
USACE / NAVFAC / AFCEC / NASA UFGS-35 01 43 (April 2008)

Preparing Activity: USACE Superseding
UFGS-35 01 43 (April 2006)

UNIFIED FACILITIES GUIDE SPECIFICATIONS

References are in agreement with UMRL dated July 2013

SECTION TABLE OF CONTENTS

DIVISION 35 - WATERWAY AND MARINE CONSTRUCTION

SECTION 35 01 43

WIRE ROPE FOR GATE OPERATING DEVICES

04/08

PART 1 GENERAL

- 1.1 SUMMARY
- 1.2 REFERENCES
- 1.3 SYSTEM DESCRIPTION
 - 1.3.1 Work Plan
 - 1.3.2 Safety Plan
 - 1.3.3 Tools, Equipment and Expertise
- 1.4 SUBMITTALS
- 1.5 SUPERVISOR'S QUALIFICATIONS
- 1.6 DELIVERY, STORAGE, AND HANDLING
 - 1.6.1 General
 - 1.6.2 Inspection on Delivery
- 1.7 WARRANTY

PART 2 PRODUCTS

- 2.1 WIRE ROPE AND SOCKETS
 - 2.1.1 Quantity
 - 2.1.2 Type of Wire Rope
 - 2.1.3 Pre-Stretching
 - 2.1.4 Wire Strength and Ductility
 - 2.1.5 Pre-forming
 - 2.1.6 Stress Relief
 - 2.1.7 Weld Distribution
 - 2.1.8 Galvanizing
 - 2.1.9 Pitch Length
 - 2.1.10 Core Strand Wires
 - 2.1.11 End Terminations
 - 2.1.12 Tension Testing
 - 2.1.13 Attaching and Proof Loading Terminations
- 2.2 LUBRICATION

PART 3 EXECUTION

- 3.1 EXAMINATION

3.1.1	Inspections
3.1.2	Verify Dimensions
3.2	ATTACHING SOCKETS
3.3	CLEAN DRUMS AND SHEAVES
3.4	LUBRICATION
3.5	GENERAL REQUIREMENTS
3.6	UN-REELING AND INSTALLING WIRE ROPE
3.7	REMOVAL OF EXISTING (OLD) WIRE ROPE
3.8	FIELD TENSIONING MULTI-LINE HOISTS
3.9	BREAK-IN/TESTING
3.10	ORDERLY WORK AREA/SITE CLEANUP
-- End of Section Table of Contents --	

USACE / NAVFAC / AFCEC / NASA UFGS-35 01 43 (April 2008)

Preparing Activity: USACE Superseding
UFGS-35 01 43 (April 2006)

UNIFIED FACILITIES GUIDE SPECIFICATIONS

References are in agreement with UMRL dated July 2013

SECTION 35 01 43

WIRE ROPE FOR GATE OPERATING DEVICES 04/08

NOTE: This guide specification covers the requirements for supplying and installing wire rope (new or replacement) needed by gate operating devices (i.e. spillway gates, tainter gates, etc.)

Adhere to UFC 1-300-02 Unified Facilities Guide Specifications (UFGS) Format Standard when editing this guide specification or preparing new project specification sections. Edit this guide specification for project specific requirements by adding, deleting, or revising text. For bracketed items, choose applicable items(s) or insert appropriate information.

Remove information and requirements not required in respective project, whether or not brackets are present.

Comments, suggestions and recommended changes for this guide specification are welcome and should be submitted as a Criteria Change Request (CCR).

PART 1 GENERAL

NOTE: This guide specification is based on the assumption that a single Contractor will be responsible for supply and installation of the wire rope. Please refer to US Army Corps of Engineers Engineer Manual 1110-2-3200 Wire Rope Selection Criteria for Gate-Operating Devices prior to editing this section. It is recommended that the designer talk with wire rope manufacturers to get their consensus that the proposed wire rope type can be manufactured and used successfully.

If a specification is needed only for supply of wire rope, or for installation of wire rope, there are example specifications included in the appendices of

US Army Corps of Engineers Engineer Manual
1110-2-3200 Wire Rope Selection Criteria for
Gate-Operating Devices. It is also assumed the wire
rope is for replacement for a gate operating
device. Paragraphs written in regard to removal of
existing wire rope, and cleaning drums and sheaves
would need to be deleted if the application is for a
new installation.

1.1 SUMMARY

In general, perform the following work in regard to the operating devices
for [one] [two] [three] [_____] [spillway] [tainter] [_____] gates [at the
[_____] Project]: [remove the existing wire rope,] furnish new wire rope,
and install the new wire rope. Provide all manufacturing facilities,
tools, equipment, personnel, and expertise to accomplish this work. [The
[_____] Project is located on the [_____] River approximately [_____] km
miles [north] [east] [south] [west] [_____] of the city of [_____] .]

1.2 REFERENCES

NOTE: This paragraph is used to list the
publications cited in the text of the guide
specification. The publications are referred to in
the text by basic designation only and listed in
this paragraph by organization, designation, date,
and title.

Use the Reference Wizard's Check Reference feature
when you add a RID outside of the Section's
Reference Article to automatically place the
reference in the Reference Article. Also use the
Reference Wizard's Check Reference feature to update
the issue dates.

References not used in the text will automatically
be deleted from this section of the project
specification when you choose to reconcile
references in the publish print process.

The publications listed below form a part of this specification to the
extent referenced. The publications are referred to within the text by the
basic designation only.

ASTM INTERNATIONAL (ASTM)

ASTM A148/A148M	(2008) Standard Specification for Steel Castings, High Strength, for Structural Purposes
ASTM A351/A351M	(2013) Standard Specification for Castings, Austenitic, for Pressure-Containing Parts

U.S. ARMY CORPS OF ENGINEERS (USACE)

EM 385-1-1

(2008; Errata 1-2010; Changes 1-3 2010;
Changes 4-6 2011; Change 7 2012) Safety
and Health Requirements Manual

U.S. GENERAL SERVICES ADMINISTRATION (GSA)

FS RR-W-410

(Rev G) Wire Rope and Strand

WIRE ROPE TECHNICAL BOARD (WRTB)

WRTB

(2005) Wire Rope Users Manual

1.3 SYSTEM DESCRIPTION

1.3.1 Work Plan

The work required in accordance with this specification is of a complicated nature, requiring technical expertise and planning. Submit a work plan, which will indicate how the existing wire rope will be removed and how the new wire rope will be installed, without damaging either existing equipment or the new wire rope. Include in the work plan a schedule indicating how the work will be accomplished within the time limit of this contract. Submit the approved work plan before any work can be performed, including:

- Schedule for delivery.
- Schedule for installation.
- Removal plan for old wire rope.
- Installation plan for new wire rope.
- Plan for tensioning wire ropes.

1.3.2 Safety Plan

The work area and conditions, and type of work required create considerable potential for accidents. Submit a safety plan indicating how accidents will be prevented. Include in the safety plan details of how the wire rope will be handled and installed to minimize the risk to personnel. Work shall be in accordance with the U.S. Army Corps of Engineers Safety and Health Requirements Manual, EM 385-1-1. Include the safety provisions of this section in the safety plan required by Section [01 35 26 GOVERNMENT SAFETY REQUIREMENTS] [____].

1.3.3 Tools, Equipment and Expertise

**NOTE: The last sentence may or may not be needed,
or consider propane powered equipment.**

Furnish all tools and equipment, and expertise needed to perform the specified work. Note that much of the work will take place in areas with limited ventilation, and only electric or air powered tools and equipment will be allowed within those areas (no internal combustion engines).

1.4 SUBMITTALS

NOTE: Review submittal description (SD) definitions

in Section 01 33 00 SUBMITTAL PROCEDURES and edit the following list to reflect only the submittals required for the project.

The Guide Specification technical editors have designated those items that require Government approval, due to their complexity or criticality, with a "G." Generally, other submittal items can be reviewed by the Contractor's Quality Control System. Only add a "G" to an item, if the submittal is sufficiently important or complex in context of the project.

For submittals requiring Government approval on Army projects, a code of up to three characters within the submittal tags may be used following the "G" designation to indicate the approving authority. Codes for Army projects using the Resident Management System (RMS) are: "AE" for Architect-Engineer; "DO" for District Office (Engineering Division or other organization in the District Office); "AO" for Area Office; "RO" for Resident Office; and "PO" for Project Office. Codes following the "G" typically are not used for Navy, Air Force, and NASA projects.

Choose the first bracketed item for Navy, Air Force and NASA projects, or choose the second bracketed item for Army projects.

Government approval is required for submittals with a "G" designation; submittals not having a "G" designation are for [Contractor Quality Control approval] [information only. When used, a designation following the "G" designation identifies the office that will review the submittal for the Government.] The following shall be submitted in accordance with Section 01 33 00 SUBMITTAL PROCEDURES:

SD-01 Preconstruction Submittals

Work Plan[; G][; G, [____]]
Safety Plan[; G][; G, [____]]

SD-02 Shop Drawings

End Terminations[; G][; G, [____]]

SD-03 Product Data

Lubrication[; G][; G, [____]]
Pre-Stretching[; G][; G, [____]]
End Termination Attachment Method[; G][; G, [____]]
Manufacturer's Qualifications[; G][; G, [____]]
Supervisor's Qualifications[; G][; G, [____]]

SD-06 Test Reports

Tension Testing[; G][; G, [____]]
Attaching and Proof Loading Terminations[; G][; G, [____]]

Wire Strength and Ductility[; G][; G, [____]]
Pre-forming[; G][; G, [____]]
Stress Relief[; G][; G, [____]]
Zinc Coating[; G][; G, [____]]
End Terminations[; G][; G, [____]]

SD-07 Certificates

Type of Wire Rope[; G][; G, [____]]
Tension Testing Equipment[; G][; G, [____]]

1.5 SUPERVISOR'S QUALIFICATIONS

Provide, as a minimum, a supervisor at the site experienced in the installation of wire rope. The supervisor shall have performed work similar to that required in this contract on at least three occasions. Submit the approved Installation Supervisor's experience record before work at the site may begin.

1.6 DELIVERY, STORAGE, AND HANDLING

1.6.1 General

[The Contractor's work and storage areas are indicated on Drawing No. [____].] [The work areas are indicated on Drawing No. [____]]. A representative of the Contracting Officer will assign the Contractor a storage area in the vicinity of the work area.] The wire ropes shall be wound on spools in the same direction as they were bent during manufacturing. The spools shall be covered for protection from rain, snow and road spatter during shipping. After delivery, the wire ropes shall be stored in well ventilated enclosures in the Contractor's storage area, so that they will be protected from the elements.

1.6.2 Inspection on Delivery

**NOTE: Consider altering or deleting this paragraph
to reduce cost if the wire rope can be inspected
completely, while being installed.**

Upon delivery to the Contractor's work or storage area, the wire [ropes] [ropes and sockets] shall be inspected in the presence of the Contracting Officer. In particular, the wire rope shall be inspected for dings, kinks or other damage. The wire ropes shall be reeled from spool to spool in order to allow complete inspection of the wire ropes over their entire length. Perform the unreeling/reeling operation, and furnish extra spools or any other equipment required. Upon completion of the inspection, furnish the Contracting Officer with a written report of the results.

1.7 WARRANTY

**NOTE: Designer should contact wire rope
manufacturers to determine the extent of
manufacturer's warranties available. Warranties may
vary with type of rope and application.**

At the completion of the project, furnish signed copies of a [1][_____] year[s] warranty for all materials and services provided under this section.

PART 2 PRODUCTS

2.1 WIRE ROPE AND SOCKETS

Provide wire rope and sockets which are the standard product of a manufacturer regularly engaged in the manufacture of wire rope, and that essentially duplicate products having been in satisfactory use for at least 3 years prior to bid opening. Submit [manufacturer's qualifications](#) statement.

2.1.1 Quantity

Furnish [[_____] wire ropes with end terminations (sockets) at both ends. Each wire rope shall be of the length indicated on Drawing No. [_____] , and within the tolerance also indicated on that drawing.] [[_____] [meters](#) [feet](#) of wire rope. The wire rope shall be wound on reels in lengths such that [_____] sections, each with a length of [_____] [meters](#) [feet](#) will be available for use, as splicing will not be allowed.]

2.1.2 [Type of Wire Rope](#)

NOTE: Selection should be based on EM 1110-2-3200.

Submit wire material certification. The wire rope shall be of the following type:

- a. Strand configuration: [6x19 Seale] [7x19 Seale] [6x26 Warrington Seale Swaged] [_____] .

NOTE: This, particularly the advantages of lang lay wire rope, is discussed in more detail in EM 1110-2-3200.

- b. Lay: [right, regular] [left, regular] [right, lang] [left, lang] (In many Corps applications existing regular lay wire rope would best be replaced by lang lay wire rope.

- c. Diameter: [_____] [mm](#) [inch](#), with a tolerance of - 0 and plus 5 percent

- d. Finish: [galvanized] [plain]

NOTE: Stainless steel wire ropes tends to abrade on itself when wrapped on disk-layered drums. Some manufacturers are questioning the wisdom of making regular lay stainless steel wire rope with flattened strands, as the cold-working tends to be excessive and weaken the rope. Stress relieving to alleviate the cold working can be difficult and inconsistent with the stainless steels.

e. Material: [extra improved plow steel] [AISI 302 stainless] [AISI 304 stainless] [_____]

NOTE: It is not recommended that fiber core be used
for a gate lifting device.

f. Core type: independent wire rope core

NOTE: There is no reason not to preform.

g. Pre-formed: [yes] [no]

2.1.3 Pre-Stretching

NOTE: In the following paragraphs the manufacturer
is tasked with some testing, etc. This is
intentional, as personnel who are familiar with the
required procedures should perform these tasks.

Pre-stretching is highly recommended for
installations with multi-rope drums, because initial
stretch in the wire ropes tends to be uneven.
Pre-stretching will likely result a more equal
tension between the ropes. It is also recommended
for other wire rope so that final length after use
will be closer to length at the time of installation.

Submit Pre-Stretching Procedure. The manufacturer shall pre-stretch the
[wire rope.] [wire ropes before attaching their end terminations.] This
shall be done by subjecting them to three cycles at 40 percent of its
nominal strength. The 40 percent loads shall be held for 5 minutes with 5
percent loads for 5 minutes between cycles. The manufacturer may propose a
method of dynamic pre-stretching.

2.1.4 Wire Strength and Ductility

The Manufacturer shall perform testing in accordance with FS RR-W-410 to
verify wire strength and ductility. Submit test results.

2.1.5 Pre-forming

The wire rope shall be pre-formed, and the manufacturer shall perform
testing in accordance with FS RR-W-410 to verify pre-forming. Submit test
results.

2.1.6 Stress Relief

The wire rope shall be stress relieved, and the manufacturer shall perform
testing in accordance with FS RR-W-410 to verify stress relief. Submit
test results.

2.1.1.7 Weld Distribution

Wire joints in any strand shall not be closer than 450 mm 18 inches in any strand.

2.1.1.8 Galvanizing

NOTE: Wire rope woven from galvanized wires will have much better resistance to corrosion than un-galvanized wire rope woven from bare carbon steel. It will also have better resistance to corrosion than wire rope woven from drawn galvanized wire. However, it will also have a significantly lower strength. If full strength is required, then use wire rope woven from plain carbon steel or from drawn galvanized wire depending on how important corrosion resistance is. If full strength is not required, but high corrosion resistance is required, use wire ropes woven from galvanized wire and perform the zinc coat test to verify the zinc thickness. See FS RR-W-410 for information on the rate of zinc coating. Of course stainless steel wire rope would not be galvanized, and this entire paragraph would be deleted.

[The wire rope shall be woven from drawn galvanized wire. That is, the wires shall be galvanized prior to their last drawing operation. The wire rope shall have the same accepted industry standards for nominal strength as it would, had it not been galvanized.] [The wire ropes shall be woven from galvanized wire. Zinc shall be applied at a rate of [_____] grams per square meter ounces per square foot of wire surface. The manufacturer shall perform testing in accordance with FS RR-W-410 to verify the zinc coating has been applied at the required rate. Submit test results.]

2.1.1.9 Pitch Length

Strand pitch length shall not be less than 4-1/2 times the nominal rope diameter.

2.1.1.10 Core Strand Wires

The number of wires in the core strand shall be equal to or greater than the number of wires in the other strands. The wires shall be of the same material as the wires in the other strands, or of a material with a lower tensile strength.

2.1.1.11 End Terminations

NOTE: EM 1110-2-3200 discusses materials and coatings, and attachment methods for sockets. Note that the wire rope industry usually recommends replacing sockets when replacing wire rope.

Submit fabrication drawings, as specified. The wire rope end terminations (sockets) shall be fabricated as indicated on Drawing No. [_____] , and

shall be cast from [steel conforming to ASTM A148/A148M, Grade 105-85]
[stainless steel conforming to ASTM A351/A351M CF8M] [_____]. Submit
materials properties test for casting end terminations.

2.1.12 Tension Testing

Submit rope tension test report. A tension test shall be performed to verify the wire rope meets the accepted industry standards for nominal strength. Two rope samples shall be tested to failure to be sure the expected performance level has been met. The test shall be performed using suitable tension testing equipment and by qualified personnel, both furnished by the Contractor. Submit certification of rope tension testing device. The rope samples shall cut to no less than 1 meter 3 feet of length. The test will not be considered valid if the failure occurs less than 50 mm 2 inches from either socket or holding mechanism. Relative speed between the machine heads shall not exceed 25 mm 1 inch per minute.

2.1.13 Attaching and Proof Loading Terminations

NOTE: EM1110-2-3200 suggests that pre-stretching
the wire rope and proof loading the terminations
might be accomplished simultaneously. However, for
multi-rope drums the wire rope would need to be
pre-stretched first to be sure they are closer to
their final correct length before attaching the
terminations. If the sockets must be attached in
the field delete this paragraph.

The manufacturer shall attach the end terminations after pre-stretching the wire rope. The end termination attachment method shall be as indicated on Drawing No. [_____]. After their attachment, the wire ropes shall be proof loaded at 40 percent of nominal strength of the rope. Length of the wire ropes shall be measured to the nearest 0.25 mm 0.01 inch at a load of [_____]. Submit proof load of terminations test report and measured rope lengths.

2.2 LUBRICATION

NOTE: If specifying stainless steel wire rope,
which will rarely be used, it may be best to specify
that it not be lubricated. As explained in EM
1110-2-3200, in some cases the presence of a heavy
lubricant will increase corrosion on stainless steel
wire ropes.

Submit Brand/specifications for factory and field lubricant. [The wire ropes shall be lubricated at the manufacturing facility. The lubricant shall be applied with equipment capable of forcing the lubricant between the rope wires, including the center strand.] [The wire rope shall not be lubricated.]

PART 3 EXECUTION

3.1 EXAMINATION

It is highly recommended that bidders visit the site before submitting bids. Drawings and verbal descriptions cannot fully describe the effort required to satisfactorily complete the contract work. [A pre-bid site visit, between the dates of [] and [] can be arranged by contacting [] at telephone number [].] [See Section [] for site visit arrangements.]

3.1.1 Inspections

Be prepared to accommodate up to two representatives of the Contracting Officer to witness the various manufacturing processes for the wire rope. At a minimum, a site visit will be made to witness the tension test, and the wire rope will be inspected upon delivery. Inspection during removal of the existing wire rope and installation of the new wire rope will be ongoing.

3.1.2 Verify Dimensions

After becoming familiar with the details of the work, verify dimensions in the field, and immediately advise the Contracting Officer of any discrepancies before performing any work.

3.2 ATTACHING SOCKETS

**NOTE: Delete this paragraph if the sockets are to
be attached at the wire rope factory.**

Attach the end terminations to the wire rope in accordance with Drawing No. [] and the recommendations of FS RR-W-410 Wire Rope and Strand, and the WRTB Wire Rope Users Manual.

3.3 CLEAN DRUMS AND SHEAVES

Clean all drum and sheave grooves with a power wire brush, and inspect them for wear, abrasion, corrosion or other roughness and verify their dimensions are suitable for the new wire rope. Immediately advise the Contracting Officer of any problems.

3.4 LUBRICATION

**NOTE: If stainless steel wire rope is used, it may
be best to delete this paragraph. As explained in
EM 1110-2-3200, in some cases the presence of a
heavy lubricant will increase corrosion on stainless
steel wire ropes.**

Lubricate the wire ropes after they are installed, but before break-in/testing. Submit the proposed method in the work plan. The field and factory lubricants shall be compatible.

3.5 GENERAL REQUIREMENTS

This part covers [removal of the existing wire rope] [and] [installation of the new wire rope].

3.6 UN-REELING AND INSTALLING WIRE ROPE

NOTE: EM1110-2-3200 suggests at least two and
preferably three dead wraps of the rope on the drum.

The wire rope(s) shall be attached to drums, pulleys as shown on Drawing No. [____]. Ensure that the wire rope is wound under adequate tension and that the each wind of the rope(s) is guided to its proper location. The wire rope shall be wound in the same direction it was bent during its manufacture. Ensure that no twists or loops occur. Submit the proposed method of un-reeling and installing in the work plan.

3.7 REMOVAL OF EXISTING (OLD) WIRE ROPE

After its removal, the old wire rope will become the property of the Contractor who shall then remove the old wire rope from the project.

3.8 FIELD TENSIONING MULTI-LINE HOISTS

Adjust the tension of the wire ropes to ensure that they share load equally. Submit the proposed method field tensioning in the work plan. After "break-in/testing" the ropes shall be tested to determine if they share load equally, and if not, they shall be re-tensioned.

3.9 BREAK-IN/TESTING

After installation is complete, run the gate-operating device through [one] [two] [three] [four] [____] complete cycles, fully open to fully closed.

3.10 ORDERLY WORK AREA/SITE CLEANUP

Maintain neat and orderly storage and work areas, as much as possible. The Contract will not be considered complete until all the Contractor's tools, equipment and property have been removed from the site, and the Contractor's storage and work areas have been properly cleaned up. All dirt, debris, litter etc. shall be removed from project and disposed of in a proper manner. Special care shall be taken to ensure that no materials fall into or contaminate project waters.

-- End of Section --