalent open gear lube. For dirty conditions use a dry lubricant such as dry graphite or Moly.

3.2.4 LUBRICATE THE WIRE ROPE and other equipment by following the manufacturer's recommendations.

3.3 Inspecting the Equipment

Important!

- Start an inspection program as soon as you put the winch into use.
- Appoint a qualified person to be responsible for regularly inspecting the equipment.
- Keep written records of inspection. This allows comparison with comments from previous inspections so you can see changes in condition or performance.

Perform frequent inspections:

- Before each operation.
- Every 3 hours during operation.
- Whenever you notice signs of damage or poor operation.

Frequent Wire Rope Inspection:

- Use ASME B30.7 as a guideline for rope inspection, replacement and maintenance.
- Check the wire rope, end connections and end fittings for corrosion, kinking, bending, crushing, bird-caging or other signs of damage.
- Check the number, distribution and type of visible broken wires. See paragraph 3.3.4 b and Figure 5.
- Check the wire rope for reduction of rope diameter from loss of core support, or wear of outside wires. See Figure 7.
- Take extra care when inspecting sections of rapid deterioration such as sections in contact with saddles, sheaves, repetitive pickup points, crossover points and end connections.

⚠WARNING

Do not use damaged or malfunctioning equipment. Place an "OUT OF ORDER" sign on the winch. Do not use the winch until the sign is removed by a qualified maintenance person who has completely corrected the problem.

Inspect the winch to detect signs of damage or poor operation before they become hazardous. See Table 1.

3.3.1 CONSULT APPLICABLE CODES AND REGULATIONS for specific rules on inspecting the winch and other equipment.

3.3.2 CONSULT MANUFACTURER'S RECOMMENDATIONS for information on inspecting the wire rope and other equipment.

3.3.3 **Instructions for Frequent Inspection**

a VISUALLY INSPECT the entire winch and all other equipment involved in the operation.

- Check all equipment for cracks, dents, bending, rust, wear, corrosion and other damage.
- Make sure the wire rope is installed correctly and anchored securely to the drum.
- Make sure the winch is properly lubricated.
- Make sure the set screws holding the handle in place are tight, and the hair pin clip is installed.
- Make sure mounting fasteners are tightened securely.
- Make sure the foundation is in good condition, and capable of supporting the winch and its load under all load conditions.

b TEST WINCH PERFORMANCE by moving a test load not exceeding the load rating.

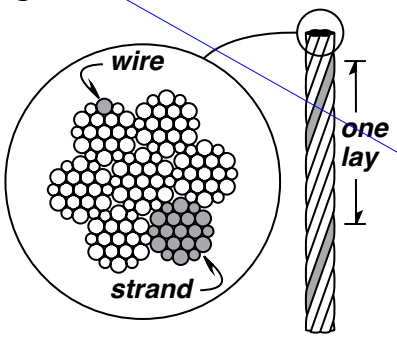
- Listen for unusual noises, and look for signs of damage as you operate the winch.
- Make sure the wire rope winds evenly and tightly onto the drum. If it is loose or uneven, rewind it before continuing.
- Make sure the handle rotates freely in both directions.
- Make sure the ratchet engages and disengages completely.
- If equipped with a brake, check the brake. Raise the load, then lower it and stop it a few feet off the ground. If the load continues to coast or creep under normal operating conditions, the brake needs repair or replacement. Contact Thern, Inc.

Completely correct all problems before continuing. Use the Troubleshooting Chart to help determine the cause of certain problems. See Table 2.

Perform periodic inspections:

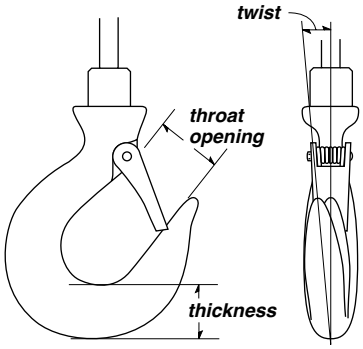
- Every 6 months.
- Whenever you return the winch to service from storage.
- Whenever you notice damage or poor operation in a frequent inspection.
- Whenever you have, or think you may have, overloaded or shock loaded the winch.

Figure 5 – Broken Wires



Wire rope assembly must be replaced if more than 6 wires are broken in one lay, or if more than 3 wires are broken in one strand in one lay.

Figure 6 – Load Hook Inspection



The wire rope assembly must be replaced if the throat opening is 15% wider than nominal, if the thickness is 10% less than nominal, or if the hook is twisted 10° or more.

3.3.4 **Instructions for Periodic Inspection**

a VISUALLY INSPECT the winch and all other equipment.

- Check the finish for wear, flaking, or other damage.
- Check all equipment for cracks, dents, bending, rust, wear, corrosion and other damage. If the equipment was overloaded, or if you notice cracks or other signs of overloading and damage, promptly remove equipment from use and have it repaired or replaced. **DO NOT CONTINUE TO USE DAMAGED OR OVERLOADED EQUIPMENT OR WIRE ROPE.**
- Check all fasteners for striped threads, wear, bending, and other damage.
- Check the foundation for cracks, corrosion, and other damage.
- Make sure the winch is properly lubricated.
- Make sure all labels and plates are readable, firmly attached, free of damage and clean. Replacements are available from the factory.

b INSPECT THE WIRE ROPE according to the wire rope manufacture's recommendations or follow accepted industry standards for wire rope inspections.

- Always wear protective clothing when handling wire rope.
- Check the entire length of wire rope for bent wires, crushed areas, broken or cut wires, corrosion, and other damage. Carefully inspect areas that pass over sheaves or through roller guides.
- Note the location and concentration of broken wires. Replace wire rope if more than 6 wires are broken in one lay, or more than 3 wires are broken in one strand in one lay. See Figure 5.
- Make sure the load hook, anchor fitting or other devices are securely attached to the wire rope, and the wire rope where they are attached is not frayed, corroded, broken, or otherwise damaged.
- Measure the throat opening, thickness, and twist of the hook. Replace the hook if it shows signs of damage. See Figure 6.
- Make sure hook latch opens without binding and closes when released.
- Check the anchor holes in the drum and the surrounding area for signs of wear or distortion.

c MOVE THE DRUM with your hands. Check for excessive movement indicating worn or loose gears, bearings, or shafts. Slight endplay in the driveshaft is normal. Excessive movement is caused by overloading or overheating, and is a sign that your application may require a larger winch.

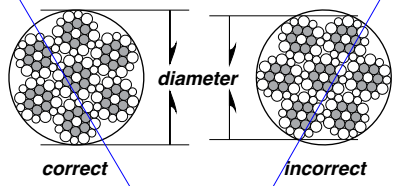
d PLACE enough weight to keep the wire rope straight and tightly drawn.

- Measure the diameter of the wire rope, especially in areas where wear is noticeable. Replace the wire rope if the diameter measures below the minimum diameter at any point. See Figure 7.

e REMOVE THE WINCH from the foundation.

- Check fasteners for stripped threads, wear, bends, and other damage.
- Check the frame for bending, distortion, cracks and other damage. A bent frame is caused by overloading, and is a sign that your application may require a winch with a larger load rating.

Figure 7 – Rope Diameter



The wire rope assembly must be replaced if the diameter measures less than the minimum diameter at any point.

wire rope size	minimum diameter
1/8 in	7/64 in (.1094 in)
3/16 in	11/64 in (.1719 in)
1/4 in	15/64 in (.2344 in)
5/16 in	19/64 in (.2969 in)
3/8 in	11/32 in (.3438 in)
1/2 in	15/32 in (.4688 in)
5/8 in	37/64 in (.5781 in)
3/4 in	45/64 in (.7031 in)

f TEST WINCH PERFORMANCE by operating the winch with a load equal to the load rating.

- Listen for unusual noises, and look for signs of damage as you operate the winch.
- Make sure the wire rope winds evenly and tightly onto the drum. If it is loose or uneven, rewind it before continuing.
- Observe the rotating drum, look for signs of loose or misaligned bearings.
- Make sure the load moves smoothly, without hesitation or strain.
- Make sure the handle rotates freely in both directions.
- Make sure the ratchet engages and disengages completely.
- If equipped with a brake, check the brake. Raise the load, then lower it and stop it a few feet off the ground. If the load continues to coast or creep under normal operating conditions, the brake needs repair or replacement. Contact Thern, Inc.

Completely correct all problems before continuing. Use the troubleshooting chart to help determine the cause of certain problems. See Table 2.

Table 1 – Inspection Checklist

checked boxes indicate damage or problem in need of repair

	damages	problems
general	☐ finish weathered, flaking, otherwise damaged	☐ winch jerks or hesitates during operation
	☐ parts cracked, bent, rusted, worn, otherwise damaged	☐ unusual noises, other signs of malfunction
fasteners	☐ stripped threads, bent, worn, otherwise damaged	☐ loose, not tightened to proper torque
gears	☐ excessively worn, cracked, corroded, otherwise damaged	☐ loose or improperly lubricated
ratchet	☐ ratchet corroded, cracked, worn, otherwise damaged	☐ ratchet does not engage or disengage
brake assembly	☐ brake corroded, cracked, worn, otherwise damaged	☐ brake does not operate properly
drum	☐ anchor hole worn, distorted, otherwise damaged	☐ excessive movement or backlash
wire rope	☐ bent, crushed, otherwise damaged	☐ wire rope loosely or unevenly wound
	☐ broken wires, see Figure 5	
	replace if more than 6 wires in one lay,	number per strand =
	or 3 wires in one strand in one lay, are broken	number per lay =
	☐ diameter reduced, see Figure 7	
	replace if diameter is excessively worn	diameter =
end connections	☐ corroded, rusted, worn, otherwise damaged	☐ not securely attached
load hook	☐ twisted, bent, worn, otherwise damaged, see Figure 6	☐ hook latch fails to close when released
	replace if twist is 10 degrees or more	twist =
	replace if throat width is 15% larger than nominal	throat width =
	replace if thickness is 10% less than nominal	thickness =
labels and plates	☐ dirty, illegible, otherwise damaged	☐ loosely attached or missing
comments:		
authorized signature: _____		**date** _____

Table 2 – Troubleshooting Chart

Contact the factory for detailed instructions if you are required to disassemble the winch or brake for any reason. Disassembly of the winch or brake before contacting Thern, Inc. voids all warranties.

problem	cause	correction
handle turns, drum doesn't turn	• loose or broken spring pins	inspect winch and brake, repair as necessary
	• loose, stripped or broken gears	inspect gears and repair as necessary
handle turns hard or not at all	• ratchet on winch engaged	disengage winch ratchet
	• load too heavy	lighten load
	• spring pins loose or broken on winch or brake	inspect winch and brake, repair as necessary
	• disc brake damaged or locked	inspect brake, repair as necessary
	• gears or bearings broken or locked	inspect and repair as necessary
brake does not operate properly	• friction discs worn or damaged	inspect and replace as necessary
	• friction discs damaged from over lubrication	inspect and replace as necessary
	• disc brake ratchet pawl damaged	inspect and repair as necessary
excessively worn gears or bearings	• load too heavy	lighten load
(excessive backlash)	• poor lubrication of gears or bearings	inspect and relubricate as necessary
overheating	• operated too long without rest	allow to cool
	• load too heavy	lighten load
	• poor lubrication	inspect and lubricate as necessary
	• bearing seized up	inspect and replace as necessary
unusual noises		
high pitched squeak	• poor lubrication	inspect and relubricate as necessary
grinding noise	• contaminated lubrication	clean and relubricate winch
	• dirt in brake or winch gears	inspect and clean as necessary
	• broken gears or bearings	inspect and replace as necessary
rattling noise	• loose bolts, set screws or other fasteners	tighten all bolts and other fasteners
uneven clicking noise in brake	• broken gear tooth in brake	inspect and repair as necessary
weak clicking noise in brake	• spring or ratchet pawl dirty or damaged	inspect and clean or repair as necessary
	• worn brake ratchet pawl, gear, or spring	inspect and replace as necessary
no clicking noise in brake	• ratchet incorrectly installed	disassemble and install correctly
	• ratchet pawl damaged or worn excessively	inspect and replace as necessary

3.4 Repairing the Winch

Important!

- It is your responsibility to determine when to replace parts. When considering whether to continue using a part or to replace it, remember that replacing it is the best way to avoid further equipment damage.
- Replace all spring pins and retaining rings when you disassemble the winch or brake for repair or replacement.
- Appoint a qualified person to be responsible for all repairs to the equipment.

3.4.1 GET FACTORY AUTHORIZATION for all repairs. Unauthorized repairs will void the warranty, and may lead to damage or failure of the winch.

3.4.2 REPLACE DAMAGED OR POORLY OPERATING PARTS with Thern repair parts.

3.4.3 REFINISH AREAS where the paint is worn or flaking. A good finish helps to protect against corrosion and weather damage.

a REMOVE THE FINISH from damaged areas, down to the bare metal.

b CLEAN THE AREA thoroughly.

c REPAINT with a high quality primer and finishing coat.

3.4.4 TO ORDER REPAIR PARTS, contact your local dealer. Include the following information when ordering:

- model number
- serial number (or code number)
- part number
- date purchased, and from whom
- description of what happened, or what is wrong
- your name and return address

4.1 Transporting the Winch

Important!

- Keep a record of what you ship, and when you send it.

4.1.1 PACK THE WINCH using the original packaging materials, if possible.

4.1.2 SEAL THE WINCH in plastic with a desiccant to help protect it from rust, corrosion, and other damage.

4.1.3 INSPECT THE WINCH according to the Instructions for Periodic Inspection before installing it in a new location.

4.2 Storing the Winch

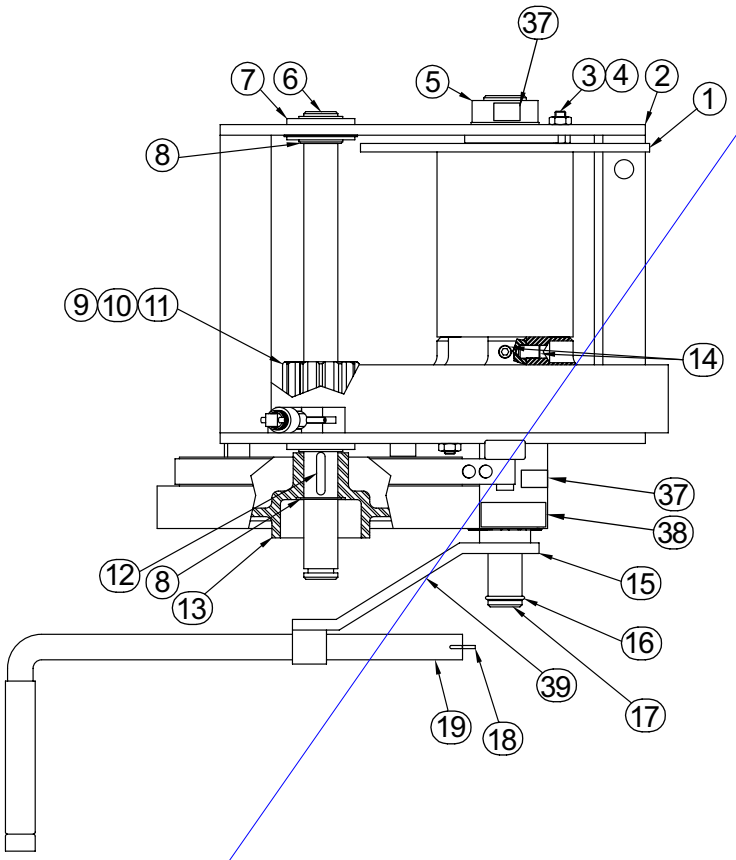
4.2.1 SEAL THE WINCH in plastic with a desiccant to help protect it from rust, corrosion, and other damage.

4.2.2 STORE THE WINCH in a cool clean place away from corrosive chemicals and moisture.

4.2.3 ROTATE THE DRUM periodically to keep bearing and gears surfaces from becoming lacquered.

4.2.4 INSPECT THE WINCH according to the Instructions for Periodic Inspection before installing it for operation.

Spur Gear Hand Winch		Model M452	
item	**description**	**part number**	**qty.**
1	DRUM	C1022	1
2	FRAME	D1001	1
3	HEX JAM NUT NYLK .312-18NC SST	A4379	2
4	CAPSCREW HEXHD .312-18NC X .625 SST	A4170	2
5	BEARING HOUSING ASSEMBLY	A1442	2
6	COUNTERSHAFT	B1381	1
7	RADIAL BALL BEARING 1.00ID X 2.00OD X .75 STL	A1439	2
8	RETAINING RING EXT 1.000 SST	A4381	2
9	PINION 2.25OD X 2.0PD X 1.71RD	A5388	1
10	SET SCREW SOKHD NYLK .250-20NC X .250 SST	A3943	1
11	KEY .250 X .250 X 1.750	A5394	1
12	KEY .250 X .250 X 1.250	A5393	1
13	COUNTERSHAFT GEAR	C1102	1
14	SET SCREW SOKHD NYLK .375-16NC X .625 SST	A3948	2
15	FLAT HANDLE ASSEMBLY	B1181	1
16	HAIR PIN CLIP .750 X .093 DIA SST	A4380	1
17	DRUM SHAFT	B1047	1
18	COTTER PIN .187 X 1.250 SST	A4309	1
19	HANDLE ASSEMBLY	B1045	1
20	RATCHET PIN	A1624	1
21	SLOTTED SPRING PIN .156 X .750 SST	A4277	2
22	COMPRESSION SPRING .658OD X .048WD X 1.000 SST	A1397	2
23	RATCHET PIN KNOB	A1620	1
24	SLOTTED SPRING PIN .156 X 1.500 SST	A4278	1
25	SET SCREW SQHD .312-18NC X .500 SST	A4266	1
26	HANDLE GRIP	A1043	1
27	BRAKE HANDLE	B1173	1
28	BRAKE BAND ASSEMBLY	C1104	1
29	FLAT WASHER SMALL OD .312 X .750 SST	A2941	1
30	WASHER HELSPRLK .312 X .596 X .078 SST	A3936	1
31	BRAKE HANDLE BUSHING	A1438	1
32	HEX NUT .312-18NC SST	A4324	1
33	LABEL LOAD RATING	A7526	1
34	LABEL CAUTION	A2175	1
35	LABEL CODE	10477	1
36	LABEL WARNING	A1979	1
37	LABEL OIL	A2176	2
38	LABEL CABLE TAKEUP	A1923	1
39	LABEL WARNING	A2691	1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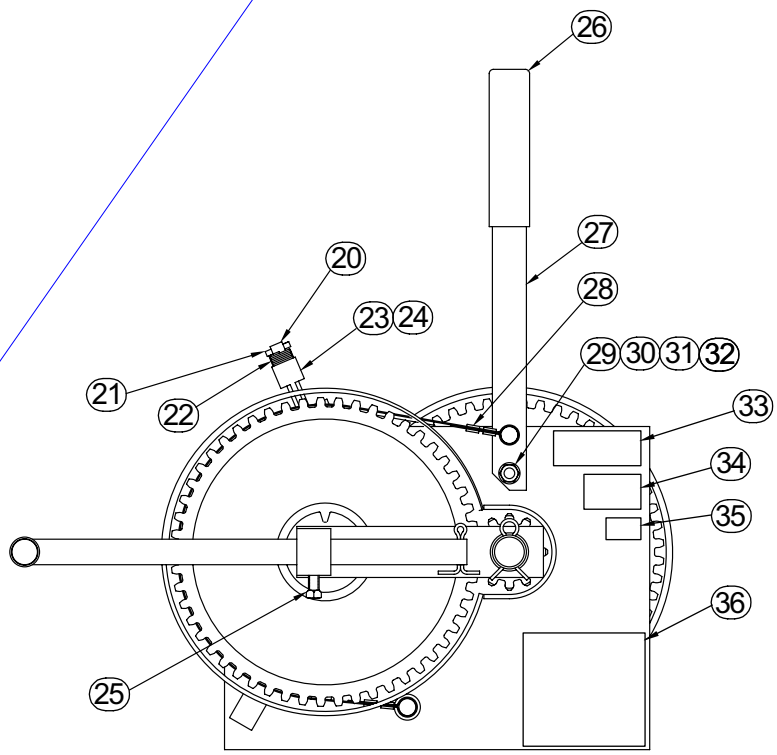
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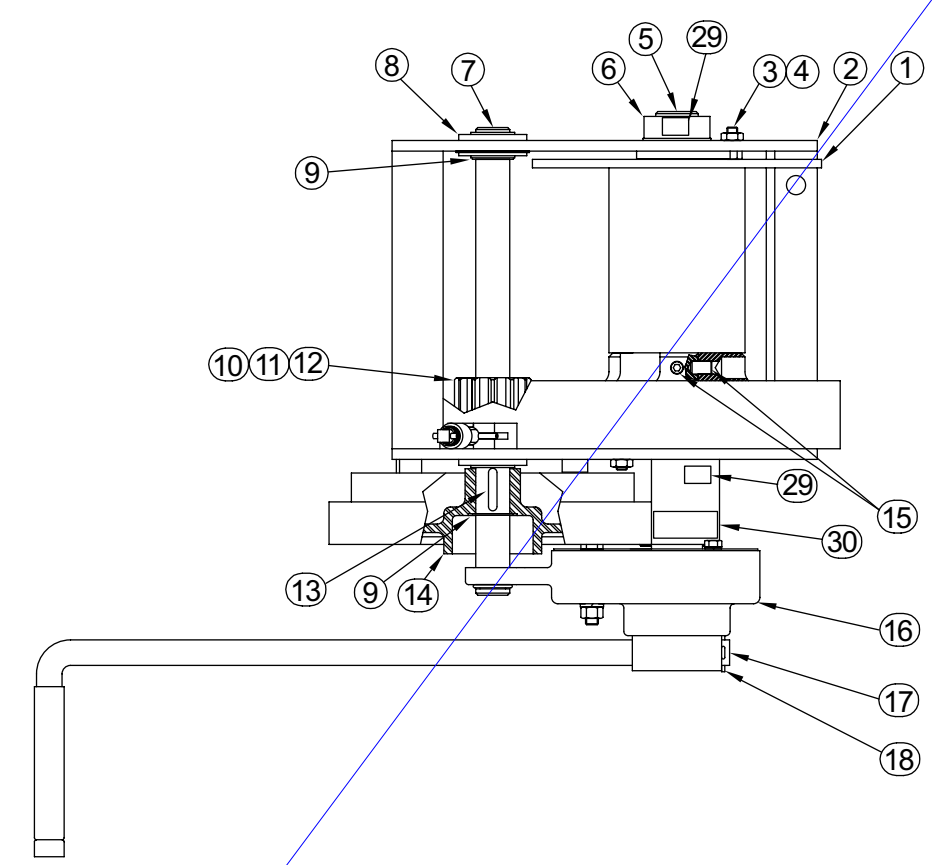
Spur Gear Hand Winch		Model M452B[1]	
item	**description**	**part number**	**qty.**
1	DRUM	C1022	1
2	FRAME	D1001	1
3	HEX JAM NUT NYLK .312-18NC SST	A4379	2
4	CAPSCREW HEXHD .312-18NC X .625 SST	A4170	2
5	DRUM SHAFT	B1047	1
6	BEARING HOUSING ASSEMBLY	A1442	2
7	COUNTER SHAFT	B1381	1
8	BALL BEARING RAD 1.00ID X 2.00OD X .75 STL	A1439	2
9	RETAINING RING EXT 1.000 SST	A4381	2
10	PINION	A5388	1
11	SET SCREW SOKHD NYLK .250-20NC X .250 SST	A3943	1
12	KEY .250 X .250 X 1.750	A5394	1
13	KEY .250 X .250 X 1.250	A5393	1
14	COUNTERSHAFT GEAR	C1102	1
15	SET SCREW SOKHD NYLK .375-16NC X .625 SST	A3948	2
16	BRAKE SUBASSEMBLY	C2731	1
17	HANDLE ASSEMBLY	B1015	1
18	COTTER PIN .187 X 1.250 SST	A4309	1
19	RATCHET PIN	A1624	1
20	SLOTTED SPRING PIN .156 X .750 SST	A4277	2
21	COMPRESSION SPRING .658OD X .048WD X 1.000 SST	A1397	2
22	RATCHET PIN KNOB	A1620	1
23	SLOTTED SPRING PIN .156 X 1.500 SST	A4278	1
24	HAIR PIN CLIP .750 X .093 DIA SST	A4380	1
25	LABEL LOAD RATING	A2169	1
26	LABEL CAUTION	A2175	1
27	LABEL CODE	10477	1
28	LABEL WARNING	A1979	1
29	LABEL OIL	A2176	2
30	LABEL CABLE TAKEUP	A1923	1

[1] See Hand Operated Disc Brake manual (A6191) for brake information.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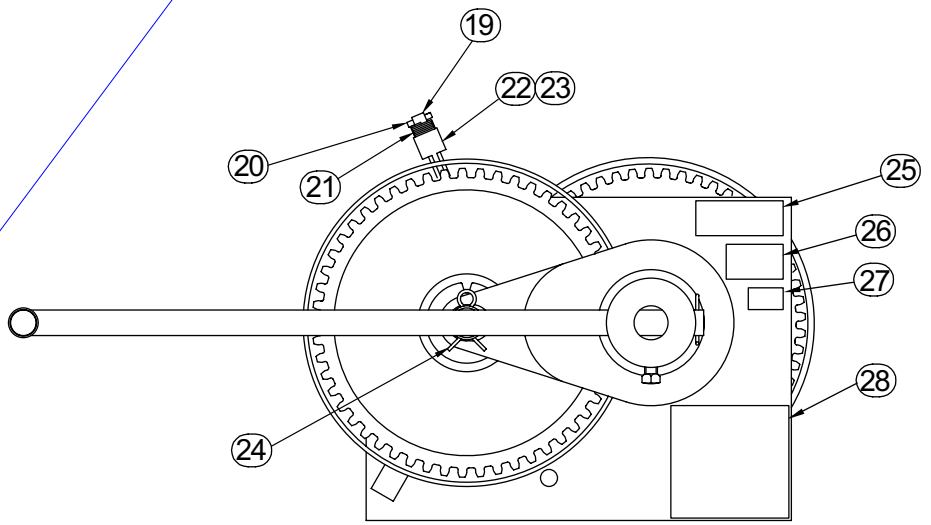
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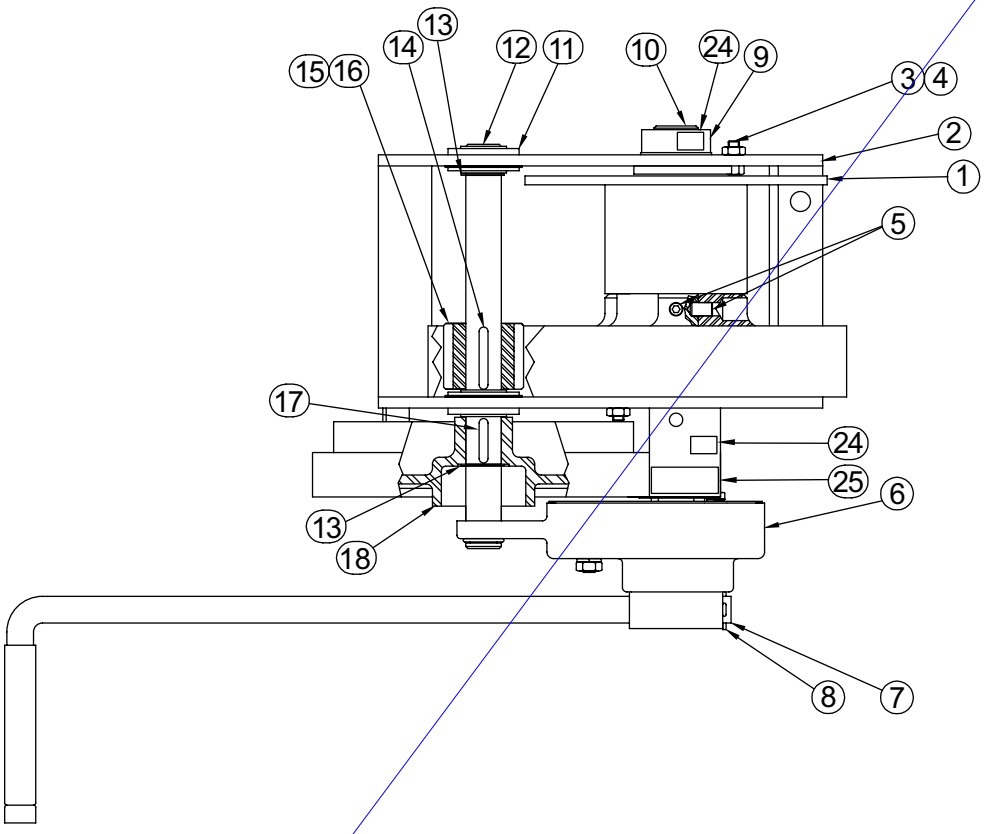
Spur Gear Hand Winch		Model M452B-A[1]	
item	**description**	**part number**	**qty.**
1	DRUM	C2727	1
2	FRAME	D1487	1
3	HEX JAM NUT NYLK .312-18NC SST	A4379	2
4	CAPSCREW HEXHD .312-18NC X .625 SST	A4170	2
5	SET SCREW SOKHD NYLK .375-16NC X .625 SST	A3948	2
6	BRAKE SUBASSEMBLY	C2731	1
7	HANDLE ASSEMBLY	B1015	1
8	COTTER PIN .187 X 1.250 SST	A4309	1
9	BEARING HOUSING ASSEMBLY	A1442	2
10	DRUM SHAFT	B2776	1
11	BALL BEARING RAD 1.00ID X 2.00OD X .75 STL	A1439	2
12	COUNTER SHAFT	B2775	1
13	RETAINING RING EXT 1.000 SST	A4381	2
14	KEY .250 X .250 X 1.750	A5394	1
15	PINION 2.25OD X 2.0PD X 1.71RD	A5388	1
16	SET SCREW SOKHD NYLK .250-20NC X .250 SST	A3943	1
17	KEY .250 X .250 X 1.250	A5393	1
18	COUNTERSHAFT GEAR	C1102	1
19	HAIR PIN CLIP .750 X .093 DIA SST	A4380	1
20	LABEL LOAD RATING	A7609	1
21	LABEL CAUTION	A2175	1
22	LABEL CODE	10477	1
23	LABEL WARNING	A1979	1
24	LABEL OIL	A2176	2
25	LABEL CABLE TAKEUP	A1923	1

[1] See Hand Operated Disc Brake manual (A6191) for brake information.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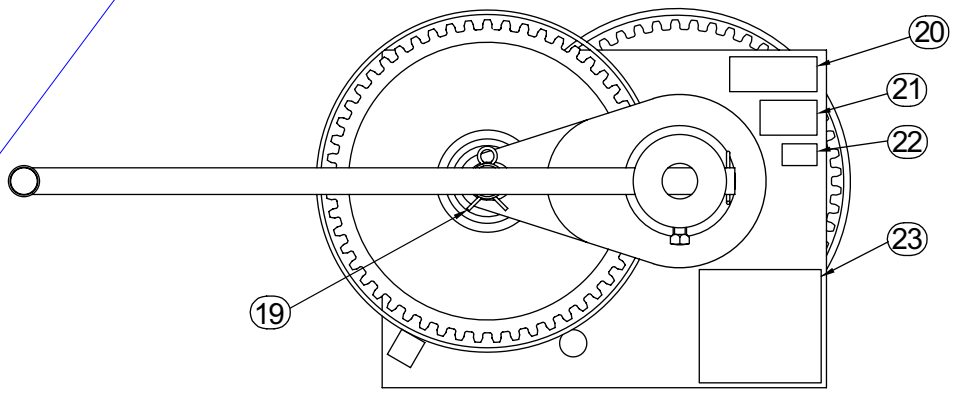
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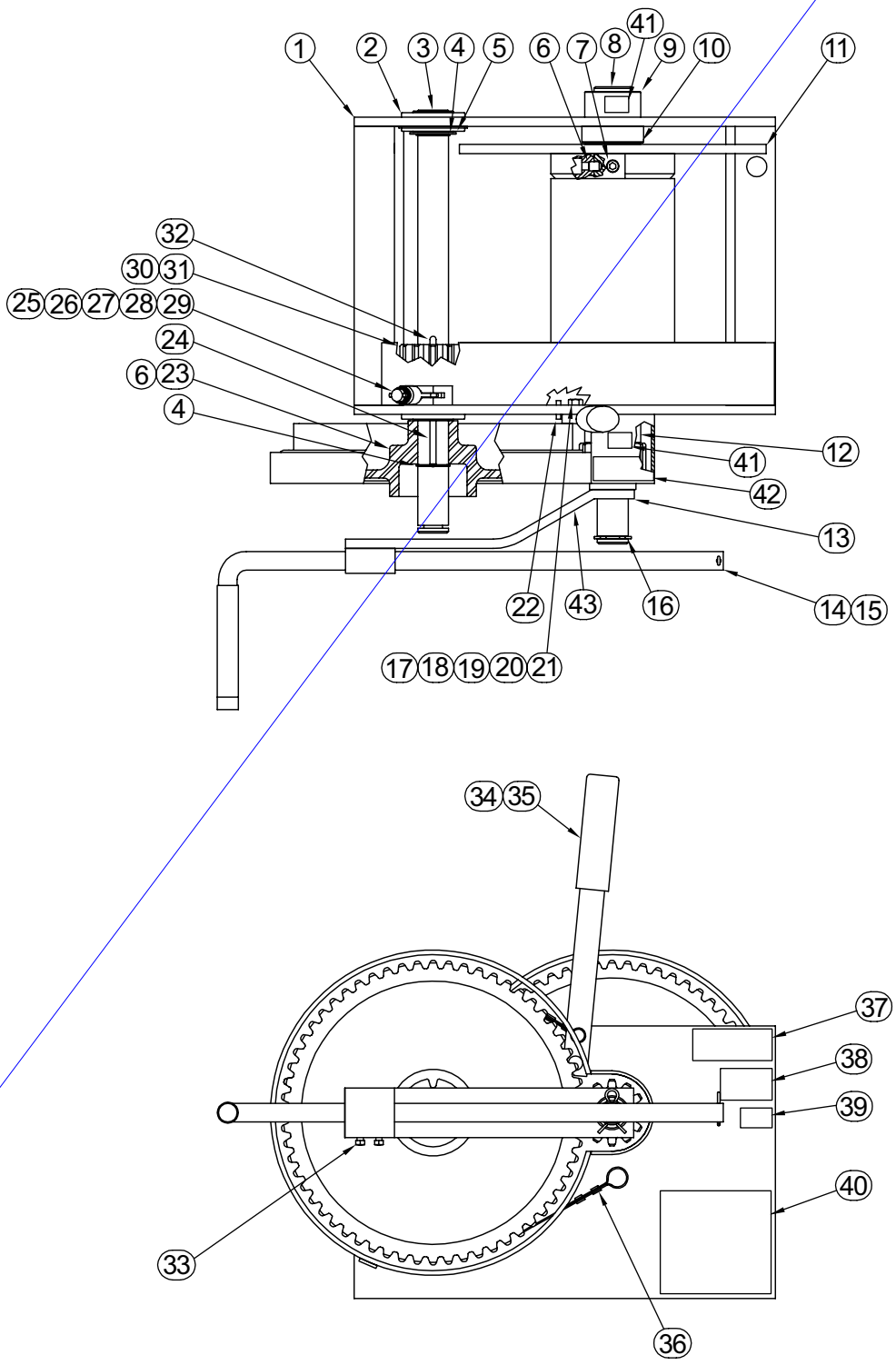
Spur Gear Hand Winch		Model M492		Model M492-12	
item	description	part number	qty.	part number	qty.
1	FRAME	D1038	1	SD1129	1
2	RADIAL BALL BEARING	A1520	2	A1520	2
3	COUNTERSHAFT	B1225	1	SB1312	1
4	RETAINING RING EXT 1.250 SST	A3892	2	A3892	2
5	MACHINERY BUSHING 1.250 X 1.875 X 18GA	A3921	2	A3921	2
6	SET SCREW SOKHD NYLK .375-16NC X .500 SST	A3947	2	A3947	2
7[1]	SET SCREW SOKHD NYLK .500-13NC X .625 SST	A3949	1	A3949	1
7[2]	SET SCREW SOKHD NYLK .500-13NC X 1.000 SST	A8322	1	A8322	1
8	DRUM SHAFT	B1224	1	SB1314	1
9	BEARING HOUSING ASSEMBLY	B1443	1	B1443	1
10	MACHINERY BUSHING 1.500 X 2.250 X 18GA	A3924	2	A3924	2
11	DRUM	C1077	1	SC1159	1
12	BEARING HOUSING ASSEMBLY	B2839	1	B2839	1
13	FLAT HANDLE ASSEMBLY	B1228	1	B1228	1
14	HANDLE ASSEMBLY	B1045	1	B1045	1
15	COTTER PIN .187 X 1.250 SST	A4309	1	A4309	1
16	HAIR PIN CLIP .750 X .093 DIA SST	A4380	1	A4380	1
17	BRAKE HANDLE BUSHING	A1438	1	A1438	1
18	CAPSCREW HEXHD .312-18NC X 1.250 SST	A4173	1	A4173	1
19	HEX NUT .312-18NC SST	A4324	1	A4324	1
20	FLAT WASHER SMALL OD .312 X .750 SST	A2941	1	A2941	1
21	WASHER HELSPRLK .312 X .596 X .078 SST	A3936	1	A3936	1
22	SLOTTED SPRING PIN .187 X .750 SST	A4282	1	A4282	1
23	COUNTERSHAFT GEAR	C1121	1	C1121	1
24	KEY .250 X .250 X 1.750	A2674	1	A2674	1
25	RATCHET PIN	A1622	1	A1622	1
26	RATCHET PIN KNOB	A1620	1	A1620	1
27	COMPRESSION SPRING .658OD X .048WD X 1.000 SST	A1397	2	A1397	2
28	SLOTTED SPRING PIN .156 X .750 SST	A4277	1	A4277	1
29	SLOTTED SPRING PIN .156 X 1.500 SST	A4278	1	A4278	1
30	PINION	A1515	1	A1515	1
31	SET SCREW SOKHD NYLK .250-20NC X .250 SST	A3943	1	A3943	1
32	KEY .250 X .250 X 2.500	A5180	1	A5180	1
33	SET SCREW SQHD .250-20NC X .750 SST	A4264	2	A4264	2
34	HANDLE GRIP	A1043	1	A1043	1
35	BRAKE HANDLE	B1173	1	B1173	1
36	BRAKE BAND ASSEMBLY	B1233	1	B1233	1
37	LABEL LOAD RATING	A7527	1	A7730	1
38	LABEL CAUTION	A2175	1	A2175	1
39	LABEL CODE	10477	1	10477	1
40	LABEL WARNING	A1979	1	A1979	1
41	LABEL OIL	A2176	2	A2176	2
42	LABEL CABLE TAKEUP	A1923	1	A1923	1
43	LABEL WARNING	A2691	1	A2691	1

[1] For use with wire rope greater than 9/16 inch.
[2] For use with 9/16 inch wire rope or smaller.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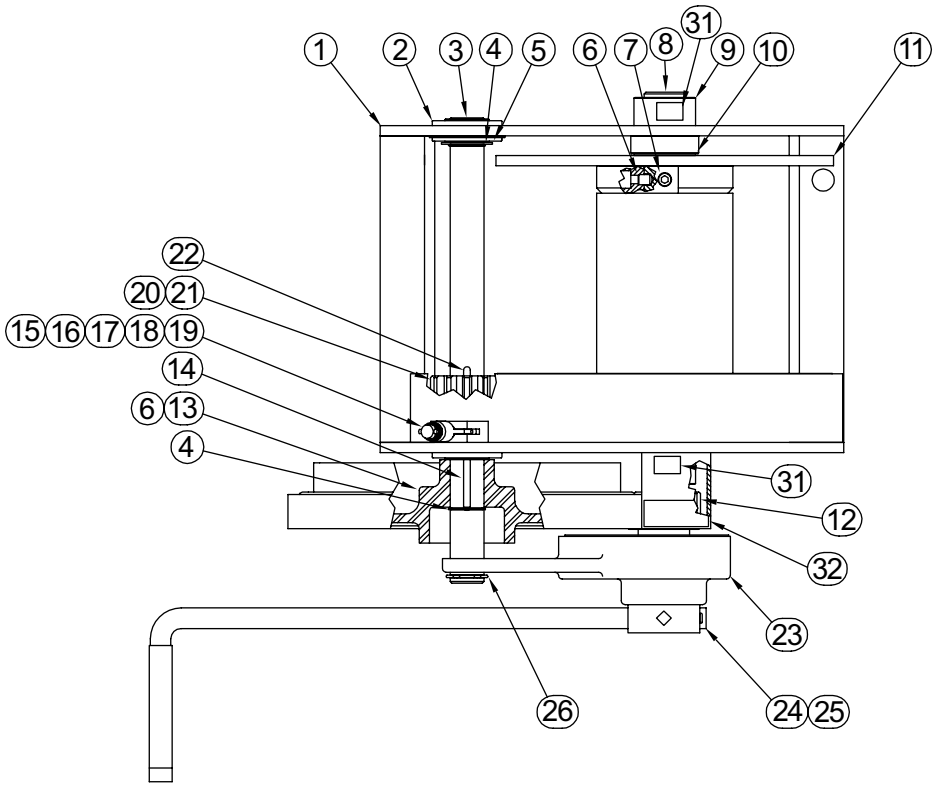
Spur Gear Hand Winch		Model M492B[1]		Model M492B-12[1]	
item	**description**	**part number**	**qty.**	**part number**	**qty.**
1	FRAME	D1038	1	SD1129	1
2	RADIAL BALL BEARING	A1520	2	A1520	2
3	COUNTERSHAFT	B1225	1	SB1312	1
4	RETAINING RING EXT 1.250 SST	A3892	2	A3892	2
5	MACHINERY BUSHING 1.250 X 1.875 X 18GA ZPLIRDI ST	A3921	2	A3921	2
6	SET SCREW SOKHD NYLK .375-16NC X .500 SST	A3947	2	A3947	2
7[2]	SET SCREW SOKHD NYLK .500-13NC X .625 SST	A3949	1	A3949	1
7[3]	SET SCREW SOKHD NYLK .500-13NC X 1.000 SST	A8322	1	A8322	1
8	DRUM SHAFT	B1224	1	SB1314	1
9	BEARING HOUSING ASSEMBLY	B1443	1	B1443	1
10	MACHINERY BUSHING 1.500 X 2.250 X 18GA ZPLIRDI ST	A3924	2	A3924	2
11	DRUM	C1077	1	SC1159	1
12	BEARING HOUSING ASSEMBLY	B2839	1	B2839	1
13	COUNTERSHAFT GEAR	C1121	1	C1121	1
14	KEY .250 X .250 X 1.750	A2674	1	A2674	1
15	RATCHET PIN	A1622	1	A1622	1
16	RATCHET PIN KNOB	A1620	1	A1620	1
17	COMPRESSION SPRING .658OD X .048WD X 1.000 SST	A1397	2	A1397	2
18	SLOTTED SPRING PIN .156 X .750 SST	A4277	2	A4277	2
19	SLOTTED SPRING PIN .156 X 1.500 SST	A4278	1	A4278	1
20	PINION	A1515	1	A1515	1
21	SET SCREW SOKHD NYLK .250-20NC X .250 SST	A3943	1	A3943	1
22	KEY .250 X .250 X 2.500	A5180	1	A5180	1
23	BRAKE SUBASSEMBLY	C3559	1	C3559	1
24	HANDLE ASSEMBLY	B1015	1	B1015	1
25	COTTER PIN .187 X 1.250 SST	A4309	1	A4309	1
26	HAIR PIN CLIP .750 X .093 DIA SST	A4380	1	A4380	1
27	LABEL LOAD RATING	A7700	1	A7731	1
28	LABEL CAUTION	A2175	1	A2175	1
29	LABEL CODE	10477	1	10477	1
30	LABEL WARNING	A1979	1	A1979	1
31	LABEL OIL	A2176	2	A2176	2
32	LABEL CABLE TAKEUP	A1923	1	A1923	1

[1] See Hand Operated Disc Brake manual (A6191) for brake information.
[2] For use with wire rope greater than 9/16 inch.
[3] For use with 9/16 inch wire rope or smaller.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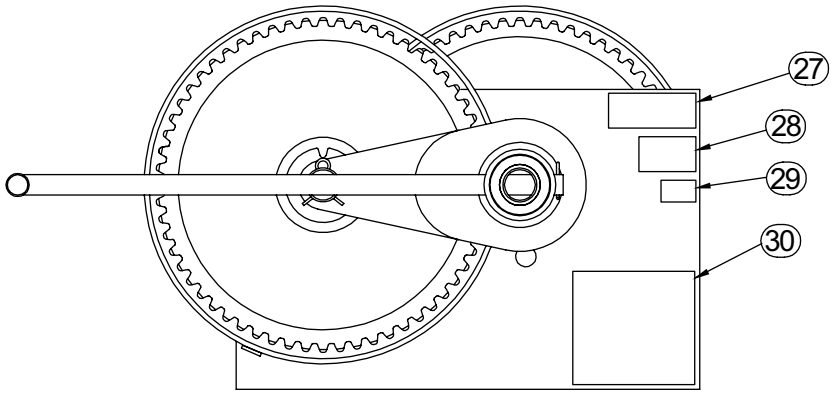
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Spur Gear Hand Winches – Performance Characteristics [3]

model number	description	load rating (lb) 1st layer	load rating (lb) mid drum	load rating (lb) full drum	wire rope dia. (in)	drum capacity (ft)[1] 1st layer	drum capacity (ft)[1] mid drum	drum capacity (ft)[1] full drum	single gear ratio	double gear ratio	force [2] to lift 1000 lb
M452	4000 lb – marine duty (for pulling only)	4000	3300	2500	1/4 5/16 3/8	23 18 14	130 89 64	300 200 140	4.42:1	19.54:1	10 lb (double gear)
M452B	4000 lb – marine duty with brake (for lifting)	4000	3300	2500	1/4 5/16 3/8	23 18 14	130 89 64	300 200 140	—	19.54:1	10 lb (double gear)
M452B-A	4000 lb – marine duty with brake (for lifting) 4 inch drum width	4000	3300	2500	1/4 5/16 3/8	13 9 7	83 56 40	190 120 89	—	19.54:1	10 lb (double gear)
M492	10,000 lb – marine duty (for pulling only)	10,000	7400	5400	5/16 3/8 1/2	27 21 15	240 170 100	540 390 230	5.00:1	25.00:1	8 lb (double gear)
M492B	10,000 lb – marine duty with brake (for lifting)	10,000	7400	5400	5/16 3/8 1/2	27 21 15	240 170 100	540 390 230	—	25.00:1	8 lb (double gear)
M492-12	10,000 lb – marine duty (for pulling only) 12 inch drum width	10,000	7400	5400	5/16 3/8 1/2	46 37 27	380 270 160	850 610 360	5.00:1	25.00:1	8 lb (double gear)
M492B-12	10,000 lb – marine duty with brake (for lifting) 12 inch drum width	10,000	7400	5400	5/16 3/8 1/2	46 37 27	380 270 160	850 610 360	—	25.00:1	8 lb (double gear)

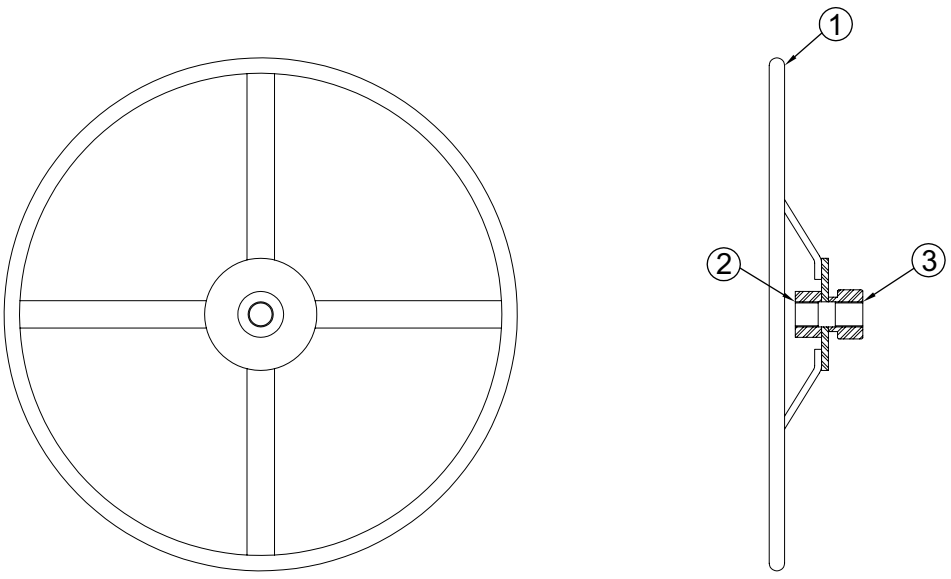
[1] Actual drum capacities may be 25-30% less, due to nonuniform winding. Wire rope tension will also affect drum capacity.

[2] Approximate handle force required to lift 1000 lb with an empty drum, and maximum handle length.

[3] Performance Characteristics are for standard products referred to in this manual. Non-standard products may vary from the original design. Contact Thern, Inc. for this information.

Hand Wheel		Model HW452		Model HW492	
item	**description**	**part number**	**qty.**	**part number**	**qty.**
1	HAND WHEEL	C1210	1	C1211	1
2	BEARING SLEEVE	A3642	1	A3636	1
3	BEARING SLEEVE	A4366	1	A3635	1
4[1]	LABEL CODE NUMBER	10477	1	10477	1
5[1]	LABEL MODEL	A1921	1	A1922	1
6[1]	LABEL WARNING	A2224	1	A2224	1

[1] These items are not shown in parts drawing.



NOTES:

2.A.2

DRILL MOTOR & CLUTCH

1-1/4" Large Drill, 250 RPM

2404-1

What's Included

(1) 1-1/4" Large Drill, 250 RPM (2404-1)
(1) Pipe Handle

Where to Buy

Shop Online
Find Local

The most hand-held power available in a specialty drill. Part of Milwaukee’s Super Hole Shooter line, the 1-1/4” Large Drill delivers versatile, portable power for the toughest drilling and auger applications. The drill is furnished with a powerful Milwaukee-built motor and a #3 internal Morse taper socket. Poly chrome alloy steel gears produce high torque with minimum wear. You’ll get quiet performance from the heat-treated, helical-cut gears. The extra long switch handle and pipe handle provide maximum leverage and added control.

Features

- Powerful 10.0-amp motor: Delivers up to 250 RPM with reverse
- Torque: Offers 1-1/4” capacity in steel
- Heat-treated gears: Helical-cut for quiet performance
- 8-ft. fixed rubber cord: Durable construction for longer tool life

Specifications

Length	18-3/4"
Weight	23.8 lbs
Voltage	120 AC/DC
Tool Warranty	5 Years
Cord Type	8' Fixed
No Load RPM	250
Amps	10
Spindle	#3 M.T.
Capacity in Steel	Twist Bit 1-1/4"
Capacity in Wood	Flat Boring Bit 1-1/2"|Hole Saw 6"|Auger 1-1/2"|Self-Feed 4-5/8"
Chuck Size	1-1/4"
Construction Type	Grounded
Gear Train	Triple

OPERATOR'S MANUAL
MANUEL de L'UTILISATEUR
MANUAL del OPERADOR

Catalog No.
No de Cat.
1854-1
2404-1

SUPER HOLE SHOOTERS
PERCEUSES HAUTE PERFORMANCE
PERFORADORAS SUPER

TO REDUCE THE RISK OF INJURY, USER MUST READ AND UNDERSTAND OPERATOR'S MANUAL.

AFIN DE RÉDUIRE LE RISQUE DE BLESSURES, L'UTILISATEUR DOIT LIRE ET BIEN COMPRENDRE LE MANUEL DE L'UTILISATEUR.

PARA REDUCIR EL RIESGO DE LESIONES, EL USUARIO DEBE LEER Y ENTENDER EL MANUAL DEL OPERADOR.

GENERAL POWER TOOL SAFETY WARNINGS

⚠ *WARNING* *READ ALL SAFETY WARNINGS AND ALL INSTRUCTIONS.* Failure to follow the warnings and instructions may result in electric shock, fire and/or serious injury. *Save all warnings and instructions for future reference.* The term "power tool" in the warnings refers to your mains-operated (corded) power tool or battery-operated (cordless) power tool.

WORK AREA SAFETY

- **Keep work area clean and well lit.** Cluttered or dark areas invite accidents.
- **Do not operate power tools in explosive atmospheres, such as in the presence of flammable liquids, gases or dust.** Power tools create sparks which may ignite the dust or fumes.
- **Keep children and bystanders away while operating a power tool.** Distractions can cause you to lose control.

ELECTRICAL SAFETY

- **Power tool plugs must match the outlet. Never modify the plug in any way. Do not use any adapter plugs with earthed (grounded) power tools.** Unmodified plugs and matching outlets will reduce risk of electric shock.
- **Avoid body contact with earthed or grounded surfaces such as pipes, radiators, ranges and refrigerators.** There is an increased risk of electric shock if your body is earthed or grounded.
- **Do not expose power tools to rain or wet conditions.** Water entering a power tool will increase the risk of electric shock.
- **Do not abuse the cord. Never use the cord for carrying, pulling or unplugging the power tool. Keep cord away from heat, oil, sharp edges or moving parts.** Damaged or entangled cords increase the risk of electric shock.
- **When operating a power tool outdoors, use an extension cord suitable for outdoor use.** Use of a cord suitable for outdoor use reduces the risk of electric shock.
- **If operating a power tool in a damp location is unavoidable, use a ground fault circuit interrupter (GFCI) protected supply.** Use of an GFCI reduces the risk of electric shock.

PERSONAL SAFETY

- **Stay alert, watch what you are doing and use common sense when operating a power tool. Do not use a power tool while you are tired or under the influence of drugs, alcohol or medication.** A moment of inattention while operating power tools may result in serious personal injury.
- **Use personal protective equipment. Always wear eye protection.** Protective equipment such as dust mask, non-skid safety shoes, hard hat, or hearing protection used for appropriate conditions will reduce personal injuries.
- **Prevent unintentional starting. Ensure the switch is in the off-position before connecting to power source and/or battery pack, picking up or carrying the tool.** Carrying power tools with your finger on the switch or energising power tools that have the switch on invites accidents.
- **Remove any adjusting key or wrench before turning the power tool on.** A wrench or a key left attached to a rotating part of the power tool may result in personal injury.
- **Do not overreach. Keep proper footing and balance at all times.** This enables better control of the power tool in unexpected situations.
- **Dress properly. Do not wear loose clothing or jewellery. Keep your hair, clothing and gloves away from moving parts.** Loose clothes, jewellery or long hair can be caught in moving parts.
- **If devices are provided for the connection of dust extraction and collection facilities, ensure these are connected and properly used.** Use of dust collection can reduce dust-related hazards.

POWER TOOL USE AND CARE

- **Do not force the power tool. Use the correct power tool for your application.** The correct power tool will do the job better and safer at the rate for which it was designed.
- **Do not use the power tool if the switch does not turn it on and off.** Any power tool that cannot be controlled with the switch is dangerous and must be repaired.
- **Disconnect the plug from the power source and/or the battery pack from the power tool before making any adjustments, changing accessories, or storing power tools.** Such preventive safety measures reduce the risk of starting the power tool accidentally.
- **Store idle power tools out of the reach of children and do not allow persons unfamiliar with the power tool or these instructions to operate the power tool.** Power tools are dangerous in the hands of untrained users.
- **Maintain power tools. Check for misalignment or binding of moving parts, breakage of parts and any other condition that may affect the power tool's operation. If damaged, have the power tool repaired before use.** Many accidents are caused by poorly maintained power tools.
- **Keep cutting tools sharp and clean.** Properly maintained cutting tools with sharp cutting edges are less likely to bind and are easier to control.
- **Use the power tool, accessories and tool bits etc. in accordance with these instructions, taking into account the working conditions and the work to be performed.** Use of the power tool for operations different from those intended could result in a hazardous situation.

SERVICE

- **Have your power tool serviced by a qualified repair person using only identical replacement parts.** This will ensure that the safety of the power tool is maintained.

SPECIFIC SAFETY RULES

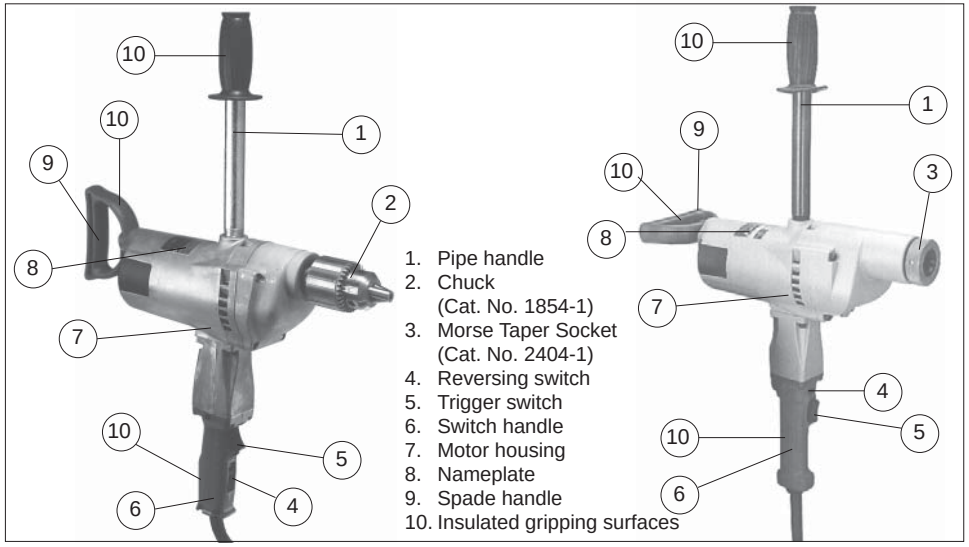
- **Use auxiliary handle(s), if supplied with the tool.** Loss of control can cause personal injury.
- **Hold power tool by insulated gripping surfaces, when performing an operation where the cutting accessory may contact hidden wiring or its own cord.** Cutting accessory contacting a "live" wire may make exposed metal parts of the power tool "live" and could give the operator an electric shock.
- **Maintain labels and nameplates.** These carry important information. If unreadable or missing, contact a *MILWAUKEE* service facility for a free replacement.
- **WARNING** Some dust created by power sanding, sawing, grinding, drilling, and other construction activities contains chemicals known to cause cancer, birth defects or other reproductive harm. Some examples of these chemicals are:
  - lead from lead-based paint
  - crystalline silica from bricks and cement and other masonry products, and
  - arsenic and chromium from chemically-treated lumber.

  Your risk from these exposures varies, depending on how often you do this type of work. To reduce your exposure to these chemicals: work in a well ventilated area, and work with approved safety equipment, such as those dust masks that are specially designed to filter out microscopic particles.

SYMBOLOGY

A	Amps
V	Volts
≂	Direct or Alternating Current
n_0 xxxx min.$^{-1}$	No Load Revolutions per Minute (RPM)
c UL us	Underwriters Laboratories, Inc. United States and Canada
NOM · ANCE	Mexican Approvals Marking

SPECIFICATIONS



1. Pipe handle
2. Chuck (Cat. No. 1854-1)
3. Morse Taper Socket (Cat. No. 2404-1)
4. Reversing switch
5. Trigger switch
6. Switch handle
7. Motor housing
8. Nameplate
9. Spade handle
10. Insulated gripping surfaces

FUNCTIONAL DESCRIPTION

Tool			Wood					Steel	Masonry
Cat. No.	Volts AC/DC	No Load RPM	Flat Boring Bit	Hole Saws	Auger Bit	Ship Auger Bit	Selfeed Bit	Steel Bit	Carbide Tip Bit
1854-2	120	350	1-1/2"	6"	1-1/2"	1-1/2"	4-5/8"	3/4"	1-1/2"
2404-1*	120	250	1-1/2"	6"	1-1/2"	1-1/2"	4-5/8"	1-1/4"	1-1/2"

*To adapt a 3/4" capacity chuck to Cat. No. 2404-1 drill with No. 3 Internal Morse Taper Socket specify Chuck Kit No. 49-22-1550. Kit consists of Chuck No. 48-66-2000 and Arbor No. 48-07-0100.

GROUNDING

WARNING Improperly connecting the grounding wire can result in the risk of electric shock. Check with a qualified electrician if you are in doubt as to whether the outlet is properly grounded. Do not modify the plug provided with the tool. Never remove the grounding prong from the plug. Do not use the tool if the cord or plug is damaged. If damaged, have it repaired by a *MILWAUKEE* service facility before use. If the plug will not fit the outlet, have a proper outlet installed by a qualified electrician.

Grounded Tools: Tools with Three Prong Plugs

Tools marked "Grounding Required" have a three wire cord and three prong grounding plug. The plug must be connected to a properly grounded outlet (See Figure A). If the tool should electrically malfunction or break down, grounding provides a low resistance path to carry electricity away from the user, reducing the risk of electric shock.

The grounding prong in the plug is connected through the green wire inside the cord to the grounding system in the tool. The green wire in the cord must be the only wire connected to the tool's grounding system and must never be attached to an electrically "live" terminal.

Your tool must be plugged into an appropriate outlet, properly installed and grounded in accordance with all codes and ordinances. The plug and outlet should look like those in Figure A.

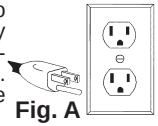


Fig. A

Double Insulated Tools: Tools with Two Prong Plugs

Tools marked "Double Insulated" do not require grounding. They have a special double insulation system which satisfies OSHA requirements and complies with the applicable standards of Underwriters Laboratories, Inc., the Canadian Standard Association and the National Electrical Code. Double Insulated tools may be used in either of the 120 volt outlets shown in Figures B and C.

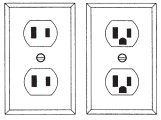


Fig. B Fig. C

EXTENSION CORDS

Grounded tools require a three wire extension cord. Double insulated tools can use either a two or three wire extension cord. As the distance from the supply outlet increases, you must use a heavier gauge extension cord. Using extension cords with inadequately sized wire causes a serious drop in voltage, resulting in loss of power and possible tool damage. Refer to the table shown to determine the required minimum wire size.

The smaller the gauge number of the wire, the greater the capacity of the cord. For example, a 14 gauge cord can carry a higher current than a 16 gauge cord. When using more than one extension cord to make up the total length, be sure each cord contains at least the minimum wire size required. If you are using one extension cord for more than one tool, add the nameplate amperes and use the sum to determine the required minimum wire size.

Guidelines for Using Extension Cords

- If you are using an extension cord outdoors, be sure it is marked with the suffix "W-A" ("W" in Canada) to indicate that it is acceptable for outdoor use.
- Be sure your extension cord is properly wired and in good electrical condition. Always replace a damaged extension cord or have it repaired by a qualified person before using it.
- Protect your extension cords from sharp objects, excessive heat and damp or wet areas.

Recommended Minimum Wire Gauge For Extension Cords*

	Extension Cord Length				
Nameplate Amperes	25'	50'	75'	100'	150'
0 - 2.0	18	18	18	18	16
2.1 - 3.4	18	18	18	16	14
3.5 - 5.0	18	18	16	14	12
5.1 - 7.0	18	16	14	12	12
7.1 - 12.0	16	14	12	10	--
12.1 - 16.0	14	12	10	--	--
16.1 - 20.0	12	10	--	--	--

* Based on limiting the line voltage drop to five volts at 150% of the rated amperes.

READ AND SAVE ALL INSTRUCTIONS FOR FUTURE USE.

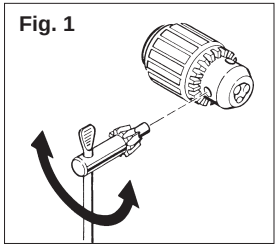
ASSEMBLY

WARNING To reduce the risk of injury, always unplug tool before changing or removing accessories. Only use accessories specifically recommended for this tool. Others may be hazardous.

Installing Bits into Keyed Chucks

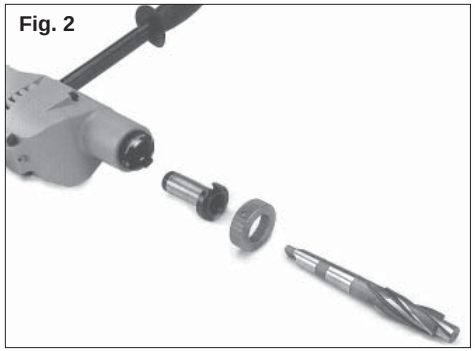
1. Unplug tool.
2. Open the chuck jaws wide enough to insert the bit. Be sure the bit shank and chuck jaws are clean. Dirt particles may prevent the bit from lining up properly.
3. Insert the bit into the chuck. Center the bit in the chuck jaws and lift it about 1/16" off of the bottom. Then, tighten the chuck jaws by hand to align the bit.
4. Place the chuck key in each of the three holes in the chuck, turning it clockwise as shown. Tighten securely.
5. To remove the bit, insert the chuck key into one of the holes in the chuck and turn it counterclockwise.

Fig. 1



Installing Bits into Morse Taper Sockets

Fig. 2



A No. 3 Morse Taper Socket is furnished as standard equipment on Super Hole-Shooter Cat. No. 2404-1. Before inserting the drill bit, be sure its taper matches the socket taper. To insert drill bit, push the shank of the bit firmly into the socket. This is all that is necessary to properly seat the bit for drilling. Always keep the taper shanks clean, free of nicks and coated with a film of oil.

To remove the bit from the socket, unscrew the knurled taper socket cap and pull out the bit and the socket. Once removed, the bit can be gently knocked free with a soft metal mallet. Replace the socket and the knurled cap.

Bit Selection

- Use sharp bits. Sharp bits are less likely to bind when drilling.
- Use the proper bit for the job. There are many types of bits designed for specific purposes. Check the information on the bit's packaging for proper usage.
- Do not use bits larger than the rated capacity of the drill. Gear damage or motor overload may result (see "Specifications").

Pipe Handle

Thread pipe handle into the threaded hole in the motor housing.

OPERATION

WARNING To reduce the risk of injury, always wear eye protection.

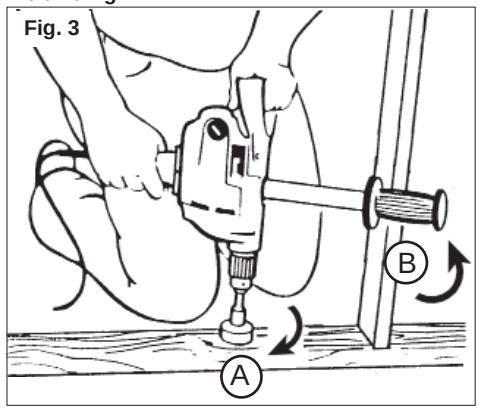
WARNING To reduce the risk of personal injury when drilling, always hold tool by the insulated gripping surfaces when performing an operation where the cutting tool may contact hidden wiring or its own cord. Contact with a "live" wire will make exposed metal parts of the tool "live" and shock the operator.

WARNING When drilling, always brace the drill against a solid fixed object (such as a stud) in preparation for a sudden reaction. When drilling, never use your body to brace drill.

Never put your hands (or other body parts) between the part of the drill being braced and the object it is being braced against. Hands (or other body parts) that are in the path of the reaction can be pinched, crushed or broken.

Bit binding

Fig. 3



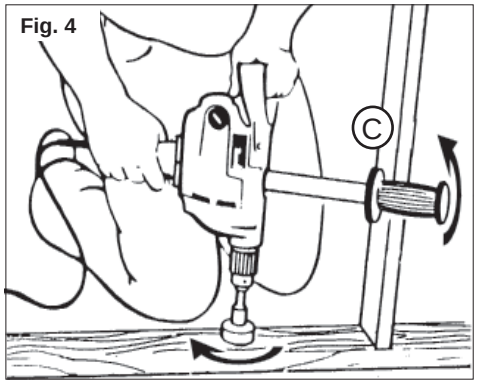
If the bit binds, the drill will suddenly react in the opposite direction of the rotation of the bit. Figure 3 shows the path of reaction, (B) if the drill bit binds while being driven in forward (A).The operator should reduce the chances of a sudden reaction by following the instructions listed below.
The operator should also prepare for a sudden reaction by holding securely using the pipe handle or bracing against a solid fixed object.

To reduce the chance of bit binding:
- Use sharp bits. Sharp bits are less likely to bind when drilling.
- Use the proper bit for the job. There are many types of bits designed for specific purposes.
- Avoid drilling warped, wet, knotty, and or pitchy material if possible.
- Avoid drilling in material that you suspect contains hidden nails or other things that may cause the bit to bind.

The direction of reaction is always opposite of the direction of bit rotation.
Reaction is even more likely to occur when enlarging already existing holes and at the point when the bit breaks through the other side of the material.

Bracing for forward rotation

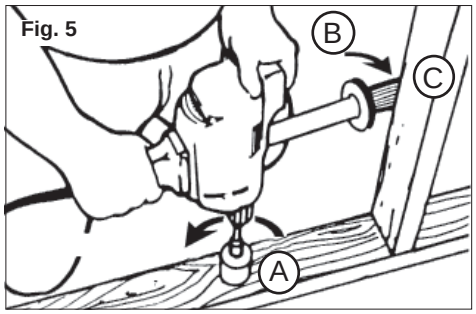
Fig. 4



When drilling in forward, the bit will **rotate** in a clockwise direction. If the bit binds in the hole, the bit will come to a sudden stop and drill will suddenly **react** in a counterclockwise direction.
Figure 4 shows an example of a Super Hole-Shooter properly braced for forward rotation.
A. Forward (clockwise) rotation
B. Reaction
C. Brace drill with pipe handle here
If the bit binds, the pipe handle or the motor housing braced against the stud will hold the drill in position.

Bracing for reverse rotation

Fig. 5



When drilling in reverse, the bit will **rotate** in a counterclockwise direction. If the bit binds in the hole, the bit will come to a sudden stop and the drill will suddenly **react** in a clockwise direction.
Figure 5 shows an example of the Super Hole-Shooter properly braced for reverse rotation.
A. Reverse (counterclockwise) rotation
B. Reaction
C. Brace drill with pipe handle here
If the bit binds, the pipe handle or the motor housing braced against the stud will hold the drill in position.

Reversing (Fig. 6)
A reversing switch is located below the trigger switch for removal of bits from holes. Permit the motor to come to a complete stop before reversing. Reversing the tool with the gears in motion may cause severe damage. When removing selfeed bits from partially drilled holes, a flick of the trigger switch will free the threaded pilot screw. When the threads are loose, lift the bit from the workpiece with the motor stopped.

Fig. 6

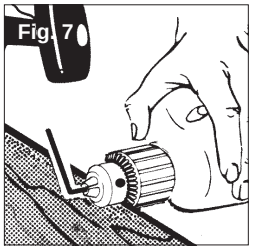
⚠ *WARNING* To reduce the risk of electric shock, check work area for hidden pipes and wires before drilling or driving screws.

Drilling
Before drilling, clamp the material down securely. A poorly secured piece of material may result in personal injury or inaccurate drilling. When drilling in light gauge metal or wood, use a wooden block to back up the material to prevent damage to the workpiece.
Mark the center of the hole to be drilled with a center punch to give the bit a start and to prevent it from "walking." Lubricate the drill bit with cutting oil when drilling iron or steel. Use a coolant when drilling nonferrous metals such as copper, brass or aluminum.

⚠ *WARNING* To reduce the risk of injury, always wear eye protection.

Chuck Removal
This tool is equipped with a threaded spindle to hold the chuck. Before removing the chuck, unplug the tool and open the chuck jaws. A left-handed thread screw is located inside the chuck to prevent the chuck from loosening when the tool is operated in reverse direction. Remove the screw by turning it clockwise.

Fig. 7



To remove the chuck, hold the tool so that only the side of the chuck rests firmly and squarely on a solid workbench. Insert the chuck key or a chuck remover bar in one of the keyholes. Turn the chuck so the key is at about a 30° angle to the bench top and strike the key sharply with a hammer so the chuck turns in a counterclockwise direction (looking from the front of the tool). This should loosen the chuck from the spindle which has a right hand thread making it easy to remove the chuck by hand.
NOTE: When replacing the chuck, always replace the left hand thread screw in the chuck.

ACCESSORIES

⚠ *WARNING* To reduce the risk of injury, always unplug the tool before attaching or removing accessories. Use only specifically recommended accessories. Others may be hazardous.

For a complete listing of accessories refer to your *MILWAUKEE* Electric Tool catalog or go on-line to www.milwaukeetool.com. To obtain a catalog, contact your local distributor or a service center.

MAINTENANCE

⚠ *WARNING* To reduce the risk of injury, always unplug your tool before performing any maintenance. Never disassemble the tool or try to do any rewiring on the tool's electrical system. Contact a *MILWAUKEE* service facility for ALL repairs.

Maintaining Tools
Keep your tool in good repair by adopting a regular maintenance program. Before use, examine the general condition of your tool. Inspect guards, switches, tool cord set and extension cord for damage. Check for loose screws, misalignment, binding of moving parts, improper mounting, broken parts and any other condition that may affect its safe operation. If abnormal noise or vibration occurs, turn the tool off immediately and have the problem corrected before further use. Do not use a damaged tool. Tag damaged tools "DO NOT USE" until repaired (see "Repairs").
Under normal conditions, relubrication is not necessary until the motor brushes need to be replaced. After six months to one year, depending on use, return your tool to the nearest *MILWAUKEE* service facility for the following:
- Lubrication
- Brush inspection and replacement
- Mechanical inspection and cleaning (gears, spindles, bearings, housing, etc.)
- Electrical inspection (switch, cord, armature, etc.)
- Testing to assure proper mechanical and electrical operation

⚠ *WARNING* To reduce the risk of injury, electric shock and damage to the tool, never immerse your tool in liquid or allow a liquid to flow inside the tool.

Cleaning
Clean dust and debris from vents. Keep the tool handles clean, dry and free of oil or grease. Use only mild soap and a damp cloth to clean your tool since certain cleaning agents and solvents are harmful to plastics and other insulated parts. Some of these include: gasoline, turpentine, lacquer thinner, paint thinner, chlorinated cleaning solvents, ammonia and household detergents containing ammonia. Never use flammable or combustible solvents around tools.

Repairs
If your tool is damaged, return the entire tool to the nearest service center.

UNITED STATES
MILWAUKEE Service

MILWAUKEE prides itself in producing a premium quality product that is NOTHING BUT HEAVY DUTY®. Your satisfaction with our products is very important to us! If you encounter any problems with the operation of this tool, or you would like to locate the *factory* Service/Sales Support Branch or *authorized service station* nearest you, please call...

Additionally, we have a nationwide network of *authorized* Distributors ready to assist you with your tool and accessory needs. Check your "Yellow Pages" phone directory under "Tools-Electric" for the names & addresses of those nearest you or see the 'Where To Buy' section of our website.

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Central Time
or visit our website at
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Contact our Corporate After Sales Service Technical Support about ...
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•Service/Repair Questions
•Warranty

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fax: 1.800.638.9582
email: metproductsupport@milwaukeetool.com

Register your tool online at www.milwaukeetool.com and...
- receive important notifications regarding your purchase
- ensure that your tool is protected under the warranty
- become a HEAVY DUTY club member

CANADA - Service *MILWAUKEE*

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18129 111 Avenue NW, Edmonton, AB T5S 2P2

Additionally, we have a nationwide network of *authorized* Distributors ready to assist you with your tool and accessory needs. Call 1.800.268.4015 to find the names and addresses of the closest retailers or consult "Where to buy" on our Web site **www.milwaukeetool.com**

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- reciba importantes avisos sobre su compra
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- conviértase en integrante de Heavy Duty

MILWAUKEE ELECTRIC TOOL CORPORATION
13135 West Lisbon Road • Brookfield, Wisconsin, U.S.A. 53005
58-14-1754d10 10/13 Printed in China

SLIP-EASE | MECHANICAL SLIP CLUTCHES

Utilizes an axial loaded multi-plate design. For applications where space is at a premium and low backlash is required.

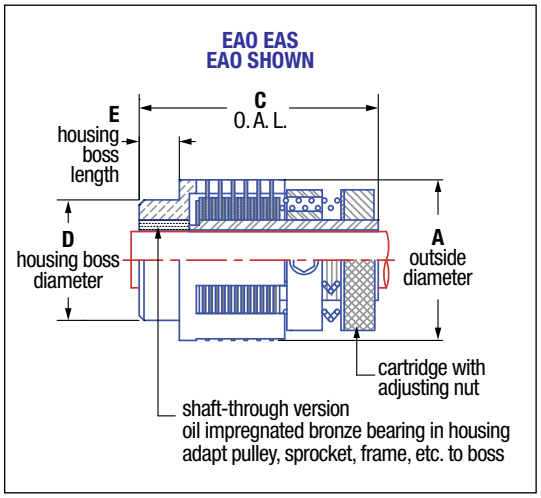
1/2"bore

winch end

drill end

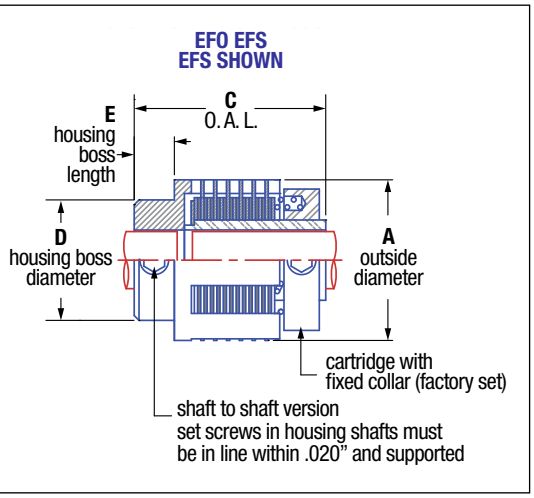
ADJUSTABLE

EAO EAS
EAO SHOWN

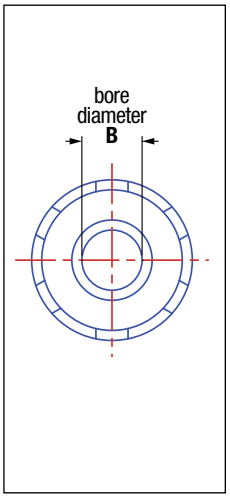


FIXED FACTORY SET – NON ADJUSTABLE

EFO EFS
EFS SHOWN



END VIEW TYPICAL



PART NUMBER EXAMPLES

See page 200 for part number identification.

E A S 32 - 8 - 10

1. Slip-Ease
2. Adjustable torque
3. Shaft to shaft installation type
4. Size 32 (relative size) 1.625-inch outside dia.
5. 8/16 = .500-inch bore dia. in clutch cartridge
6. 10/16 = .625-inch bore dia. in housing

E F O 44 - 12mm - 12mm

1. Slip-Ease
2. Fixed torque (factory preset)
3. Shaft-through installation type
4. Size 44 (relative size) 2.25-inch outside dia.
5. 12 mm bore dia. in clutch cartridge
6. 12 mm bore dia. in clutch housing

QUOTE REQUEST FORMS: SEE PAGE 201.

SLIP-EASE | SPECIFICATIONS

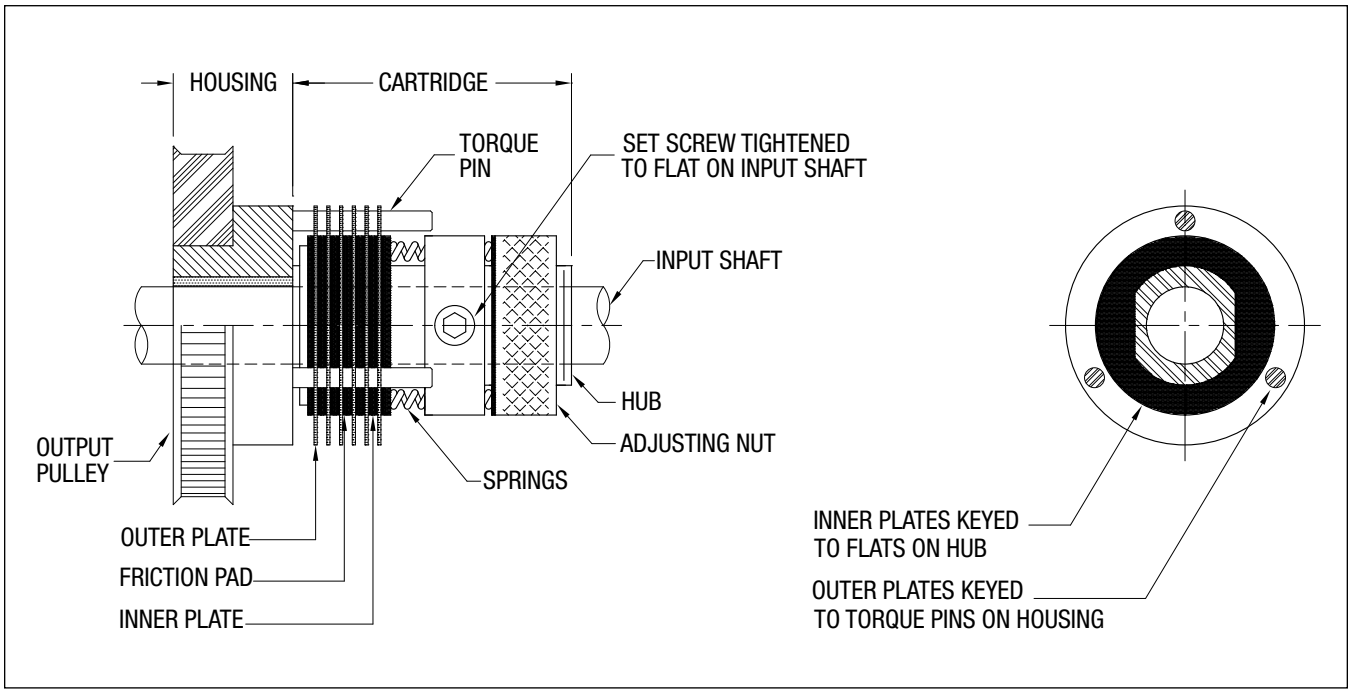
See pages 198-199 for slip clutch operation (construction, installation, capacity) and mounting options.

MODEL NO.	A inches (mm)	B* STD. inches (mm)	B MAX. inches (mm)	C inches (mm)	D inches (mm)	E inches (mm)	CAPACITY @ 50 RPM		FRICTION SURFACES
		+.002 / -.000 inches (+.05 / -.00 mm)					lb-in (Nm)	Watts	
EAS 12 & EA0 12	.750 (19.05)	.1875 (5)	.250 (6)	1.25 (31.75)	.562 (14.28)	.188 (4.78)	8.5 (.96)	4.5	8
EFS 12 & EF0 12	.750 (19.05)	.1875 (5)	.250 (6)	1.00 (25.40)	.562 (14.28)	.188 (4.78)	8.5 (.96)	4.5	8
EFS 16 & EF0 16	1.000 (25.40)	.250 (8)	.375 (10)	1.19 (30.2)	.750 (19.05)	.25 (6.35)	16 (1.81)	9	12
EAS 16 & EA0 16	1.000 (25.40)	.250 (8)	.375 (10)	1.50 (38.1)	.750 (19.05)	.25 (6.35)	16 (1.81)	9	12
EFS 24 & EF0 24	1.375 (34.90)	.375 (10)	.500 (13)	2.00 (50.8)	1.000 (25.40)	.38 (9.65)	25 (2.82)	15	12
EAS 24 & EA0 24	1.375 (34.90)	.375 (10)	.500 (13)	2.50 (63.50)	1.000 (25.40)	.38 (9.65)	25 (2.82)	15	12
EFS 32 & EF0 32	1.625 (41.28)	.500 (12)	.625 (16)	1.87 (47.5)	1.375 (34.93)	.50 (12.70)	50 (5.65)	30	12
EAS 32 & EA0 32	1.625 (41.28)	.500 (12)	.625 (16)	2.44 (62.0)	1.375 (34.93)	.50 (12.70)	50 (5.65)	30	12
EFS 44 & EF0 44	2.250 (57.15)	.500 (12)	.625 (16)	1.87 (47.5)	1.625 (41.28)	.50 (12.70)	75 (8.47)	43	12
EAS 44 & EA0 44	2.250 (57.15)	.500 (12)	.625 (16)	2.44 (62.0)	1.625 (41.28)	.50 (12.70)	75 (8.47)	43	12
~~EAS 52~~ & EA0 52	3.250 (82.55)	.750 (20)	1.250 (32)	4.00 (101.6)	2.000 (50.8)	.50 (12.70)	150 (16.95)**	85	12

*Bore diameters (Dimension B): other than standards shown are available up to the maximum diameter.
**Maximum capacity is 500 lb-in / 56 Nm. Heat generation should not exceed maximum Watts capacity. Watts = Torque x RPM x Duty Cycle x 0.011

QUOTE REQUEST FORMS: SEE PAGE 201.

SLIP CLUTCH | CONSTRUCTION, INSTALLATION & CAPACITY



CONSTRUCTION

A Polyclutch consists of two parts: a cartridge and a housing (see above).

The cartridge is set screwed or keyed to the input shaft.

- The cartridge includes the clutch pack: outer plates, friction pads, inner plates
- Plates are brass with a proprietary finish
- Inner plates are keyed to the cartridge hub
- Outer plates are keyed to the cartridge housing
- Friction pads are a proprietary plastic-based composite (no asbestos)

The housing is either set screwed or keyed to the output shaft, or (as shown), attached to the output gear or pulley, with a bronze bearing to allow relative motion between the input shaft and the output gear/pulley.

Torque is controlled by changing the pressure applied to the clutch pack. In an adjustable style clutch, the torque level is controlled by compressing the springs with the adjusting nut. In a fixed style clutch, a collar is attached to the hub in a fixed position, and the torque level is set by pushing and locking the spring collar to a calibrated position.

All slip clutch torques are calibrated to +/- 20% but can be held to closer tolerances.

Backlash of 6° is standard for Slipper models and 2° for the Slip-Ease models. Slipper models can be held to 2° if required.

Our proprietary burn-in process ensures that all Polyclutch slippers will perform consistently right out of the box, with no break-in period required.

INSTALLATION (see page 199 for mounting options)

Shaft-through versions: Insert input shaft into cartridge and tighten set screws. Insert housing around input shaft, with torque pins engaging holes in outer plates. Input shaft will keep the cartridge and housing aligned.

Shaft to Shaft versions: Insert input shaft into cartridge and tighten set screws. Insert output shaft into housing and tighten set screws. Input and output shafts must be properly journaled with centerlines within +/- .010 T.I.R.

Do not lubricate the clutch. Friction materials are designed to run without additional lubrication. Lubrication will cause a change in torque and erratic behavior. The inherent axial loaded design will keep dirt and dust out of the friction surfaces.

CAPACITY

The clutch capacity is based on continuous operation at 50 RPM for over 25 million cycles. Torque, RPM, duty cycle and life are interdependent. A reduction of any of these will allow an increase in any other. (Running at 25 RPM will allow twice the torque, or running for only 10% of the cycle will allow higher RPM, etc.). The limit is based on heat buildup measured in watts per:

Watts = Torque (lb-in) x RPM x Duty Cycle* x 0.011

Please consult our factory for high torque, high RPM and rapid cycling applications.

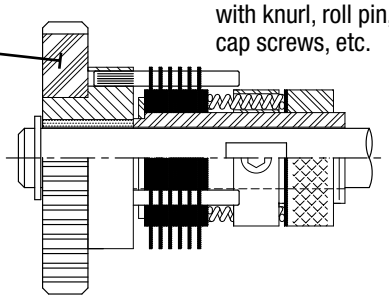
*Percent of the time the clutch is slipping, expressed as a decimal. For example, 0.5 = 50% of the time the clutch is slipping.

SLIP CLUTCH | TYPICAL MOUNTING FOR MECHANICAL & PNEUMATIC SLIP CLUTCHES

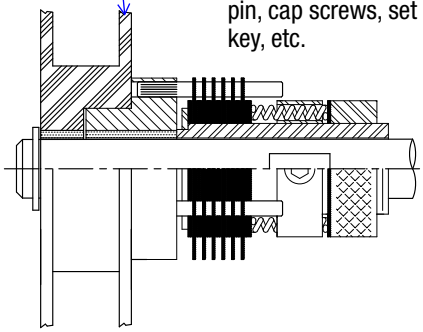
All Polyclutch slip clutches perform the basic function of controlling the torque between two elements. They can be supplied as a shaft-to-shaft coupling or a shaft to pulley, gear, or sprocket model. Polyclutch custom slip clutches can be provided with non-standard bore sizes, keyways, low backlash or higher torque, minus housings and with pulley, gear or sprocket.

REPRESENTS COMPONENT THAT ATTACHES TO WINCH CRANK

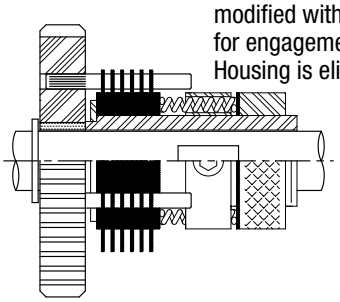
EXAMPLE 2 Gear/Pulley/Sprocket adapted to housing with knurl, roll pin, cap screws, etc.



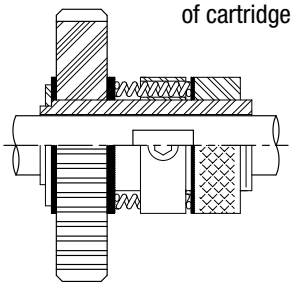
EXAMPLE 3 Supply or rewind spool adapted to housing with knurl, pin, cap screws, set screw, key, etc.



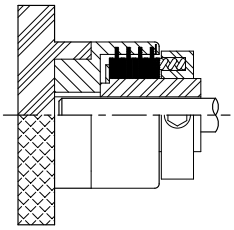
EXAMPLE 4 Gear/Pulley/Sprocket modified with pins for engagement Housing is eliminated



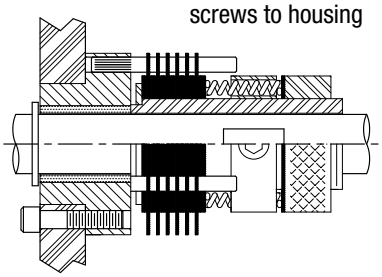
EXAMPLE 5 Gear/Pulley/Sprocket integrated as part of cartridge



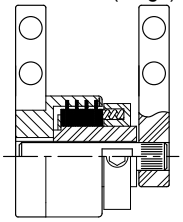
EXAMPLE 6 Knob adapted to housing knurl, set screw, pin, etc.



EXAMPLE 7 Machine frame adapted with cap screws to housing



EXAMPLE 8 Rotary position holder (hinge)



SLIP CLUTCH | HOW TO CREATE A PART NUMBER

S A S 24 - 4 - 6

1 2 3 4 5 6

HOUSING BORE SIZE:
Generally represented in sixteenths of an inch. For metric, add MM after bore sizes. (e.g., SAS24-4MM-6MM).

CARTRIDGE BORE SIZE:
Generally represented in sixteenths of an inch. For metric, add MM after bore size (e.g., SAS24-4MM).

OUTER DIAMETER:
Generally represented in sixteenths of an inch, please see specifications for exact dimensions.

INSTALLATION TYPE:
"S" is shaft to shaft
"O" is shaft-through for mounting to pulley, gear, sprocket, etc.
"Y" is cartridge only

TORQUE SETTING:
"A" is adjustable torque
"F" is factory preset (fixed) torque*

TYPE OF SLIP CLUTCH:

S = Multi-Plate Slipper	P = Single-Plate Slipper	V = V-Series Slipper
E = Slip-Ease	A = Slip-Aire (air-actuated)	

*Please indicate torque value if fixed - 'T' =

STANDARD OPTIONS

Polyclutch slip clutches are designed to cover a wide range of solutions. To help better fit the clutch to your specific application, here is a list of standard options:

- Bore size changes – English (inches) and metric (mm)
- High torque option, accomplished by extra springs – "H" part no. suffix
  - Will increase capacity of standard adjustable slip clutches by 50% (note: removing springs will lower capacity, increase sensitivity)
- Keyways – English and metric – "K" part no. suffix
- Low backlash in Slipper clutch – "UL" part no. suffix
- Heavy inner plates for extra cooling – "D" part no. suffix
- 303/304 stainless steel construction – "Q" part no. prefix
- Two-plate Slipper clutch – "R" version (part no. begins with "R")
- Plastic cover for Slipper and Slip-Aire clutches

CUSTOM CLUTCHES

If you are looking for something outside of our standard options, our engineers will work with you to help design a clutch for your specific application.

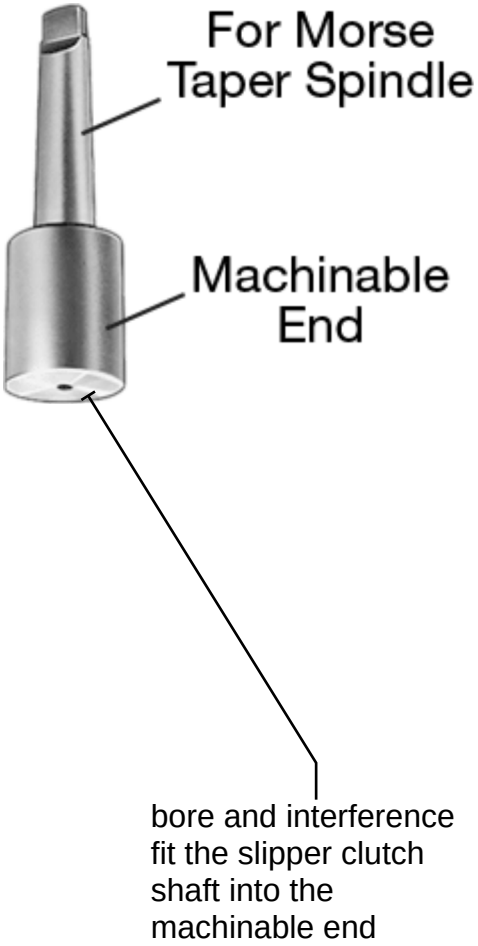
Phone: 262-786-1500 or 800-298-2066 | Fax: 262-786-3280 | Email: sales@dynatect.com | www.dynatect.com

McMASTER-CARR®

Machinable-End Morse Taper-Mount Spindle Arbor

for Number 3 Morse Taper Spindle

In stock
$58.51 Each
2862A12



For Machine Spindle Shank Type	Morse Taper
For Machine Spindle Morse Taper	
Number	3
Diameter	0.938"
Machinable End	
Body Diameter	1 3/4"
Body Length	2 1/8"
Overall Length	5 3/16"
Material	1144 Carbon Steel

One end is made of soft steel that can be machined to suit your job requirements; the Morse taper end fits into your machine spindle. Morse taper spindles are most often found on drill presses.

Note: To determine the Morse taper number of your machine spindle, measure the internal diameter of the spindle (which will be equal to the diameter of the arbor you need) and match the measurement up with its corresponding taper number provided in the table.

2.A.3

JAEMAR SWIVEL BLOCK

BLOCKS

Single Swivel
Directional Blocks

Jeamar Steel Blocks Are Precision Made From The Highest Quality Fine-Grain Steel.

Both single and double options are available. Floor or wall mountable, this versatile block is both strong and economical. The S 52000, S 68000 and S 83000 are supplied with double row cylindrical roller bearings.

View Double Swivel Directional Block *here.*

Get Your FREE Quote Today! | Call Now | Technical Notes

High Strength & Low Weight
The strength of the steel used by Jeamar considerably exceeds that of cast iron. Steel also has a weight-saving advantage of up to 50 percent over cast iron, resulting in easier handling and installation.

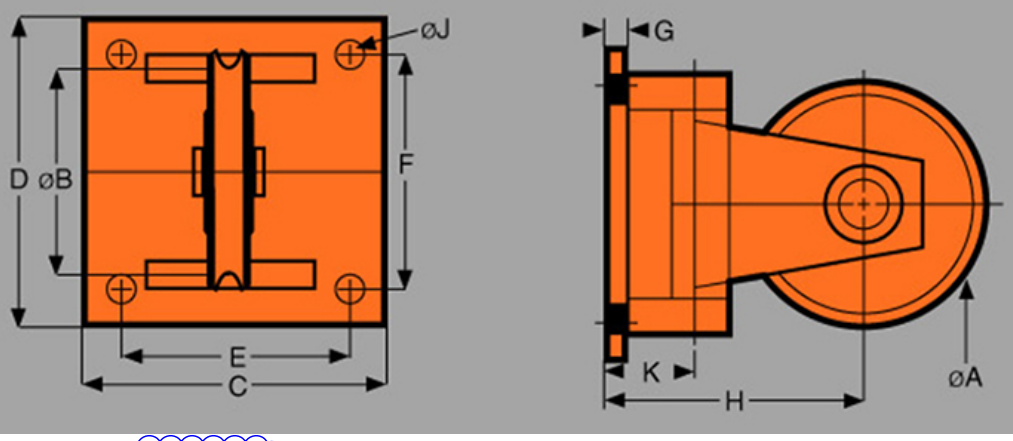
Exceptional Arc of Support
Our steel swivel directional blocks are designed to ensure that the shape of your rope is maintained under normal load conditions.

High Efficiency Bearings
Jeamar fits its swivel directional blocks with high-efficiency, deep-groove, double ball bearings for maximum efficiency. This results in reduced friction, smooth motion, high speed and a longer operational life.

High Sheave-to-Rope Ratio
With a minimum sheave-to-rope ratio of 15:1, the rope's bending stress is reduced for longer life.

Lifetime Lubrication
Precision sealed bearings stay lubricated ensuring low maintenance.

Block Loading
Jeamar blocks are rated for the full working load limit at 180° rope angle.



Model Number		SS 3500	SS 7000	SS 10500	SS 16000	SS 23000	SS 31000	SS 41000	SS 52000	SS 68000	SS 83000
Working Load Limit	lb	3500	7000	10500	16000	23000	31000	41000	52000	68000	83000
	kg	1587	3175	4772	7272	10455	14090	18636	23583	30839	37642
Sheave Diameter	in	4.25	6.00	8.00	10.00	12.00	14.00	16.00	21.54	23.54	26.34
	mm	109	152	203	254	305	357	406	547	598	669
Rope Size	in	1/4	3/8	1/2	5/8	3/4	7/8	1	1 1/8	1 1/4	1 3/8
	mm	6	10	13	16	19	22	25	29	32	35
Weight	lb	10	25	40	121	180	290	450	645	1104	1768
	kg	4.5	11.3	18.1	55	82	132	204	293	501	802
Dimensions A	in	4.29	5.98	7.99	10.00	12.01	14.06	15.98	21.54	23.54	26.34
	mm	109	152	203	254	305	357	406	547	598	669
B	in	3.74	5.35	7.05	8.74	10.43	12.32	14.25	17.99	20.00	22.01
	mm	95	136	179	222	265	313	362	457	508	559
C	in	4.72	7.20	9.57	12.01	14.17	16.54	18.90	19.02	20.28	22.91
	mm	120	183	243	305	360	420	480	483	515	582
D	in	5.31	9.69	10.59	12.99	15.55	17.72	20.47	25.55	27.91	31.18
	mm	135	246	269	330	395	450	520	649	709	792
E	in	3.54	5.91	7.09	8.86	10.63	12.60	14.17	15.98	17.01	19.25
	mm	90	150	180	225	270	320	360	406	432	489
F	in	3.94	8.46	7.87	9.84	11.81	13.78	15.75	22.52	24.49	27.52
	mm	100	215	200	250	300	350	400	572	622	699
G	in	0.24	0.39	0.47	0.63	0.79	0.79	0.98	0.98	1.14	1.26
	mm	6	10	12	16	20	20	25	25	29	32
H	in	4.53	7.28	8.43	10.55	12.60	14.80	16.85	19.02	20.98	23.31
	mm	115	185	214	268	320	376	428	483	533	592
J	in	0.47	0.55	0.55	0.63	0.79	1.02	1.30	1.30	1.42	1.57
	mm	12	14	14	16	20	26	33	33	36	40
K	in	1.42	2.13	2.83	2.95	4.09	5.12	5.67	5.67	6.18	6.93
	mm	36	54	72	75	104	130	144	144	157	176

NOTICE | Contact us for any customized application you have.

IMPORTANT NOTICE | Due to our policy of continuing development, all specifications are subject to change without notice. Users of these products are responsible for ensuring their suitability for the application in which they are being used.

2.A.4

WIRE ROPE SLINGS

2.A.4 WIRE ROPE

6x19 Class

Product Features and Benefits

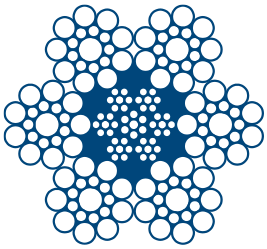
High quality
6-strand rope is exceptionally robust.

Superior strength
Confirmed by Bridon's Powercheck process for testing a sample (where noted in the table).

Durability
Outstanding resistance to wear.

Lubrication
Fully lubricated to reduce wear and tear.

Options
Available in both steel and fiber core.



6x19 Class

Seale construction	19S	(9/9/1)
Warrington construction	19W	(6+6/6/1)
Filler construction	25F	(12/6F/6/1)
Warrington Seale construction	26WS	(10/5+5/5/1)

Lay Type		Lay Direction		Finish		Grade
Regular	Lang	Right hand	Left hand	Bright	Galv	EIP
•		•		•		•

Available as standard.

6x19 FC

Diameter	Approx mass FC		Minimum breaking force			
			EIP FC		EEIP FC	
in	lb/ft	kg/ft	tons	kN	tons	kN
1/4	0.11	0.05	3.02	26.79	—	—
5/16	0.16	0.07	4.69	41.74	—	—
3/8	0.24	0.11	6.71	59.72	7.38	65.68
7/16	0.32	0.14	9.09	80.99	10.00	89.00
1/2	0.42	0.19	11.80	105.02	12.90	114.81
9/16	0.53	0.23	14.90	132.61	16.30	145.07
5/8	0.66	0.29	18.30	163.76	20.20	179.78
3/4	0.95	0.42	26.20	233.18	28.80	256.32
7/8	1.29	0.57	35.40	315.06	39.00	347.10
1	1.68	0.74	46.00	409.40	50.60	450.34
1 1/8	2.13	0.94	57.90	515.31	63.60	566.04
1 1/4	2.63	1.16	71.00	632.00	78.20	695.98
1 3/8	3.18	1.40	85.40	760.00	94.00	836.60
1 1/2	3.78	1.67	101.00	898.90	111.00	987.90
1 5/8	4.44	1.96	118.00	1050.20	129.00	1148.10
1 3/4	5.15	2.27	136.00	1210.40	150.00	1335.00
1 7/8	5.91	2.61	155.00	1379.50	171.00	1521.90
2	6.73	2.97	176.00	1566.40	194.00	1726.60
2 1/8	7.60	3.35	197.00	1753.30	217.00	1931.30
2 1/4	8.52	3.76	220.00	1957.00	—	—

NOTE: Metric rope diameters on request.
Check www.bridon.com or call customer service for more information.

NOTE: Sizes 1/4" to 1" Powerchecked.

6x19 IWRC

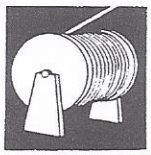
Diameter	Approx mass IWRC		Minimum breaking force			
			EIP IWRC		EEIP IWRC	
in	lb/ft	kg/ft	tons	kN	tons	kN
1/4	0.12	0.05	3.40	30.30	—	—
5/16	0.18	0.08	5.27	46.90	—	—
3/8	0.26	0.11	7.55	67.20	—	—
7/16	0.35	0.15	10.20	90.70	11.20	99.60
1/2	0.46	0.20	13.30	118.40	14.60	129.90
9/16	0.58	0.26	16.80	149.50	18.50	164.70
5/8	0.72	0.32	20.60	183.30	22.70	202.00
3/4	1.04	0.46	29.40	261.70	32.40	288.40
7/8	1.41	0.62	39.80	354.20	43.80	389.80
1	1.85	0.82	51.70	460.10	56.90	506.40
1 1/8	2.34	1.03	65.00	578.50	71.50	636.40
1 1/4	2.89	1.28	79.90	711.10	87.90	782.30
1 3/8	3.49	1.54	96.00	854.40	106.00	943.40
1 1/2	4.16	1.84	114.00	1014.60	125.00	1112.50
1 5/8	4.88	2.15	132.00	1174.80	146.00	1299.40
1 3/4	5.66	2.50	153.00	1361.70	169.00	1504.10
1 7/8	6.49	2.86	174.00	1548.60	192.00	1708.80
2	7.39	3.26	198.00	1762.20	217.00	1931.30
2 1/8	8.34	3.68	221.00	1966.90	243.00	2162.70
2 1/4	9.35	4.13	247.00	2198.30	272.00	2420.80
2 3/8	10.42	4.60	274.00	2438.60	301.00	2678.90

NOTE: Metric rope diameters on request.
Check www.bridon.com or call customer service for more information.

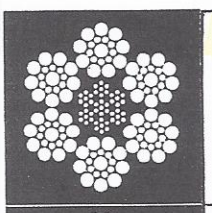
NOTE: Sizes 1/4" to 1" Powerchecked.

BRIDON

GENERAL PURPOSE WIRE ROPES
6 x 19 Classification

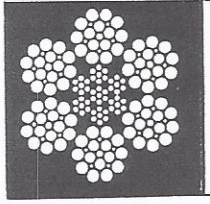


6 x 19 Classification ropes provide an excellent balance between fatigue and wear resistance. They give excellent service with sheaves and drums of moderate size. 6 x 19 Classification ropes contain 6 strands with 15 through 26 wires per strand, no more than 12 of which are outside wires.



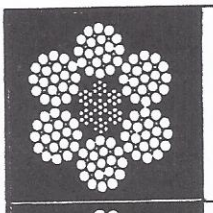
6x19 Seale
Characteristics
Resistant to abrasion and crushing; medium fatigue resistance
Typical Applications
Haulage rope, choker rope, rotary drilling line

IWRC shown; fiber core available



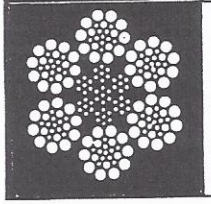
6x21 Filler Wire
Characteristics
Less abrasion resistance; more bending fatigue resistance
Typical Applications
Pull Ropes, load lines, backhaul ropes, draglines

IWRC shown; fiber core available



6x25 Filler Wire
Characteristics
Most flexible rope in classification; best balance of abrasion and fatigue resistance
Typical Applications
Most widely used of all wire ropes - cranes hoists, skip hoists, haulage, mooring lines, conveyors, etc.

IWRC shown; fiber core available



6x26 Warrington Seale
Characteristics
Good balance of abrasion and fatigue resistance

Typical Applications
Boom hoists, logging and tubing lines

IWRC shown; fiber core available

6 x 19 Classification Rope

Diameter, in.	Nominal Strength,* Tons (Bright or Drawn Galvanized)†						Approximate Wt./Ft., lb.	
	EEIP		EIP		IPS			
	IWRC	Fiber Core	IWRC	Fiber Core	IWRC	Fiber Core	IWRC	Fiber Core
1/4	....	....	3.40	3.02	2.94	2.74	0.116	0.105
5/16			5.27	4.69	4.58	4.26	0.18	0.164
3/8	....	....	7.55	6.71	6.56	6.10	0.26	0.236
7/16	11.2	9.90	10.2	9.09	8.89	8.27	0.35	0.32
1/2	14.6	12.9	13.3	11.8	11.5	10.7	0.46	0.42
9/16	18.5	16.2	16.8	14.9	14.5	13.5	0.59	0.53
5/8	22.7	20.0	20.6	18.3	17.9	16.7	0.72	0.66
3/4	32.4	28.6	29.4	26.2	25.6	23.8	1.04	0.95
7/8	43.8	38.6	39.8	35.4	34.6	32.2	1.42	1.29
1	57.5	50.0	51.7	46.0	44.9	41.8	1.85	1.68
1 1/8	71.5	63.0	65.0	57.9	56.5	52.6	2.34	2.13
1 1/4	87.9	77.5	79.9	71.0	69.4	64.6	2.89	2.63
1 3/8	106.0	93.0	96.0	85.4	83.5	77.7	3.50	3.18
1 1/2	125.0	111.0	114.0	101.0	98.9	92.0	4.16	3.78
1 5/8	145.0	129.0	132.0	118.0	115.0	107.0	4.88	4.44
1 3/4	168.0	149.0	153.0	136.0	133.0	124.0	5.67	5.15
1 7/8	191.0	169.0	174.0	155.0	152.0	141.0	6.50	5.91
2	218.0	192.0	198.0	176.0	172.0	160.0	7.39	6.72
2 1/8	....	....	221.0	197.0	192.0	179.0	8.35	7.59
2 1/4	....	....	247.0	220.0	215.0	200.0	9.36	8.51
2 3/8	....	....	274.0	244.0	239.0	222.0	10.4	9.48
2 1/2	....	....	302.0	269.0	262.0	244.0	11.6	10.5
2 5/8	....	....	331.0	....	288.0	268.0	12.8	11.6
2 3/4	....	....	361.0	....	314.0	292.0	14.0	12.7

*Acceptance strength is not less than 2½% below the nominal strengths listed.

†Galvanizing: For class A galvanized wire rope (EIP and IPS grades only), deduct 10% from the nominal strength shown.

10086

CERTIFICATE OF CONFORMITY

WIRE ROPE INDUSTRIES
1000, Kirkley Dr
Belton, TX, USA 76513
514 426-6406 FAX:514 697-3693
FED ID# 31-1714467
UNITED STATES

BRIDON · BEKAERT
THE ROPES GROUP

Date issued: 09/09/2016
Certificate No.: **550898.13-2**

Customer: KULKONI INC. Customer P.O. No.: 14982 - 30B

WRI Product Code: 1202311

PRODUCT DESCRIPTION - AMERICAN WIRE ROPE

Diameter	3/8 Dia.	Type	Round strand
Construction	6 X 19 Seale (9-9-1)	Direction	Right Regular Lay
Core	IWRC 2 wires diameter	Wire Finish	Drawn after galvanized
Lubricant	No Lubricant		

MINIMUM B/L: 15,100 LBS

*INTERNAL I.D. MARKER: FILAMENT - RED, WHITE & BLUE

Lot No.	500378				
Actual B/L (lbs)	16,091				
Reel/Length (ft)	500378-149/2896				

Total length supplied: 2,896 FT

APPLICABLE SPECIFICATION(S) - MANUFACTURED TO API-9a

ASTM A1023 (EIPS)		

MANUFACTURED BY WIRE ROPE INDUSTRIES - USA
1000 KIRKLEY DRIVE
BELTON, TX 76513
USA

Warning : Any representation or warranty which may be made, whether expressed or implied, regarding the use of this product apply only in connection with the Minimun Breaking Load new, unused wire rope. With use, the minimum strength of wire rope is expected to reduce. All equipment using this product must be properly stored, handled, used and maintained. More importantly, wire rope must be regularly inspected during use. Damage, abuse or improper maintenance can cause rope failure. Consult the AISI Wire Rope users manual. ASME or ANSI standards, or Wire Rope Industries before use. Wire rope removal criteria is based on the use of steel sheaves. If synthetic sheaves are used, consult the sheave equipment manufactuer as wire rope removal criteria can be different.

MANUFACTURED FOR

American Wire Rope®

Signature :

Name & Title: Labbé Stephan, Quality Engineer

Domestic Wire Rope and Cable®
Stranded and Closed in the USA

REVIEWED BY: MG Q.C.
ACCEPTED: ✓
NCR NO.:
DATE 9-26-2016

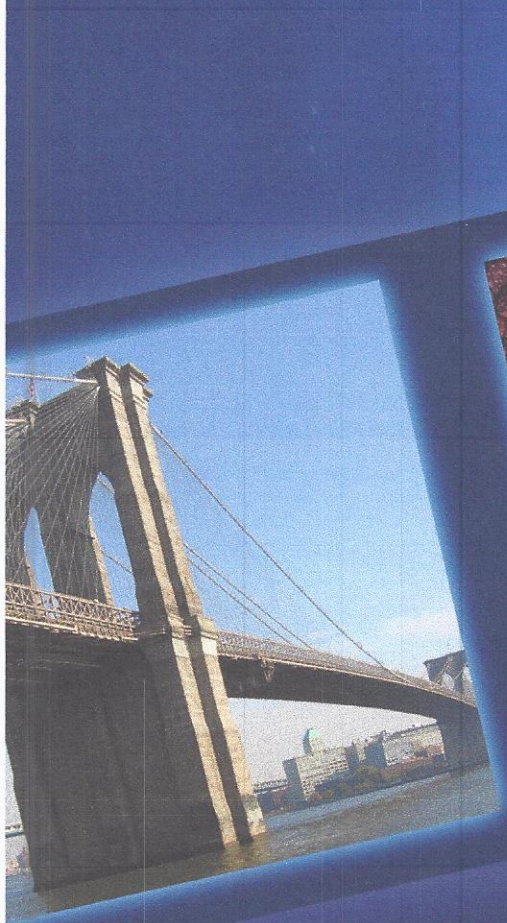
2.A.5

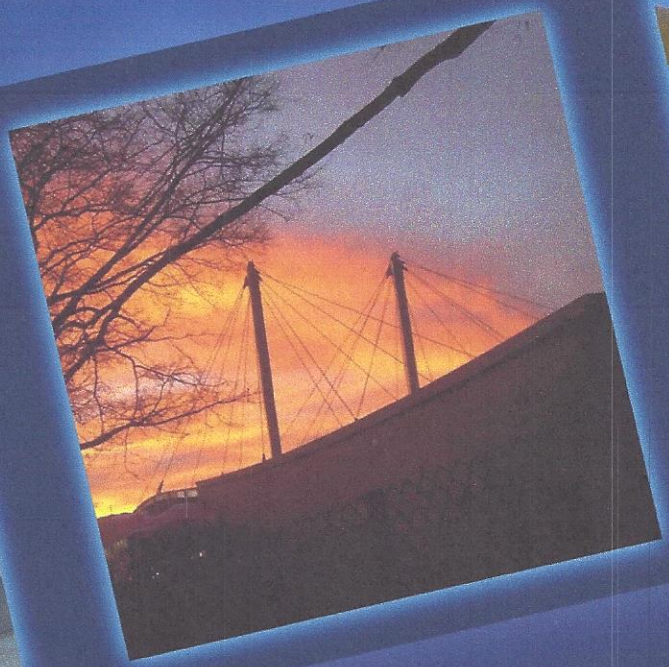
SHACKLES & WIRE ROPE HARDWARE

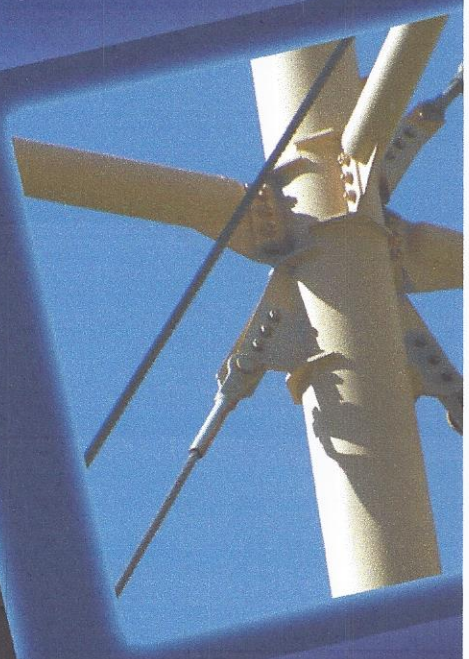
2013 EDITION

MUNCY™ INDUSTRIES

Catalog & User's Manual



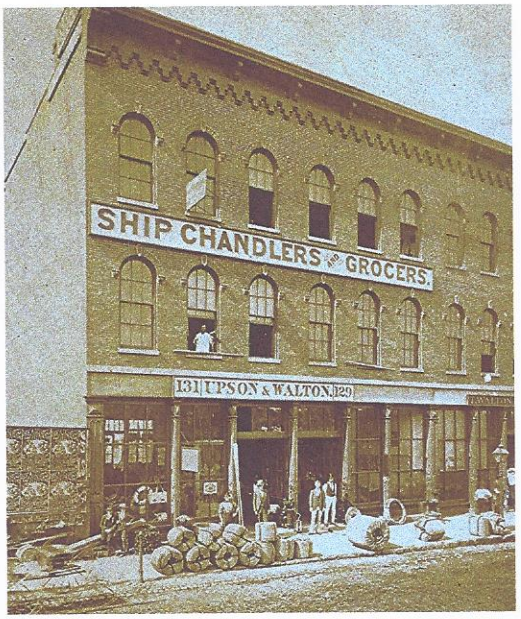




Inspiring Confidence

Four Divisions, One Mission

Our mission is to provide quality wire rope fittings, lifting hardware and machines at competitive prices to serve our customers. We at Muncy Industries, along with our experienced employees, are committed to providing the ultimate in quality and service.



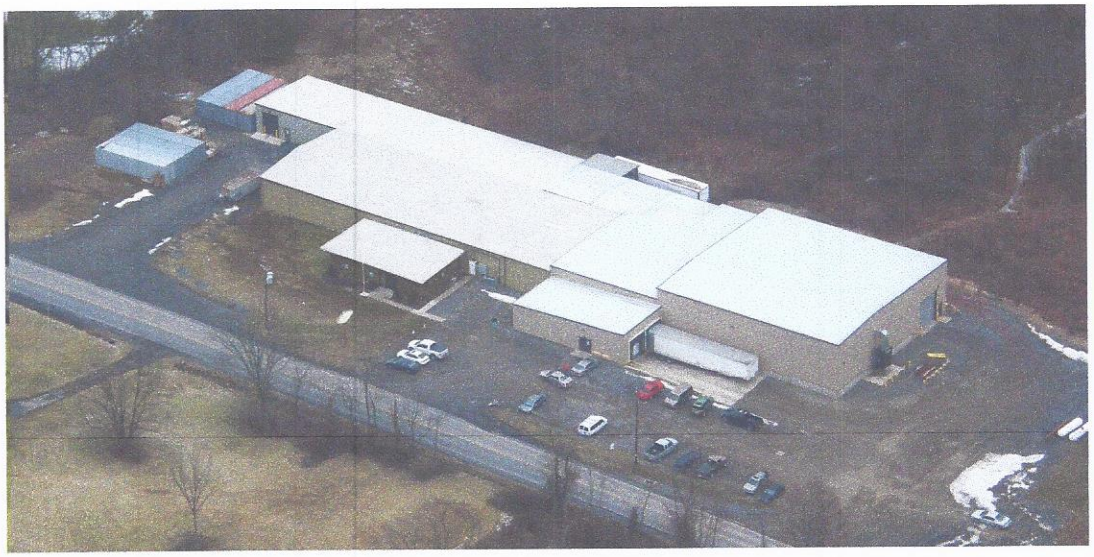
Companies History

Muncy Machine & Tool Co., Inc. is the successor to Muncy Machine & Repair Company, founded in 1949 by Charles J. Kunz. The business originally occupied a 4,000 square foot building situated near Muncy, Pennsylvania. In addition to general repair work, the company began machining parts for J&L Wire Rope in Muncy, and Bethlehem Steel in Williamsport.

Service was expanded over the years to other companies in the wire rope industry and Charles' grandon, James R. Fetter Jr., took the reins in 1976 becoming the company's president. The very next year, Muncy moved to its current location near Turbotville, Pennsylvania, consisting of a manufacturing plant and office complex.

Founded in 1871 as a ship chandler supplying ships on the Great Lakes, **The Upson-Walton Company** became one of the nation's leading manufacturers and suppliers of wire rope fittings. The company was purchased by Ophelia Fetter in 1986 and moved to its current location in Turbotville, PA.

Muncy Marine & Architectural and **Muncy Measurements** were established in 2011 to focus on their respective markets. These four divisions work together, providing the ultimate quality and service for you, our customer.

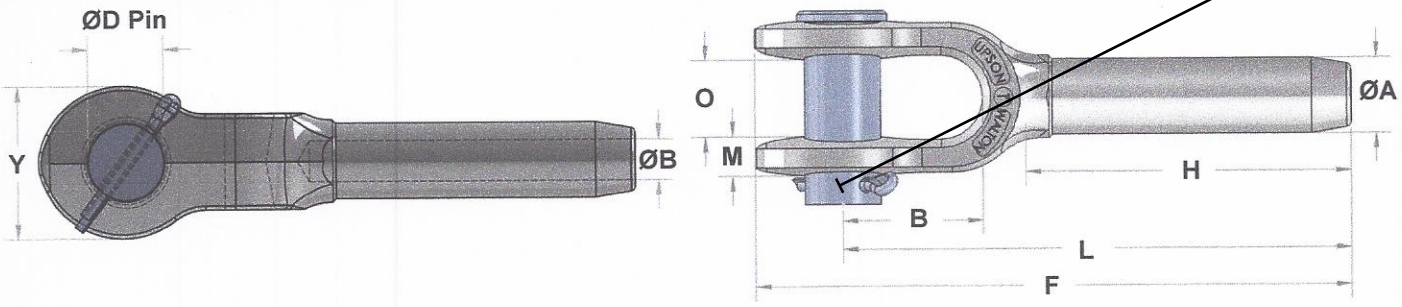


MUNCY INDUSTRIES

All dimensions are subject to tolerance.

GALVANIZED NUT, BOLT COTTER PIN CUSTOM FIT IN LIEU OF THIS INSTALLATION

Open Swage Sockets - Carbon Steel



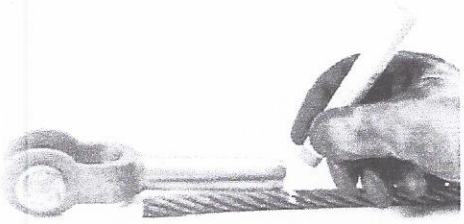
Stock No.	Rope Size	Dimensions										Weight lbs. Each	After Swage Min - Max
		A	B	D	E	F	H	L	M	O	Y		
40025002	1/4	0.495	0.272	0.688	1-1/2	4-3/4	2-1/8	4	5/16	11/16	1-3/8	0.57	0.428 - 0.460
40031302	5/16	0.770	0.339	0.812	1-3/4	6-1/4	3-3/16	5-5/16	13/32	13/16	1-5/8	1.25	0.678 - 0.710
40037502	3/8	0.770	0.406	0.812	1-3/4	6-1/4	3-3/16	5-5/16	13/32	13/16	1-5/8	1.20	0.678 - 0.710
40043802	7/16	0.982	0.484	1.000	2	7-13/16	4-1/4	6-11/16	1/2	1	2	2.45	0.865 - 0.910
40050002	1/2	0.982	0.547	1.000	2	7-13/16	4-1/4	6-11/16	1/2	1	2	2.40	0.865 - 0.910
40056302	9/16	1.257	0.609	1.190	2-1/4	9-9/16	5-5/16	8-1/8	5/8	1-1/4	2-1/2	4.80	1.115 - 1.160
40062502	5/8	1.257	0.672	1.190	2-1/4	9-9/16	5-5/16	8-1/8	5/8	1-1/4	2-1/2	4.50	1.115 - 1.160
40075002	3/4	1.545	0.796	1.380	2-3/4	11-11/16	6-3/8	10	3/4	1-1/2	3	7.80	1.365 - 1.420
40087502	7/8	1.700	0.938	1.630	3-1/4	13-5/8	7-7/16	11-5/8	15/16	1-3/4	3-3/8	11.80	1.490 - 1.550
40100002	1-0/0	1.975	1.062	2.000	3-3/4	15-5/8	8-1/2	13-3/8	1-1/32	2	4	17.80	1.740 - 1.800
40112502	1-1/8	2.245	1.188	2.250	4-1/4	17-1/2	9-9/16	15	1-3/16	2-1/4	4-1/2	28.90	1.990 - 2.050
40125002	1-1/4	2.525	1.328	2.500	4-3/4	19-7/16	10-5/8	16-1/2	1-3/16	2-1/2	5	36.20	2.240 - 2.300
40137502	1-3/8	2.800	1.453	2.500	5-1/4	21-1/4	11-11/16	18-1/8	1-5/16	2-1/2	5-1/4	47.70	2.490 - 2.560
40150002	1-1/2	3.075	1.578	2.750	5-3/4	23-1/4	12-3/4	19-3/4	1-7/16	3	5-3/4	64.40	2.740 - 2.810
40175002	1-3/4	3.385	1.859	3.500	6-3/4	27-1/8	14-7/8	23	1-11/16	3-1/2	7	93.40	2.990 - 3.060
40200002	2-0/0	3.935	2.109	3.750	8	31-7/16	17	26-3/4	1-13/16	4	8	148.00	3.490 - 3.560
40225002	2-1/4	4.450	2.360	4.250	6-3/4	32-7/8	19-1/8	27-3/4	2-9/16	4-1/2	8-3/4	173.00	3.950 - 4.020
40250002	2-1/2	4.930	2.657	4.250	6-3/4	34-5/8	19-5/8	29-1/2	2-9/16	4-1/2	8-3/4	233.00	4.350 - 4.420
40300002	3-0/0	5.960	3.166	5.250	8-5/8	41-1/8	23-3/4	35-5/8	3	5-3/4	9-1/2	382.00	5.240 - 5.310

CAUTION

Carbon Steel Open Swage Sockets are recommended for use on 6 x 19 or 6 x 37 IPS or XIP, (EIP), XXIP (EEIP) IWRC regular lay ropes. Before using Swage Sockets with any other type lay, construction, or grade of wire rope or strand, it is recommended that a test assembly be destructively tested to prove the adequacy of the assembly.

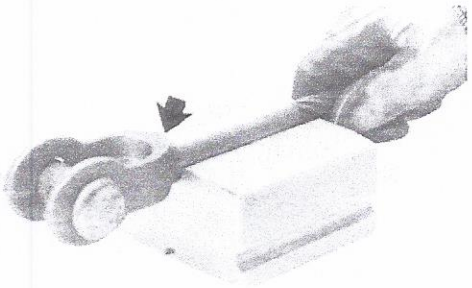
MADE IN USA

How to Swage ESCO® Forged Open and Closed Sockets/1/4" through 1-1/4"



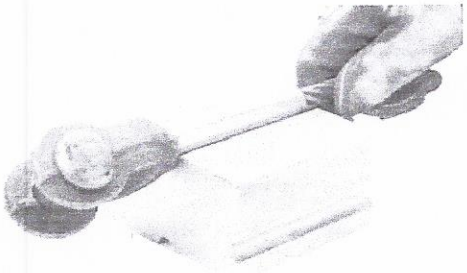
Step 1

Mark the proper length on the wire before installing the socket. See page 25 for minimum length of rope to insert into socket.



Step 2

Slip the socket onto the wire rope until the mark is flush with the end of the socket. Be sure it is fully inserted beyond the machined portion of the shank.



Step 3a

Swage sockets 1/4" through 5/8" full length on first swaging.

Step 3b

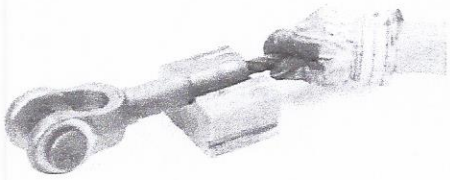
Rotate socket 45° (1/8 turn) and close dies fully on second swage to eliminate flash.

IMPORTANT: *Dies must close fully on last swaging to ensure maximum gripping strength of socket.*

Note: *When swaging 9/16" or 5/8" sockets in Mark 75 swager, use the 3 stage swaging method described in steps 5a and 5b on page 27.*

Step 4a

Swage 3/4" and 7/8" sockets in two stages. Swag 1/2 the shank at a time, swaging rope end first. Close dies fully.



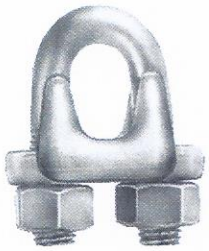
DROP FORGED WIRE ROPE CLIPS

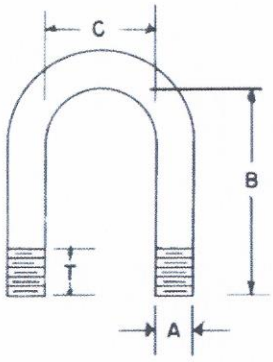
"CHICAGO" the Trade-Mark of quality in wire rope fittings is embossed on all forged steel clip bases. This identification symbolizes wire rope clips that are manufactured to rigid specifications. Component parts are galvanized. U-bolts, with or without nuts, price on application.

Made in USA

Should be used in heavy duty applications

	Hot Galvanized	U-Bolt Dimensions				Weight
Rope Size	Part No.	A	B	C	T	Per 100
1/8"	23460 3	12-24	3/4"	9/32"	1/2"	6.5
3/16"	23465 8	1/4"-20	15/16"	5/16"	5/8"	10
1/4"	23470 2	5/16"-18	1-5/32"	3/8"	3/4"	18.5
5/16"	23475 7	3/8"-16	1-1/2"	1/2"	1"	29.5
3/8"	23480 1	7/16"-14	1-5/8"	9/16"	7/8"	44
7/16"	23485 6	1/2"-13	1-7/8"	5/8"	1-1/4"	64
1/2"	23490 0	1/2"-13	1-7/8"	5/8"	1-1/4"	75
9/16"	23495 5	9/16"-12	2-3/8"	3/4"	1-3/8"	106
5/8"	23500 6	9/16"-12	2-3/8"	3/4"	1-3/8"	106
3/4"	23505 1	5/8"-11	2-3/4"	7/8"	1-5/8"	153
7/8"	23510 5	3/4"-10	3-1/4"	1"	1-7/8"	237.5
1"	23515 0	3/4"-10	3-5/8"	1-1/8"	2"	272.5
1-1/8"	23520 4	3/4"-10	3-13/16"	1-1/4"	2-1/4"	325
1-1/4"	23525 9	7/8"-9	4-3/8"	1-11/32"	2-1/2"	441
1-1/2"	23535 8	7/8"-9	5-1/8"	1-11/16"	2-3/4"	550





Meets Performance Requirements of Federal Specification FF-C-450, Type 1, Class 1

1

2

3

RECOMMENDED APPLICATION FOR CHICAGO DROP FORGED WIRE ROPE CLIPS

Clip Size Inches	Minimum No. of Clips	Amount of Rope to Turn Back in Inches	Torque in Ft. Lbs.
1/8"	2	3-1/4"	4.5
3/16"	2	3-3/4"	7.5
1/4"	2	4-3/4"	15
5/16"	2	5-1/4"	30
3/8"	2	6-1/2"	45
7/16"	2	7"	65
1/2"	3	11-1/2"	65
9/16"	3	12"	95
5/8"	3	12"	95
3/4"	4	18"	130
7/8"	4	19"	225
1"	5	26"	225
1-1/8"	6	34"	225
1-1/4"	7	44"	360
1-1/2"	8	54"	360

1. The correct way to attach wire rope clips is illustrated above. Apply the first clip one base width from the dead end of the wire rope. The base or saddle should bear on the line end of the rope – U-bolt on the short end. Tighten nuts firmly.

2. Attach second clip as close to loop as possible. Tighten nuts but not firmly.

3. Attach balance of clips spaced equally between first two clips. Tighten all nuts completely. Apply initial load – inspect nuts and retighten. Inspect all clips periodically.

The number of clips shown is based on using right regular or Lang lay wire rope, 6x19 class or 6x37 class, fibre core IWRC, IPS or XIPS. The number of clips shown also applies to right regular lay wire rope, 8x19 class and 18x7 class, fibre core, IPS or XIPS, sizes 1-1/2-inch and smaller.

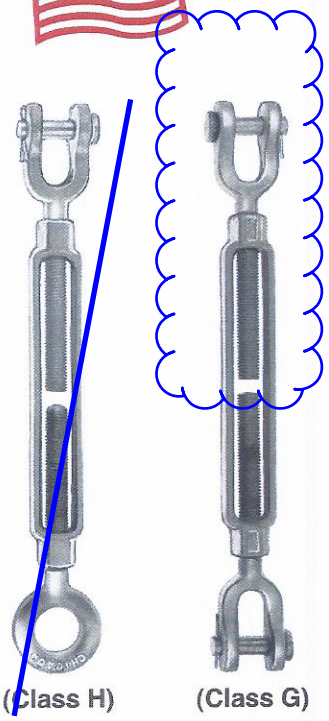
If Seale construction or similar large outer wire type construction in the 6x19 class is to be used for sizes 1-inch and larger, add one additional clip. For other classes or wire rope not mentioned, it may be necessary to add additional clips to the number shown. If more clips are used than shown, amount of rope turn back should be increased proportionately.

DROP FORGED TURNBUCKLES

Turnbuckles Meet Performance Requirements of ASTM Specification F1145-92 Type 1 Grade 1
(Supercedes FF-T-791B)

Eye, Jaw and Hook fittings are heat treated.

	Jaw and Eye Hot Galvanized			Jaw and Jaw Hot Galvanized		
Diameter & Take-up	Part No.	Closed Length	Weight per 100	Part No.	Closed Length	Weight per 100
1/4" x 4"	02605 5	8-1/4"	37.5	03055 7	8-1/2"	40
5/16" x 4-1/2"	02610 9	9-1/8"	52.5	03060 1	9-1/4"	52.5
3/8" x 6"	02615 4	11-1/2"	96.5	03065 6	11-1/2"	97.5
1/2" x 2"	02620 8	8-3/4"	109	03070 0	8-7/8"	119
1/2" x 6"	02623 9	13-1/4"	160	03073 1	13-1/2"	170
1/2" x 9"	02626 0	16-1/4"	198.5	03076 2	16-1/2"	202.5
1/2" x 12"	02629 1	19-1/4"	225	03079 3	19-1/2"	227.5
5/8" x 6"	02634 5	14-5/8"	257.5	03084 7	15-3/4"	260.5
5/8" x 9"	02637 6	17-7/8"	330	03087 8	18-3/4"	330
5/8" x 12"	02640 6	21-1/8"	402	03090 8	21-3/4"	407
5/8" x 18"	02643 7	27-1/8"	581	03093 9	27-3/4"	607
3/4" x 6"	02648 2	15-5/8"	402.5	03098 4	16-1/2"	417.5
3/4" x 9"	02651 2	18-3/4"	522.5	03101 1	19-1/2"	545
3/4" x 12"	02654 3	22"	602.5	03104 2	22-1/2"	619.5
3/4" x 18"	02657 4	28"	702	03107 3	28-1/2"	753
7/8" x 6"	02662 8	19"	655	03112 7	19-1/2"	668
7/8" x 12"	02665 9	23-1/2"	842.5	03115 8	24-1/2"	862.5
7/8" x 18"	02668 0	29-1/2"	1252	03118 9	30-1/2"	1281
1" x 6"	02673 4	19-1/8"	872	03123 3	21-3/16"	911
1" x 12"	02676 5	25-1/4"	1137.5	03126 4	25-1/2"	1165
1" x 18"	02679 6	31-1/4"	1463	03129 5	31-1/2"	1518



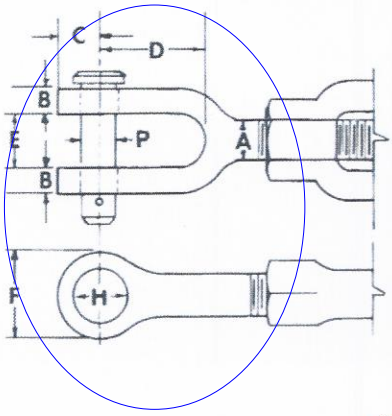
(Class H) (Class G)

Available with hot galvanized or self-colored finish. Jaw types supplied with round pins and cotter keys unless nuts and bolts are specified. Locking nuts are also available.

	Rod End Eye & Eye Self-Colored		
Diameter & Take-up	Part No.	Closed Length	Weight per 100
1/2" x 6"	03373 2	13"	131
5/8" x 6"	03384 8	13-1/4"	205
3/4" x 6"	03398 5	13-1/2"	293
7/8" x 6"	03412 8	14"	456
1" x 6"	03423 4	14-1/8"	589

JAW DIMENSIONS – STRENGTH

Dimensions – Inches								Working Load Limit in Lbs.†
A	B	C	D	*E	F	**H	P	
1/4"	7/32"	5/16"	25/32"	3/8"	5/8"	9/32"	1/4"	500
5/16"	1/4"	5/16"	7/8"	15/32"	5/8"	9/32"	1/4"	800
3/8"	9/32"	13/32"	1"	1/2"	13/16"	11/32"	5/16"	1,200
1/2"	5/16"	1/2"	1-9/32"	5/8"	1"	15/32"	7/16"	2,200
5/8"	3/8"	21/32"	1-21/32"	7/8"	1-5/16"	35/64"	1/2"	3,500
3/4"	1/2"	13/16"	1-27/32"	15/16"	1-5/8"	43/64"	5/8"	5,200
7/8"	9/16"	29/32"	1-31/32"	1-5/32"	1-7/8"	25/32"	3/4"	7,200
1"	11/16"	1-1/16"	2-13/32"	1-3/16"	2"	15/16"	7/8"	10,000

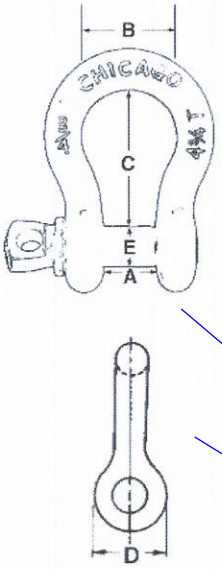


* At parting line: includes 7° draft. ** Hole size.
† Loads are based on a safety factor of 5 to 1.

NOTE: JAW END ONLY SUPPLIED, LENGTH 9"

DROP FORGED ANCHOR SHACKLES

Size, working load limit, and trademark are permanently marked on all shackles. All shackles and pins are heat treated. Loads are based on a safety factor of 6 to 1, except (**) which is 5 to 1. When tested all shackles are pulled at a uniform rate of speed in a direct tension.



Shackles Meet Performance Requirements of Federal Specifications RR-C-271D Type IVA*

Anchor – Round Pin – Screw Pin – Safety

Working Load Limit in Tons	Dimensions – Inches								Estimated Weight Per 100 in lbs.
	Inside						O.D. Eyes (D)	Pin or Bolt Dia. (E)	
	Size Dia.	Width @ Eyes (A)	Tol. ±	Width @ Bow (B)	Length (C)	Tol. ±			
1/3	3/16"	3/8"	1/16"	9/16"	7/8"	1/16"	5/8"	1/4"	7
1/2	1/4"	15/32"	1/16"	3/4"	1-1/8"	1/16"	3/4"	5/16"	13.5
3/4	5/16"	17/32"	1/16"	15/16"	1-1/4"	1/16"	7/8"	3/8"	22
1	3/8"	21/32"	1/16"	1-1/8"	1-7/16"	1/8"	1"	7/16"	33
1-1/2	7/16"	23/32"	1/16"	1-5/16"	1-11/16"	1/8"	1-1/8"	1/2"	53.5
2	1/2"	13/16"	1/16"	1-1/2"	1-15/16"	1/8"	1-1/4"	5/8"	76.5
3-1/4	5/8"	1-1/16"	1/16"	1-7/8"	2-1/2"	1/8"	1-11/16"	3/4"	150.5
4-3/4	3/4"	1-1/4"	1/16"	2"	3"	1/4"	1-7/8"	7/8"	245.5
6-1/2	7/8"	1-7/16"	1/16"	2-5/8"	3-1/4"	1/4"	2-1/8"	1"	375
8-1/2	1"	1-11/16"	1/16"	2-3/4"	3-3/4"	1/4"	2-1/2"	1-1/8"	537.5
9-1/2	1-1/8"	1-13/16"	1/16"	2-15/16"	4-1/4"	1/4"	2-5/8"	1-1/4"	765
12	1-1/4"	2"	1/16"	3-1/4"	4-1/2"	1/4"	3"	1-3/8"	1007.5
13 1/2	**1-3/8"	2-1/4"	1/8"	3-1/2"	5-1/4"	1/4"	3-1/4"	1-1/2"	1232.5
17	1-1/2"	2-3/8"	1/8"	3-3/4"	5-3/4"	1/4"	3-1/2"	1-5/8"	1777.5

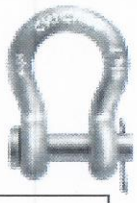
WARNING:

Any deviations such as angular lifts, shock loads, modification of the basic forging, etc., will result in drastically reduced working load limits.

All types of shackles are available in a self-colored or hot galvanized finish. When ordering specify the size, finish, and type of shackle. Other rust preventative coatings are available on a special basis.

Safety shackles are of the same specifications as the regular types except for the bolt, nut and cotter.

*Class 1



Round Pin

Size	Galvanized Part No.	Self-Colored Part No.
3/16"	21105 5	21005 8
1/4"	21110 9	21010 2
5/16"	21115 4	21015 7
3/8"	21120 8	21020 1
7/16"	21125 3	21025 6
1/2"	21130 7	21030 0
5/8"	21135 2	21035 5
3/4"	21140 6	21040 9
7/8"	21145 1	21045 4
1"	21150 5	21050 8
1-1/8"	21155 0	21055 3
1-1/4"	21160 4	21060 7
1-3/8"	21165 9	21065 2
1-1/2"	21170 3	21070 6

*Class 2

Screw Pin

Size	Galvanized Part No.	Self-Colored Part No.
3/16"	20105 6	20005 9
1/4"	20110 0	20010 3
5/16"	20115 5	20015 8
3/8"	20120 9	20020 2
7/16"	20125 4	20025 7
1/2"	20130 8	20030 1
5/8"	20135 3	20035 6
3/4"	20140 7	20040 0
7/8"	20145 2	20045 5
1"	20150 6	20050 9
1-1/8"	20155 1	20055 4
1-1/4"	20160 5	20060 8
1-3/8"	20165 0	20065 3
1-1/2"	20170 4	20070 7

*Class 3

Safety

Size	Galvanized Part No.	Self-Colored Part No.
1/4"	20610 5	20510 8
5/16"	20615 0	20515 3
3/8"	20620 4	20520 7
7/16"	20625 9	20525 2
1/2"	20630 3	20530 6
5/8"	20635 8	20535 1
3/4"	20640 2	20540 5
7/8"	20645 7	20545 0
1"	20650 1	20550 4
1-1/8"	20655 6	20555 9
1-1/4"	20660 0	20560 3
1-1/2"	20670 9	20570 2

Made in USA

2.A.6

MUNCY SWAGE SOCKETS

2.A.4.1 WIRE ROPE SLING SOCKETS

Upson-Walton™ Closed Swage Sockets

Muncy manufactures the Upson-Walton Swage Socket product line. Our forgings use special steel with mechanical and physical properties that enhance swaging, durability, and strength. Upson-Walton closed swage sockets are sometimes used by themselves for specific pins, or in conjunction with our open swage sockets.

Upson-Walton Swage Sockets are Made in USA

Muncy manufactures its Upson-Walton swage sockets from material and forgings that we make in the USA. Muncy machines and performs its secondary processes in the United States. When you receive a swage socket with an "Upson-Walton" or "UW" on the forging, you can know with confidence it was Made In USA.

Upson-Walton Sockets are easy to swage onto Wire Rope

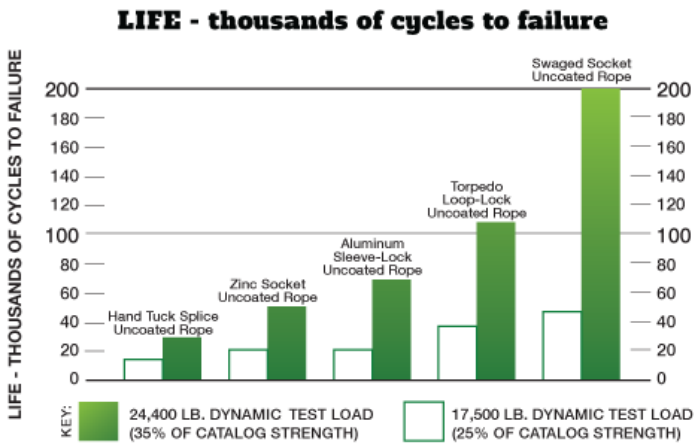
Many of our customers tell us they like how our swage sockets swage onto wire rope. Our heat treat process is designed with the swaging process in mind, as the socket is subjected to extreme pressure between dies during swaging.

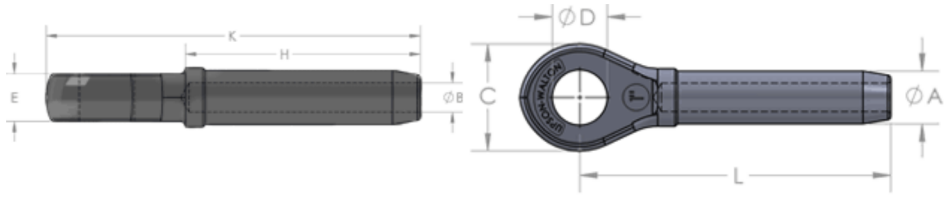
EFFICIENT, QUICK and POSITIVE

Why pour zinc or epoxy when swaging is sure? Swage sockets have as much as five times longer life than spelter sockets.

Tests prove swage sockets have the best fatigue life

An extensive research study by one of the nation's steel companies clearly established the fatigue life superiority of swaged sockets over other commonly used types of boom pendants. The tests included applied dynamic longitudinal load to the rope. They also simulated stresses which occur in pendant service. The graph at the right shows the results of these tests.





Stock No.	Rope Dia.	Dimensions								Weight LBS Each	After Swage Each	
		A	B	C	D	E	H	K	L		MIN.	MAX.
41025002	1/4	0.495	0.272	1-7/16	0.750	1/2	2-1/8	4-3/8	3-1/2	0.35	0.428	0.460
41031302	5/16	0.770	0.339	1-11/16	0.875	11/16	3-3/16	5-1/2	4-1/2	0.77	0.678	0.710
41037502	3/8	0.770	0.406	1-11/16	0.875	11/16	3-3/16	5-1/2	4-1/2	0.73	0.678	0.710
41043802	7/16	0.982	0.484	2	1.063	7/8	4-1/4	6-15/16	5-3/4	1.47	0.865	0.910
41050002	1/2	0.982	0.547	2	1.063	7/8	4-1/4	6-15/16	5-3/4	1.38	0.865	0.910
41056302	9/16	1.257	0.609	2-1/2	1.250	1-1/8	5-5/16	8-3/4	7-1/4	2.90	1.115	1.160
41062502	5/8	1.257	0.672	2-1/2	1.250	1-1/8	5-5/16	8-3/4	7-1/4	2.80	1.115	1.160
41075002	3/4	1.545	0.796	3	1.438	1-5/16	6-3/8	10-3/8	8-5/8	5.16	1.365	1.420
41087502	7/8	1.700	0.938	3-1/2	1.688	1-1/2	7-7/16	12-1/8	10-1/8	7.40	1.490	1.550
41100002	1	1.975	1.062	4	2.063	1-3/4	8-1/2	13-3/4	11-1/2	11.20	1.740	1.800
41112502	1-1/8	2.245	1.188	4-1/2	2.313	2	9-9/16	15-1/4	12-3/4	16.00	1.990	2.050
41125002	1-1/4	2.525	1.328	5	2.563	2-1/4	10-5/8	17-1/4	14-3/8	22.70	2.240	2.300
41137502	1-3/8	2.800	1.453	5-1/4	2.563	2-1/4	11-11/16	18-7/8	15-3/4	29.00	2.490	2.560

CAUTION

Swage Sockets are recommended for use on 6 x 19 or 6 x 37 IPS or XIP (EIP), XXIP (EEIP), RRL, FC, or IWRC wire ropes. They are also approved for use on galvanized bridge rope. Before using swage sockets with other type lay, construction or grade of wire rope, it is recommended that the termination be proofloaded to prove the adequacy of the assembly.

Other Materials Available

» Stainless Steel Closed Swage Sockets

Similar Products

» Open Swage Sockets » Stainless Steel Closed Swage Sockets » Boom Pendant Open Swage Sockets
» Boom Pendant Closed Swage Sockets

Looking for Spelter Sockets?

» Open Rope Spelter Sockets » Closed Rope Spelter Sockets » Stainless Steel Open Rope Spelter Sockets
» Flat Rope Spelter Sockets » Open Strand Spelter Sockets » Closed Strand Spelter Sockets
» Type 6 Anchor Sockets » Type 7 Anchor Sockets » Type 8 Anchor Sockets
» Open Boom Pendant Sockets » Closed Boom Pendant Sockets » Open Bridge Bowl Sockets
» Closed Bridge Bowl Sockets » Vibration Dampening Fittings

Main Office Location
5820 Susquehanna Trail
Turbotville, PA 17772
Phone: (570) 649-5188
Fax: (570) 649-5850

Kansas City Location
13531 Wyandotte St.
Kansas City, MO 64145
Phone: (816)-942-2861
Fax: (816)-942-6913

Lafayette Location
109A Barboa Dr.
Broussard, LA 70518
Phone: (337)-839-9000
Fax: (337)-839-2900

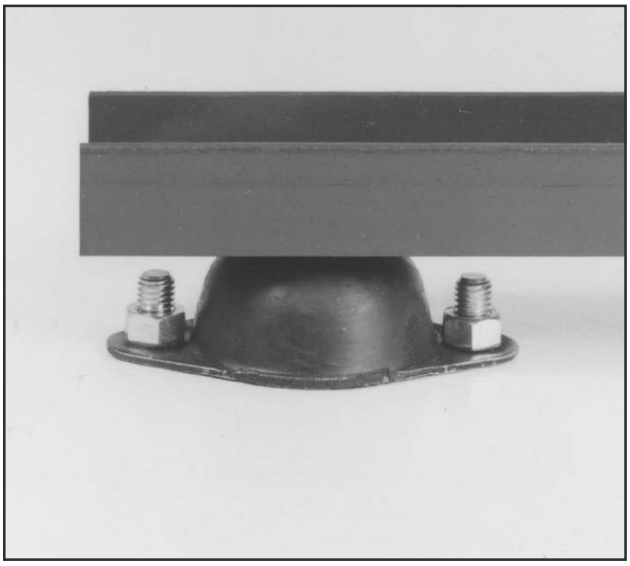
Texas Location
11200 Broadway
St: Suite 2543
Pearland, TX 77584
Phone: (832)-641-0591

Member of **Associated Wire Rope Fabricators**

2.A.7

VIBRATION ISOLATORS

KINETICS®
Elastomeric Isolators
Model RQ



Description
Kinetics Model RQ Vibration Isolators are one-piece molded neoprene mounts with encapsulated metal inserts. The metal inserts provide all-directional resistance for horizontally and vertically applied loads. Each isolator incorporates two bolt-down holes on the bottom load surface and a steel top load plate for attachment to the supported equipment. The neoprene is highly oil resistant and has been designed to operate within the strain limits of the isolator to provide the maximum isolation and longest life expectancy possible using neoprene compounds. Model RQ is designed for up to 0.13" (3 mm) deflection, available in three sizes and thirteen capacities from 210 lbs. to 1950 lbs. (95 kg to 885 kg). Kinetics Model RQ is recommended for the isolation of vibration produced by small pumps, vent sets, low pressure packaged air-handling units, etc., and is usually selected when first cost must be minimized.

Application
Kinetics Model RQ neoprene isolation mounts can be used to isolate high frequency vibration generated by mechanical equipment located on a grade-supported structural slab, pier or load-bearing wall.

Typical applications of Model RQ neoprene isolators are limited to isolation of mechanical equipment having lowest operating speeds of 1750 RPM when located on a grade-supported slab, pier or load bearing wall, and include close coupled pumps with motors of 5 H.P. or less, small vent sets, low pressure packaged air-handling units, wall-mounted electrical transformers and similar equipment types.

Model RQ neoprene isolation mounts can be used for isolation of mechanical equipment specified to be supported by neoprene rubber or elastomer isolators and with tabulated minimum static deflections up to 0.13" (3 mm).

Model RQ neoprene isolation mounts are also selected for use in seismic and windload restraint applications.

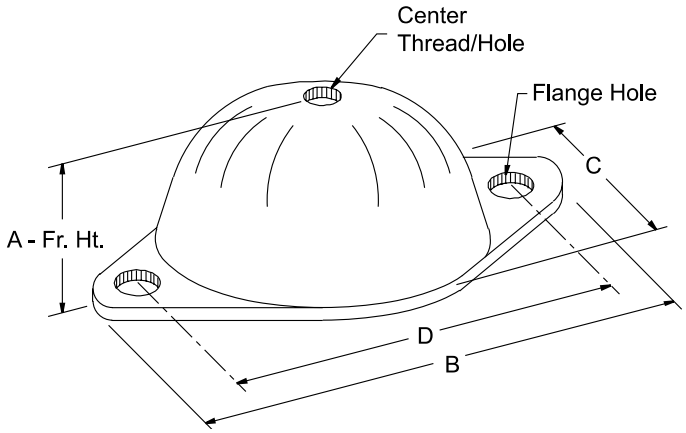
Isolator Type	Durometer	Rated Capacity		Rated Deflection		A		B		C		D		Center NC Thread		Center Hole Dia.		Flange Hole Dia.	
		lbs	kg	in	mm	in	mm	in	mm	in	mm	in	mm	in	mm	in	mm	in	mm
RQ-210 A	30A	210	95	0.10	3	1.12	28	3.75	95	2.27	58	3.00	76	0.38	10	-	-	0.34	9
RQ-370 A	40A	370	168	0.10	3	1.12	28	3.75	95	2.27	58	3.00	76	0.38	10	-	-	0.34	9
RQ-520 A	50A	520	236	0.10	3	1.12	28	3.75	95	2.27	58	3.00	76	0.38	10	-	-	0.34	9
RQ-680 A	60A	680	308	0.10	3	1.12	28	3.75	95	2.27	58	3.00	76	0.38	10	-	-	0.34	9
RQ-750 A	70A	750	340	0.08	2	1.12	28	3.75	95	2.27	58	3.00	76	0.38	10	-	-	0.34	9
RQ-375 B	40A	375	170	0.13	3	1.66	42	5.38	137	3.25	83	4.12	105	-	-	0.50	13	0.53	13
RQ-800 B	50A	800	363	0.13	3	1.66	42	5.38	137	3.25	83	4.12	105	-	-	0.50	13	0.53	13
RQ-925 B	60A	925	420	0.13	3	1.66	42	5.38	137	3.25	83	4.12	105	-	-	0.50	13	0.53	13
RQ-1425 B	70A	1425	646	0.13	3	1.66	42	5.38	137	3.25	83	4.12	105	-	-	0.50	13	0.53	13
RQ-525 C	40A	525	238	0.13	3	1.66	42	6.25	159	3.94	100	5.00	127	-	-	0.75	19	0.53	13
RQ-1000 C	50A	1000	454	0.13	3	1.66	42	6.25	159	3.94	100	5.00	127	-	-	0.75	19	0.53	13
RQ-1250 C	60A	1250	567	0.13	3	1.66	42	6.25	159	3.94	100	5.00	127	-	-	0.75	19	0.53	13
RQ-1950 C	70A	1950	885	0.13	3	1.66	42	6.25	159	3.94	100	5.00	127	-	-	0.75	19	0.53	13

Specifications

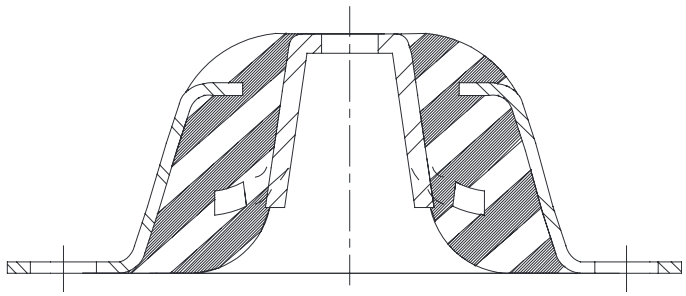
Vibration isolators shall be neoprene, molded from oil-resistant compounds, with a cast-in-top steel load transfer plate for bolting to supported equipment and a bolt-down plate with holes provided for anchoring to the supporting structure. Isolator shall provide lateral load resistance for loads applied parallel to mounting surface.

Neoprene vibration isolators shall have minimum operating static deflections as shown on the Vibration Isolation Schedule or as indicated on the project documents but not exceeding published load capabilities.

Neoprene vibration isolators shall be Model RQ, by Kinetics Noise Control, Inc.



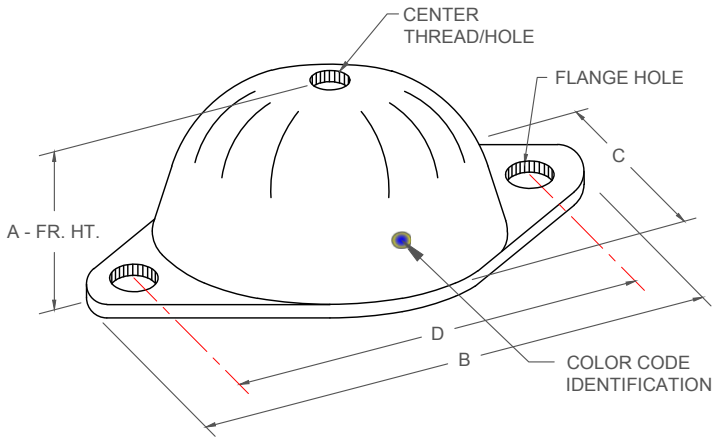
Cut-Away Showing Internal Interlocking Steel



KINETICS Noise Control

kineticsnoise.com
sales@kineticsnoise.com
1-800-959-1229

MODEL	COLOR CODE	DURO	RATED LOAD lb	RATED LOAD kg	RATED DEFL. in	RATED DEFL. mm	DIMENSION A in	DIMENSION A mm	DIMENSION B in	DIMENSION B mm	DIMENSION C in	DIMENSION C mm	DIMENSION D in	DIMENSION D mm	CENTER NC THREAD in	CENTER NC THREAD mm	CENTER HOLE DIA. in	CENTER HOLE DIA. mm	FLANGE HOLE DIA. in	FLANGE HOLE DIA. mm
RQ- 210 A	WHITE	30A	210	95	0.10	3	1.12	28	3.75	95	2.27	58	3.00	76	0.38	10			0.34	9
RQ- 370 A	YELLOW	40A	370	168	0.10	3	1.12	28	3.75	95	2.27	58	3.00	76	0.38	10			0.34	9
RQ- 520 A	ORANGE	50A	520	236	0.10	3	1.12	28	3.75	95	2.27	58	3.00	76	0.38	10			0.34	9
RQ- 680 A	BLUE	60A	680	308	0.10	3	1.12	28	3.75	95	2.27	58	3.00	76	0.38	10			0.34	9
RQ- 750 A	GREEN	70A	750	340	0.08	2	1.12	28	3.75	95	2.27	58	3.00	76	0.38	10			0.34	9
RQ- 375 B	BLUE	40A	375	170	0.13	3	1.66	42	5.38	137	3.25	83	4.12	105			0.50	13	0.53	13
RQ- 800 B	GRAY	50A	800	363	0.13	3	1.66	42	5.38	137	3.25	83	4.12	105			0.50	13	0.53	13
RQ- 925 B	WHITE	60A	925	420	0.13	3	1.66	42	5.38	137	3.25	83	4.12	105			0.50	13	0.53	13
RQ- 1425 B	ORANGE	70A	1425	646	0.13	3	1.66	42	5.38	137	3.25	83	4.12	105			0.50	13	0.53	13
RQ- 525 C	GREEN	40A	525	238	0.13	3	1.66	42	6.25	159	3.94	100	5.00	127			0.75	19	0.53	13
RQ- 1000 C	BLUE	50A	1000	454	0.13	3	1.66	42	6.25	159	3.94	100	5.00	127			0.75	19	0.53	13
RQ- 1250 C	YELLOW	60A	1250	567	0.13	3	1.66	42	6.25	159	3.94	100	5.00	127			0.75	19	0.53	13
RQ- 1950 C	RED	70A	1950	885	0.13	3	1.66	42	6.25	159	3.94	100	5.00	127			0.75	19	0.53	13



RQ MOUNTS ARE MADE OF OIL RESISTANT NEOPRENE.
RQ MOUNTS ARE BLACK IN COLOR.
RQ MOUNTS HAVE A TEMPERATURE RANGE OF -25° TO +180°F.
RQ MOUNTS HAVE INTERLOCKING STEEL CAST INTO MOUNT.

KINETICS Noise Control

Member VISCMA Vibration Isolation and Seismic Control Manufacturers Association

KINETICS NOISE CONTROL, INC
6300 IRELAN PL,
DUBLIN, OH 43017 USA
Ph: 614 889-0480, Fax: 614 889-0540
www.kineticsnoise.com

Model: MODEL RQ

By: BB
Date: 05/02/02
Revised: 10/28/14 / BB

Drawing No: S-02.05-1C

2.A.8

VECTRAN ROPE

TECH SHEET

Vectran® 12 Strand & 12x12

Vectran® 12 strand is a high strength very low stretch braided rope manufactured using Vectran® LCP (Liquid Crystal Polymer) high modulus synthetic fiber yarns. This torque-free rope is popular in applications when strength, low stretch, heat resistance and zero creep in fiber are required. Vectran® 12 strand has excellent bend and flex fatigue resistance and is easily spliced using the lock-stitch type splice, 4-3-2 or 5-4-3 tuck splice.

Vectran® 12 strand rope is typically provided with a clear polyurethane coating. Cortland's patented 12x12 construction is available on Vectran® braided rope from 1-5/8" diameter through 8-1/4" (200mm) diameter; for strengths and weights above 4" diameter please contact Cortland.

Features & Benefits

- High strength
- Low stretch
- No creep
- Soft hand
- Torque free
- Easy splicing

Applications

- Replacement for wire rope
- Theatrical rigging
- Lifting slings
- Utility winch and pulling lines
- Recreational vehicle winch lines
- Subsea lifting and mooring lines
- Seismic

	Nominal Diameter		Size (circ in.)	Approximate Weight		Minimum Tensile Strength Spliced Rope		Minimum Tensile Strength ISO Unspliced Rope	
	Inch	mm		Lbs/100ft	Kg/100m	Lbs	Te (tonnes)	Lbs	Te (tonnes)
12 Strand	0.0165	0.419	0.05	0.01	0.01	50	0.02	56	0.03
	0.023	0.584	0.07	0.02	0.03	115	0.05	128	0.06
	0.045	0.114	0.14	0.08	0.12	300	0.14	333	0.15
	0.055	0.140	0.17	0.10	0.15	415	0.2	460	0.2
	1/16	0.027	3/16	0.15	0.22	870	0.4	970	0.4
	0.1	0.100	0.30	0.30	0.45	1,500	0.7	1,670	0.8
	7/64	0.110	21/64	0.46	0.69	2,250	1.0	2,500	1.1
	1/8	3	3/8	.64	0.9	2,800	1.3	3,100	1.4
	3/16	5	9/16	1.3	1.9	5,500	2.5	6,100	2.8
	1/4	6	3/4	2.1	3.1	8,000	3.6	8,900	4
	5/16	8	15/16	3.2	4.8	11,700	5.3	13,000	5.9
	3/8	9	1-1/8	5.3	7.9	17,500	7.9	19,400	8.8
	7/16	11	1-1/4	6.1	9.1	21,000	9.5	23,300	10.6
	1/2	12	1-1/2	9.2	13.7	31,300	14.2	34,800	15.8
	9/16	14	1-3/4	11.4	17.0	37,900	17.2	42,100	19.1
	5/8	16	2	15.3	22.8	51,400	23.3	57,100	25.9
	3/4	18	2-1/4	19.2	28.6	68,500	31.1	76,100	34.5
	7/8	22	2-3/4	28.3	41.6	92,600	42	102,900	46.7
	1	24	3	33.8	50.4	110,000	49.9	122,000	55.4
	1-1/8	28	3-1/2	46.0	68.7	147,000	66.7	163,000	74
	1-1/4	30	3-3/4	52.2	77.9	165,000	74.9	183,000	83
	1-5/16	32	4	60.2	89.8	196,000	88.9	218,000	98.9
12x12 Strand	1-1/2	36	4-1/2	74.6	111.3	221,000	100	246,000	112
	1-5/8	40	5	94.8	141.4	291,000	132	323,000	147
	1-3/4	44	5-1/2	113.2	168.9	314,000	142	349,000	158
	2	48	6	132	196	355,000	161	394,000	179
	2-1/8	52	6-1/2	157	235	428,000	194	476,000	216
	2-1/4	56	7	176	263	481,000	218	534,000	242
	2-5/8	64	8	241	359	596,000	270	662,000	300
	2-3/4	68	8-1/2	270	398	660,000	299	733,000	333
	3	72	9	309	443	780,000	354	867,000	393
	3-1/4	80	10	377	561	940,000	426	1,044,000	474
	3-5/8	88	11	468	697	1,250,000	567	1,389,000	630
	4	96	12	569	847	1,520,000	690	1,689,000	766

Sizes available up to 8-1/4" diameter (200mm) and 4,900,000 lbs strength. Tensile Strengths are determined in accordance with Cordage Institute 1500, Test Methods for Fiber Rope. Weights are calculated at linear density under standard preload ($200d^2$) plus 4%. See reverse side for application and safety information

CORTLAND®

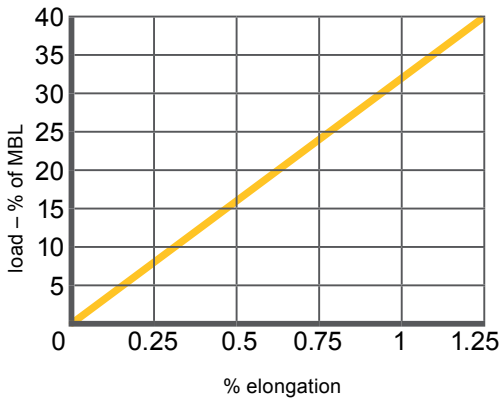
Vectran® 12 Strand & 12x12

Technical Information

Specific gravity	1.40*
Melting point	625°F (329°C)
Critical temp.	300°F (149°C)
Coefficient of friction	0.12-0.15*
Elongation at break	4%-5%
Fiber water absorption	<0.1%
UV resistance	moderate
Wet abrasion	excellent
Dry abrasion	excellent

* value based on data supplied by the fiber manufacturer for new, dry fiber

Vectran® 12 Strand & 12x12 Elongation (%)



Rope Specifications

Minimum Tensile Strength Minimum tensile strengths shown are for new (unused) rope and will decrease after use. All tests are performed in accordance with Cordage Institute Standard CI 1500-2. The rope strength will be reduced after use due to heat, abrasion, ultraviolet or chemical exposure. The tensile strengths may be further reduced by up to 50% as a result of knots or kinks. Minimum Tensile Strengths are defined as two standard deviations (typical about 10%) below the average.

Maximum Working Loads Maximum working loads are determined by dividing the tensile strength by the safety factor. The safety factor is a function of the physical properties of the rope, the age and history of the rope, the type of service it will be subjected to and the risks involved if failure occurs. For a rope manufacturer to give blanket working load recommendations would be like a car manufacturer giving the “safe driving speed” of their cars. Obviously the conditions of use far outweigh the design characteristics of the rope. Typically safety factors vary from 3:1 (for new rope used in applications with uniform loading and where failure would cause little or no risk to equipment or personnel) to 20:1 (for conditions involving moderate shock loading, possibility of snags or kinks or where failure could cause severe risk to equipment or personnel).

Rope Weights Rope weights shown are average and may vary plus or minus 5%.

Working Elongation Working elongation is shown from a preload tension of 200 times the diameter squared per the Cordage Institute Standard.

Special Requirements

Factory Splicing Various types are available for all of our ropes. Splices can be provided with various types of chafe protection or coatings.

Custom Lengths Special constructions are available on request.

Rope Terminations Cortland can provide custom terminations such as thimbles, links, rings and custom hardware. Terminations are available in plastic, bronze, stainless steel and galvanized steel. Please call or fax your requirements for a quotation.

Special Coatings Coatings such as polyurethane, polyethylene and vinylesters may be applied to any of the synthetic ropes to improve snag resistance, sunlight resistance or for color coding. Cortland can provide ropes with a variety of finishes to meet your needs.

Commercial and Military Specifications Certificates of compliance are supplied at no charge if requested when placing the order. Certified test reports can be provided at an additional charge when requested at the time of the order.

Terms & Shipping Information

Payment Terms Net 30 days from the invoice date with approved credit.

Minimum Billing $100 based on net prices.

Prices and Specifications Subject to change without notice.

Freight all prices are FOB factory – Anacortes, WA USA. Full freight allowance will be given on all surface shipments meeting minimum requirements based on delivery location, provided the invoice is paid within the 30 day terms.

Returned Goods Subject to a minimum 20% restocking charge upon inspection. No returns will be accepted without prior authorization.

2.A.9

LUBRICANTS

MULTIFAK® EP
000, 00, 0, 1, 2

PRODUCT DESCRIPTION

Multifak® EP greases are multipurpose extreme pressure greases suitable for use in many industrial grease applications.

CUSTOMER BENEFITS

Multifak EP greases deliver value through:

- **Good water resistance** — Resistance to washout of bearings.
- **Good corrosion protection** — Inhibited to protect bearing surfaces.
- **Good oxidation stability** — Helps to support long life in storage and in use.
- **Simplified lubrication** — One grease designed to satisfy many different industrial grease requirements.
- **Low oil separation tendency** — Recommended for use in typical centralized lubrication systems.

FEATURES

Multifak EP greases are multipurpose extreme pressure greases suitable for use in many industrial grease applications.

Multifak EP greases are manufactured using selected highly refined medium viscosity index base oils, a lithium 12 hydroxystearate thickener, an extreme pressure additive, and rust and oxidation inhibitors.

NLGI grade 000 is red in color and stringy in texture. NLGI grades 00, 0, 1 and 2 are amber in color and buttery in texture.

Multifak EP greases have high load-carrying capacity and, therefore, provide good protection of lubricated parts against wear. They provide good lubrication in the presence of water, protect bearing surfaces against corrosion, and have excellent resistance to oxidation, which supports long life in storage and in use.

Multifak EP greases are work stable. They resist separation or throw out from antifriction bearings. They have low oil bleeding tendency under pressure and are pumpable at low temperatures.

APPLICATIONS

Multifak EP greases are suitable for use in typical centralized lubrication systems.

Multifak EP greases can satisfy a wide range of industrial and commercial grease applications.

Typical applications include:

- General Machinery - plain, antifriction, roller, and needle bearings
- Construction equipment
- Conveyors and run-out rolls
- Crusher, shaker, or classifier screen bearings
- Chassis lubrication
- Non-disc brake wheel bearings

Multifak EP greases are recommended for both plain and antifriction bearings and particularly for bearings subjected to shock loading. **NLGI grades 1** and **2** comply with Timken's recommendation for this service.

NLGI grade 000 is a semifluid grease formulated to meet the lubrication requirements of machinery having enclosed gear cases where housings and seals have lost their ability to retain conventional gear oils.

NLGI grades 1 and **2** are approved for the NLGI Certification Mark LB.

NLGI grades 0, 1 and **2** are registered by **NSF** and are acceptable as a lubricant where there is no possibility of food contact (H2) in and around food processing areas. The NSF Nonfood Compounds Registration Program is a continuation of the USDA product approval and listing program, which

Product(s) manufactured in the USA and Colombia.
Always confirm that the product selected is consistent with the original equipment manufacturer's recommendation for the equipment operating conditions and customer's maintenance practices.

A **Chevron** company product

3 June 2016
GR-67

is based on meeting regulatory requirements of appropriate use, ingredient review and labeling verification.

TYPICAL TEST DATA

NLGI Grade	000	00	0	1	2
Product Number	*274508*	*274509*	*274501*	*274502*	*274503*
SDS/MSDS Number *USA* *Colombia*	*38345* —	*23689* —	*23562* —	*23562* —	*23562* *34392*
Operating Temperature, °C(°F) Minimum[a] Maximum[b]	-35(-31) 70(158)	-35(-31) 77(170)	-30(-22) 99(210)	-20(-4) 125(257)	-15(5) 127(260)
Penetration, at 25°C(77°F) Unworked Worked	445 460	415 415	390 370	305 325	275 280
Dropping Point, °C(°F)	160(320)	160(320)	171(340)	186(367)	188(370)
Timken OK Load, lb	40	40	40	40	40
Thickener, % Type	1.6 Lithium	2.3 Lithium	5.0 Lithium	7.0 Lithium	9.0 Lithium
ISO Viscosity Grade, Base Oil Equivalent	320	100	220	220	220
Viscosity, Kinematic* cSt at 40°C cSt at 100°C	349 22.3	112 9.8	173 15.6	173 15.6	173 15.6
Viscosity, Saybolt* SUS at 100°F SUS at 210°F	1880 112	595 60	914 82	914 82	914 82
Viscosity Index*	76	49	90	90	90
Flash Point, °C(°F)*	224(435)	204(400)	204(400)	249(480)	249(480)
Pour Point, °C(°F)*	-27(-17)	-24(-11)	-12(-10)	-12(-10)	-12(-10)
Texture	Stringy	Buttery	Buttery	Buttery	Buttery
Color	Red	Amber	Amber	Amber to Brown	Amber to Brown

a Minimum operating temperature is the lowest temperature at which a grease, already in place, could be expected to provide lubrication. Most greases cannot be pumped at these minimum temperatures.

b Maximum operating temperature is the highest temperature at which the grease could be used with frequent (daily) relubrication.

* Determined on mineral oil extracted by vacuum filtration.

Minor variations in product typical test data are to be expected in normal manufacturing.

Always confirm that the product selected is consistent with the original equipment manufacturer's recommendation for the equipment operating conditions and customer's maintenance practices.

3 June 2016
GR-67

2.A.10

MACHINED THIMBLES

AVIAN VECTRAN ROPE MACHINED THIMBLES

Provided By : ENCORE METALS US 8399-91 MO500 0.109

NORTH AMERICAN STAINLESS

METALLURGICAL TEST REPORT

6870 Highway 42 East
Ghent, KY 41045-9615
(502) 347-6000

Certificate: 254239 12

Mail To:
EARLE M. JORGENSEN COMPANY
1900 MITCHELL BLVD.
SCHAUMBURG IL 60193

Ship To:
EARLE M. JORGENSEN COMPANY
1900 MITCHELL BLVD.
SCHAUMBURG IL 60193

Customer: 0245 001
NAS Order: LP 57247 14
Your Order: P769353-423 Item Code: 525363

Date: 1/11/2017 Page: 1 Of 1
Steel: 304/304L
Finish: Cold Finish
Dia/Thk: 1.5000 in
Leg Length:
Length: 144.00 in
Corrosion: ASTM A262-10 Prac A/E OK

PRODUCT DESCRIPTION:

HEATED TO 1900F MIN & QUENCHED; GRAIN SIZE= 6-8
Round Bar, Annealed, Smooth Turned, Cold Finished
UNS S30400/S30403, EN 10204 3.1, ASTM A484/15
ASTM A276/16, ASTM A479/16, ASTM A182/13 CHEM ONLY,
ASME SA479/13, ASME SA182/10 CHEM ONLY
AMS 5639H, AMS 5647J, AMS QQS-763D, QQS-763F
NACE MR0175-03/MR0103-05(MID RADIUS ONLY), ASTM F899/11
SOLUTION ANNEAL TEMP 1900F MIN, ASTM A320/08 CL 1 GR B8
ASTM A193/10A-ASME SA193/10 CL 1 GR B8(EXC PAR 7.2)

REMARKS:

COMPLIES W/REQUIREMENTS OF DFAR 252.225-7009 EU DIRECTIVE
2011/65/EU.RoHS. EAF+AOD+CC. NO WELD REPAIR. MELTED AND MFG
IN USA FREE FROM MERCURY AND LOW MELTING ALLOY CONTAMINATION

R 137 323

Bundle	Weight	Bundle	Weight	Bundle	Weight	Bundle	Weight	Bundle	Weight	Bundle	Weight	Bundle	Weight	Bundle	Weight	Bundle	Weight
BI42019	3295	BI42021	3300	BI42022	3302												

Lab Accreditation Bureau, ISO/IEC 17025, Certificate# L2323

CHEMICAL ANALYSIS

CM(Country of Melt) ES(Spain) US(United States) ZA(South Africa) JP(Japan) Chemical Analysis per ASTM A751/14a

Heat	Supplier #	CM	C %	CO %	CR %	CU %	MN %	MO %	N %	NI %	P %	S %
234R		US	.017	.17	18.03	.41	1.50	.38	.064	8.50	.029	.0255

SI %
.29

MECHANICAL PROPERTIES

	loc	dir	HB No.	.2YS KSI	UTS KSI	RA %	Elng % 4D
BI42019	R	L	156.0	41.00	84.00	68.00	55.00
BI42021	R	L	156.0	41.00	84.00	68.00	55.00
BI42022	R	L	156.0	41.00	84.00	68.00	55.00

NAS hereby certifies that the analysis on this certification is correct. Based upon the results and the accuracy of the test methods used, the material meets the specifications stated. These results relate only to the items tested and this report cannot be reproduced, except in its entirety, without the written approval of NAS

Technical Dept.Mgr. KRIS LARK

Customer: WAITE SPECIALTY MACH WORK Ord #: S182498 Part #: MO5000.10 Cust PO#: 410-/90-1/12

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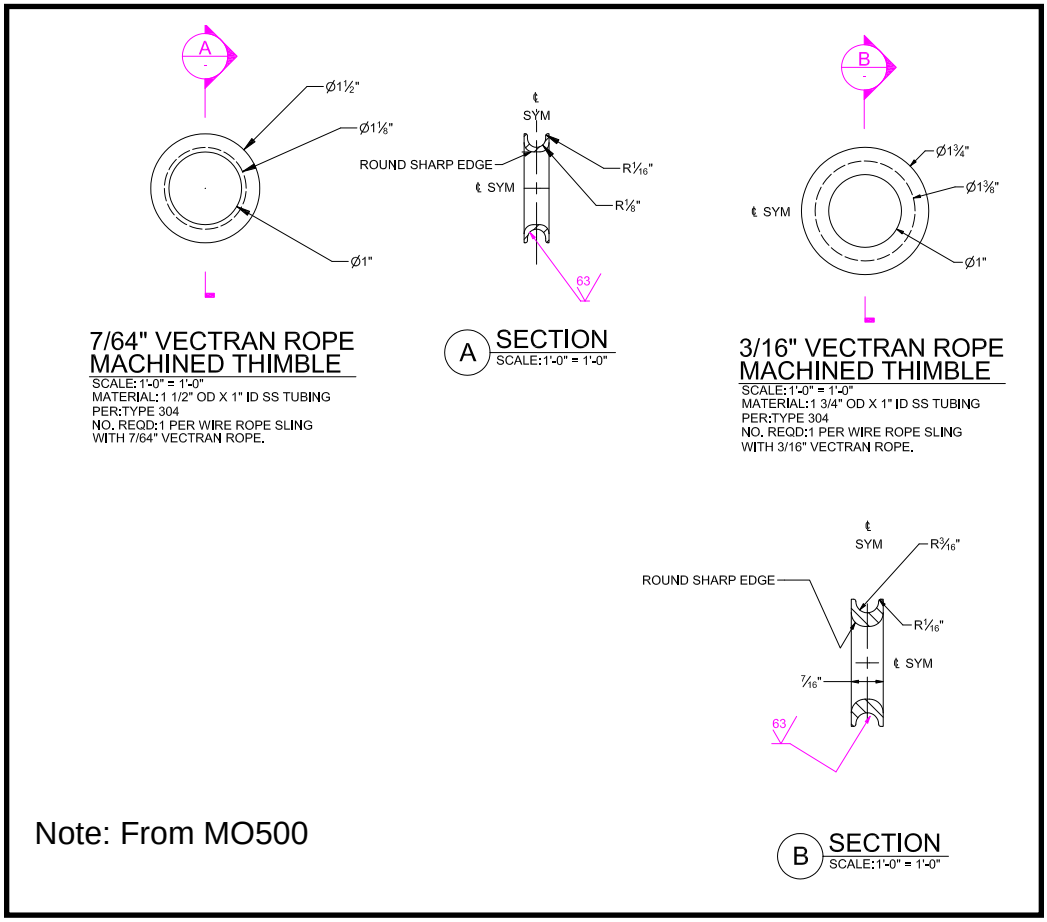
2.A.8.1 MACHINED THIMBLES



7/64" VECTRAN ROPE MACHINED THIMBLE

SCALE: 1'-0" = 1'-0"
MATERIAL: 1 1/2" OD X 1" ID SS TUBING
PER: TYPE 304
NO. REQD: 1 PER WIRE ROPE SLING
WITH 7/64" VECTRAN ROPE.

A SECTION
SCALE: 1'-0" = 1'-0"

3/16" VECTRAN ROPE MACHINED THIMBLE

SCALE: 1'-0" = 1'-0"
MATERIAL: 1 3/4" OD X 1" ID SS TUBING
PER: TYPE 304
NO. REQD: 1 PER WIRE ROPE SLING
WITH 3/16" VECTRAN ROPE.

Note: From MO500

B SECTION
SCALE: 1'-0" = 1'-0"

2.A.11

SPARE PARTS

Print Form | Save As | E-mail

1. Requested Action

☐ Issue ☒ Transfer ☐ Repair ☐ Excess ☐ FOI ☐ Temporary Loan Expiration Date:

LOSING HAND RECEIPT HOLDER			GAINING HAND RECEIPT HOLDER		
2a. Name: Justin Tomson - Knight Construction			3a. Name: Michele Hammel		
b. Office:	c. HRA: n/a	d. Phone: 5098689339	b. Office: CENWP-ODJ	c. HRA: 156	d. Phone: 5417391002

+	4. Item No.	5. Bar Tag No.	6. Catalog	7. Nomenclature (*include make, model*)	8. Cond Code	9. Serial Number	10. ACQ. Date	11. ACQ. Price	12. Document Number/ Control ID#
X	1			Clutch Adapter Set (Qty = 3)	NEW				
X	2			Clutch Assembly (Qty = 1)	NEW				
X	3			Milwaukee Drill Motor (Qty = 1)	NEW				
X	4			1-1/8" Wire Rope Clamps (Qty = 117)	NEW				
X	5			Jaw End Fittings (Qty = 20)	NEW				
X	6			Spare Avian Line (Qty = 6 Spools)	NEW				
X	7			Winch Handles (Qty = 19)	NEW				

13a. Individual/Vendor Removing or Receiving Property	b. Date	c. Signature

14a. Losing HRH Signature	b. Date	15a. Gaining HRH Signature	b. Date
Chris Wright Project Manager	2018-03-01	JONES.BLAISE.SHELBY.1259142667 Digitally signed by JONES.BLAISE.SHELBY.1259142667 DN: c=US, o=U.S. Government, ou=DoD, ou=PKI, ou=USA, cn=JONES.BLAISE.SHELBY.1259142667 Date: 2018.04.09 10:03:51 -07'00'	2018-04-09

SECTION 2.B

PAINT

International

Intergard 345

Fast drying direct to metal epoxy

Intergard® 345 gives you excellent anti-corrosive performance with rapid drying time.

The result? A reduction in the number of coats and faster steel throughput giving better productivity without compromising on performance.

- High solids versatile epoxy
- High build rapid one coat
- Suitable for use as an epoxy intermediate, primer or finish
- Anti-corrosive primer for two coat systems
- Fast drying, ideally suited for rapid steel throughput
- Early abrasion resistance assists rapid handling properties
- Suitable for moderately corrosive (C3) environments when used as a single coat
- Protection against chemical fume and spillage
- Semi gloss
- Extensive colour range from the Chromascan® remote tinting system
- HAPS free version available for US market

AkzoNobel

Suitable for use as a one or two coat new construction primer/finish coating or as an intermediate over recommended anti-corrosive primers

Intergard® 345 provides a combination of anti-corrosive barrier protection, chemical fume and spillage resistance, along with good abrasion resistance. Ideal for use in moderately corrosive environments as a single coat where fast drying/rapid recoating is desired and in more aggressive environments as part of a system.

Typical structures

Intergard® 345 is typically specified on projects requiring a good quality high build epoxy primer finish in a variety of colours, for example interior steelwork, airport concourses, wind turbine interiors, processing equipment and cranes.*

Application performance

Intergard® 345 has been designed as a one coat primer finish and gives excellent high build application in one coat. Using one coat of Intergard® 345 at 6 mils (150 µm) will give superior corrosion performance when compared to two or three coats of more traditional alkyds with the added benefit of faster coating times, lower wastage and reduced VOC emissions. Its versatility also allows its use as part of a two or three coat system.*

The rapid drying and excellent early abrasion resistance make the product particularly suitable for use when high throughput of steel is required.

Color

A full range of colors is available, even in small batches via the AkzoNobel Chromascan® system.

Technical information

Color	Full color range		
Volume solids	70%		
Film thickness	4 - 6 mils (100 - 150 µm) dry		
Mix ratio	4:1 by volume		
Temperature	Touch dry	Hard dry	Min. recoat
50˚F (10˚C)	90 mins	7 hours	7 hours
59˚F (15˚C)	75 mins	5 hours	5 hours
77˚F (25˚C)	60 mins	2 1/2 hours	2 1/2 hours
104˚F (40˚C)	30 mins	1 hour	1 hour
VOC	2.67 lb/gal USA - EPA Method 24 235 g/kg EU Solvent Emissions Directive (Council Directive 1999/13/EC		

Asset protection

Intergard® 345 offers a cost effective solution to corrosion protection of steel structures. It exhibits good abrasion, chemical fume and spillage resistance, along with good anti-corrosive barrier protection.

The product may also be used in more aggressive corrosion environments as part of a two or even three coat system. Its excellent self overcoating properties and compatibility with AkzoNobel's International® range of primers and finishes makes Intergard® 345 a truly versatile coating*.

Test data

TEST TYPE	REFERENCE	DETAILS	RESULTS
Condensation	ASTM D4585	1 x 5 mils (125 µm) DFT applied directly to Sa2 1/2 (SSPC-SP6) blasted steel	No film defects following 3180 hours exposure
Cyclic corrosion	ASTM D5894	1 x 5 mils (125 µm) DFT applied directly to Sa2 1/2 (SSPC-SP6) blasted steel	No blistering, rusting, cracking etc and typically <3mm rust creep at the scribe following >4000 hours exposure
Salt spray	ASTM G85	1 x 5 mils (125 µm) DFT applied directly to Sa2 1/2 (SSPC-SP6) blasted steel	No blistering, rusting, cracking etc and typically <5mm rust creep at the scribe following >3000 hours exposure
Salt spray	ASTM B117	1 x 15 mils (125 µm) DFT applied directly to Sa2 1/2 (SSPC-SP6) blasted steel	No blistering, rusting, cracking etc and typically <2mm rust creep at the scribe following 1500 hours exposure

The above performance data has been compiled based on present experience of in-service product performance and upon performance data obtained under laboratory test conditions. Actual performance of the product will depend upon the conditions in which the product is used.

* Consult with your local representative for the latest list of suitable zinc primers and finishes. Intergard® 345 contains epoxy and is prone to chalk if exposed to any sunlight.

www.international-pc.com
pcmarketing.americas@akzonobel.com

G2_345_US
08/14

Intergard® 345

Epoxy

PRODUCT DESCRIPTION

A two component, low VOC, high solids, fast curing epoxy primer/finish containing zinc phosphate anti-corrosive pigmentation.

INTENDED USES

Suitable for use as a one or two coat primer/finish coating or as an intermediate over recommended anti-corrosive primers.

Intergard 345 provides a combination of anti-corrosive barrier protection, chemical fume and spillage resistance, along with good abrasion resistance.

Ideal for use in moderately corrosive environments and where fast drying/rapid recoating is desired.

PRACTICAL INFORMATION FOR INTERGARD 345

Colour	Wide range via the Chromascan system
Gloss Level	Semi Gloss
Volume Solids	70%
Typical Thickness	100-150 microns (4-6 mils) dry equivalent to 143-214 microns (5.7-8.6 mils) wet
Theoretical Coverage	5.60 m²/litre at 125 microns d.f.t and stated volume solids 225 sq.ft/US gallon at 5 mils d.f.t and stated volume solids
Practical Coverage	Allow appropriate loss factors
Method of Application	Airless Spray, Air Spray, Brush, Roller

Drying Time

			Overcoating Interval with recommended topcoats	
Temperature	Touch Dry	Hard Dry	Minimum	Maximum
10°C (50°F) [1]	90 minutes	7 hours	7 hours	Extended[2]
15°C (59°F) [1]	75 minutes	5 hours	5 hours	Extended[2]
25°C (77°F) [1]	60 minutes	2.5 hours	2.5 hours	Extended[2]
40°C (104°F) [1]	30 minutes	1 hour	1 hour	Extended[2]

[1] See Product Characteristics section for further details
[2] See International Protective Coatings Definitions and Abbreviations

REGULATORY DATA

Flash Point (Typical)	Part A 33°C (91°F); Part B 43°C (109°F); Mixed 34°C (93°F)	
Product Weight	1.45 kg/l (12.1 lb/gal)	
VOC	2.67 lb/gal (320 g/lt)	EPA Method 24
	235 g/kg	EU Solvent Emissions Directive (Council Directive 1999/13/EC)
	214 g/lt	Chinese National Standard GB23985

See Product Characteristics section for further details

Intergard® 345

Epoxy

SURFACE PREPARATION

All surfaces to be coated should be clean, dry and free from contamination. Prior to paint application all surfaces should be assessed and treated in accordance with ISO 8504:2000.

Oil or grease should be removed in accordance with SSPC-SP1 solvent cleaning.

Abrasive Blast Cleaning

Abrasive blast clean to Sa2½ (ISO 8501-1:2007) or SSPC-SP6. If oxidation has occurred between blasting and application of Intergard 345, the surface should be reblasted to the specified visual standard.

Surface defects revealed by the blast cleaning process should be ground, filled, or treated in the appropriate manner.

Intergard 345 is suitable for application to blast cleaned surfaces which were initially to the above standard but have been allowed to deteriorate under good shop conditions for up to 7-10 days. The surface may deteriorate to Sa2 standard but must be free from loose powdery deposits.

Primed Surfaces

Weld seams and damaged areas should be blast cleaned to Sa2½ (ISO 8501-1:2007) or SSPC-SP6.

If the shop primer shows extensive or widely scattered breakdown overall sweep blasting may be necessary.

Concrete, Pre-Cast Blockwork etc

Intergard 345 is suitable for application to concrete. For the first coat it is recommended that Intergard 345 is thinned 10-15% by International Thinners in order to provide good penetration of the concrete substrate and act as a primer / sealer coat.

Concrete should be cured for a minimum of 28 days prior to coating. The moisture content of the concrete should be below 6%. All surfaces should be clean, dry and free from curing compounds, release agents, trowelling compounds, surface hardeners, efflorescence, grease, oil, dirt, old coatings and loose or disintegrating concrete. All poured and precast concrete must also be sweep blasted (preferred) or acid etched to remove laitence.

APPLICATION

Mixing

Material is supplied in two containers as a unit. Always mix a complete unit in the proportions supplied. Once the unit has been mixed it must be used within the working pot life specified.

(1) Agitate Base (Part A) with a power agitator.
(2) Combine entire contents of Curing Agent (Part B) with Base (Part A) and mix thoroughly with power agitator.

Mix Ratio

4 part(s) : 1 part(s) by volume

Working Pot Life

10°C (50°F)	15°C (59°F)	25°C (77°F)	40°C (104°F)
3 hours	2 hours	60 minutes	45 minutes

Airless Spray	Recommended	Tip Range 0.43-0.53 mm (17-21 thou) Total output fluid pressure at spray tip not less than 176 kg/cm² (2503 p.s.i.)	
Air Spray (Pressure Pot)	Recommended	Gun Air Cap Fluid Tip	DeVilbiss MBC or JGA 704 or 765 E
Brush	Suitable - small areas only	Typically 75-100 microns (3.0-4.0 mils) can be achieved	
Roller	Suitable - small areas only	Typically 75-100 microns (3.0-4.0 mils) can be achieved	
Thinner	International GTA220 (International GTA415)	Thinning is not normally required. Consult the local representative for advice during application in extreme conditions. Do not thin more than allowed by local environmental legislation.	

Cleaner

International GTA220 or International GTA415

Work Stoppages

Do not allow material to remain in hoses, gun or spray equipment. Thoroughly flush all equipment with International GTA220. Once units of paint have been mixed they should not be resealed and it is advised that after prolonged stoppages work recommences with freshly mixed units.

Clean Up

Clean all equipment immediately after use with International GTA220. It is good working practice to periodically flush out spray equipment during the course of the working day. Frequency of cleaning will depend upon amount sprayed, temperature and elapsed time, including any delays.

All surplus materials and empty containers should be disposed of in accordance with appropriate regional regulations/legislation.

Intergard® 345

Epoxy

PRODUCT CHARACTERISTICS

Maximum film build in one coat is best attained by airless spray. When applying by methods other than airless spray, the required film build is unlikely to be achieved. Application by air spray may require a multiple cross spray pattern to attain maximum film build. Low or high temperatures may require specific application techniques to achieve maximum film build.

When applying Intergard 345 by brush or roller, it may be necessary to apply multiple coats to achieve the total specified system dry film thickness.

This product will not cure adequately below 5°C (41°F). For maximum performance ambient curing temperatures should be above 10°C (50°F).

Surface temperature must always be a minimum of 3°C (5°F) above dew point.

When applying Intergard 345 in confined spaces ensure adequate ventilation.

In moderately corrosive environments, it is recommended that a minimum of 100 microns (4 mils) dry film thickness should be specified to ensure adequate anti-corrosive performance. However, in non-aggressive, low corrosive environments such as those equating to C2 as per ISO 12944 part 2, it is acceptable to specify Intergard 345 as a single coat at 80 microns (3.2 mils) dry film thickness.

Condensation occurring during or immediately after application may result in a matt finish and an inferior film.

When utilising certain colours, particularly the darker shades via the Chromascan system where maximum addition of colourants is required, it is necessary to allow an increase in the quoted drying and overcoating times. Consult International Protective Coatings for further details.

Exposure to dew or rain prior to specified hard dry time may cause a deterioration in surface appearance which may in turn impair overall performance. This phenomenon is particularly prominent in darker shades.

In common with all epoxies Intergard 345 will chalk and discolour on exterior exposure. However, these phenomena are not detrimental to anti-corrosive performance.

Where a durable cosmetic finish with good gloss and colour retention is required overcoat with recommended topcoats.

Note: VOC values are typical and are provided for guidance purpose only. These may be subject to variation depending on factors such as differences in colour and normal manufacturing tolerances.

Low molecular weight reactive additives, which will form part of the film during normal ambient cure conditions, will also affect VOC values determined using EPA Method 24.

SYSTEMS COMPATIBILITY

Intergard 345 is normally applied directly to blast cleaned steel, however, it can also be applied directly over the following primers:-

- Intercure 200HS
- Intercure 200
- Intergard 251
- Intergard 269
- Intergard 345
- Interzinc 52
- Interzinc 315

The following topcoats are recommended:

- Interfine 629HS
- Intergard 740
- Interthane 870
- Interthane 990

For other suitable primers/topcoats, consult International Protective Coatings.

Intergard® 345

Epoxy

ADDITIONAL INFORMATION

Further information regarding industry standards, terms and abbreviations used in this data sheet can be found in the following documents available at www.international-pc.com:

- Definitions & Abbreviations
- Surface Preparation
- Paint Application
- Theoretical & Practical Coverage

Individual copies of these information sections are available upon request.

SAFETY PRECAUTIONS

This product is intended for use only by professional applicators in industrial situations in accordance with the advice given on this sheet, the Material Safety Data Sheet and the container(s), and should not be used without reference to the Material Safety Data Sheet (MSDS) which International Protective Coatings has provided to its customers.

All work involving the application and use of this product should be performed in compliance with all relevant national, Health, Safety & Environmental standards and regulations.

In the event welding or flame cutting is performed on metal coated with this product, dust and fumes will be emitted which will require the use of appropriate personal protective equipment and adequate local exhaust ventilation.

If in doubt regarding the suitability of use of this product, consult International Protective Coatings for further advice.

PACK SIZE	Unit Size	Part A		Part B	
		Vol	Pack	Vol	Pack
	20 litre	16 litre	20 litre	4 litre	5 litre
	5 US gal	4 US gal	5 US gal	1 US gal	1 US gal
	For availability of other pack sizes, contact International Protective Coatings.				

SHIPPING WEIGHT (TYPICAL)	Unit Size	Part A	Part B
	20 litre	26.8 kg	4.3 kg
	5 US gal	50 lb	8.6 lb

STORAGE	Shelf Life	18 months minimum at 25°C (77°F). Subject to re-inspection thereafter. Store in dry, shaded conditions away from sources of heat and ignition.

Important Note

Issue date: 22/09/2015