UNIFIED FACILITIES GUIDE SPECIFICATIONS

References are in agreement with UMRL dated January 2021
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DIVISION 35 - WATERWAY AND MARINE CONSTRUCTION

SECTION 35 01 70.13

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05/14, CHG 1: 08/14

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USACE / NAVFAC / AFCEC / NASA **UFGS-35 01 70.13 (May 2014)**
Change 1 - 08/14

Preparing Activity: USACE **Superseding**
UFGS-35 01 43 (April 2008)

UNIFIED FACILITIES GUIDE SPECIFICATIONS

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SECTION 35 01 70.13

WIRE ROPE FOR GATE OPERATING DEVICES
05/14, CHG 1: 08/14

****
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 item(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 (
http://www.publications.usace.army.mil/Portals/76/Publications/EngineerManua
)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 (http://www.publications.usace.army.mil/Portals/76/Publications/EngineerManua **). 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.**

Ensure products used in this section comply with Federal procurement preference under Section 9002 of the Farm Security and Rural Investment Act of 2002. See Section 01 33 29 SUSTAINABILITY REQUIREMENTS AND REPORTING for requirements associated with EPA designated products.

****

1.1 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 Reference Identifier (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	(2020; E 2020) Standard Specification for Steel Castings, High Strength, for Structural Purposes
ASTM A351/A351M	(2018) Standard Specification for Castings, Austenitic, for Pressure-Containing Parts

U.S. ARMY CORPS OF ENGINEERS (USACE)

EM 385-1-1	(2014) Safety and Health Requirements Manual

U.S. GENERAL SERVICES ADMINISTRATION (GSA)

FS RR-W-410	(2020; Rev J) Wire Rope and Strand

WIRE ROPE TECHNICAL BOARD (WRTB)

WRTB	(2005) Wire Rope Users Manual

1.2 SYSTEM DESCRIPTION

1.2.1 Wire Rope 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. The approved work plan must submitted and approved before any work can be performed. Include the following in the plan:

Removal plan for old wire rope.
Un-reeling and installation plans for new wire rope.
Plan for tensioning wire ropes.
Schedule for delivery.
Schedule for installation.
Lubrication method.
Field tensioning method.

1.2.2 Wire Rope Safety Plan

The work area, conditions of work area(s), and type of work required can 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. Perform work in accordance with EM 385-1-1. Include the safety provisions of this section in the safety plan required by [Section [_____] SPECIAL CONTRACT REQUIREMENTS] [Section 01 35 26 GOVERNMENT SAFETY REQUIREMENTS] [_____].

1.2.3 Tools, Equipment and Expertise

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

The work may take place [over water] in areas with limited ventilation. [Only electric or air powered tools and equipment will be allowed within those areas (no internal combustion engines will be allowed).]

1.3 SUBMITTALS

****
NOTE: Review submittal description (SD) definitions

in Section 01 33 00 SUBMITTAL PROCEDURES and edit the following list, and corresponding submittal items in the text, to reflect only the submittals required for the project. The Guide Specification technical editors have classified 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 Army projects, fill in the empty brackets following the "G" classification, with a code of up to three characters 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.

The "S" classification indicates submittals required as proof of compliance for sustainability Guiding Principles Validation or Third Party Certification and as described in Section 01 33 00 SUBMITTAL PROCEDURES.

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" or "S" classification. Submittals not having a "G" or "S" classification are [for Contractor Quality Control approval.][for information only. When used, a code following the "G" classification identifies the office that will review the submittal for the Government.] Submit the following in accordance with Section 01 33 00 SUBMITTAL PROCEDURES:

SD-01 Preconstruction Submittals

Wire Rope Work Plan; G[, [_____]]

Wire Rope Safety Plan; G[, [_____]]

Manufacturer's Qualifications; G[, [_____]]

Supervisor's Qualifications; G[, [_____]]

SD-02 Shop Drawings

End Terminations; G[, [_____]]

SD-03 Product Data

Lubrication; G[, [_____]]

Pre-Stretching; G[, [_____]]

End Termination Attachment Method; G[, [_____]]

SD-06 Test Reports

Tension Testing; G[, [_____]]

Attaching and Proof Loading Terminations; G[, [_____]]

Wire Strength and Ductility; G[, [_____]]

Pre-Forming; G[, [_____]]

Stress Relief "(Wrapping Test)"; G[, [_____]]

Zinc Coating; G[, [_____]]

End Terminations; G[, [_____]]

SD-07 Certificates

Warranty

Type of Wire Rope; G[, [_____]]

Tension Testing Equipment; G[, [_____]]

1.4 SUPERVISOR'S QUALIFICATIONS

Submit the supervisor's experience in the installation of wire rope. The supervisor must have performed work similar to that required in this contract on at least three separate occasions. The supervisor must be on site at all times when wire rope is being delivered, stored, un-reeled, during testing, installation, and after installation testing. Submit the Contractor's Installation Supervisor's experience record before work at the site may begin.

1.5 DELIVERY, STORAGE, AND HANDLING

1.5.1 General

[The work and storage areas are as indicated [on Drawing _____]] [or as directed by the Contracting Officer]. Wind the wire ropes on spools in the same direction as they were bent during manufacturing. Cover the [coils] [spools] for protection from rain, snow, and/or road spatter during shipping.

1.5.2 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 work or storage area, inspect the wire [ropes] [ropes and sockets] in the presence of the Contracting Officer. Inspect the wire

rope for dings, kinks or other damage.[Unreel the wire ropes from spool to spool 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.

1.5.3 Storage

After delivery, store the wire ropes in well ventilated enclosures in the storage area and protect from the elements.

1.6 ENVIRONMENT PRECAUTIONS

Take special care to prevent any materials of any type falling into or contaminating waters surrounding the work site. Immediately notify the Contracting Officer if materials fall into or contaminate waters.

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.
****

Submit signed copies or the manufacturer's warranty 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 5 years prior to [bid opening] [proposal evaluation]. Submit manufacturer's qualifications statement.

2.1.1 Quantity

Furnish [_____] wire ropes [with end terminations (sockets) [at both ends]]. Each wire rope must be [of the length indicated on Drawing No. [_____], and within the tolerance also indicated on that drawing.] [[_____] meters feet in length.] Wind the wire rope on reels in lengths such that [_____] sections, each with a length of [_____] meters feet 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, Fed Spec RR-W-410, and the Wire Rope Users Manual. Consider flattened strand in applications where wire rope wraps on a disk-layered drum.
****

The wire rope must be of the following type:

2.1.2.1 Strand Configuration

[6x19 Seale] [7x19 Seale] [6x26 Warrington Seale] [6X37 Warrington Seale] [_____]; [Flattened strand]

2.1.2.2 Lay

****
NOTE: The advantages of lang lay wire rope are discussed in more detail in EM 1110-2-3200. In many Army Corp of Engineers applications existing regular lay wire rope would best be replaced by lang lay wire rope.
****

[Right, lang] [Left, lang] [Right, regular] [Left, regular]

2.1.2.3 Diameter

[_____] mm inch, with a tolerance of minus and plus 5 percent

2.1.2.4 Finish

[Galvanized] [Plain]

[2.1.2.5 Minimum Breaking Strength

[_____] kN [pounds] [tons]

]2.1.2.6 Material

****
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. Stainless steel should not be used in saltwater applications because of susceptibility to crevice corrosion. If they are used, they must be inspected regularly.
****

[Extra improved plow steel] [AISI 302 stainless] [AISI 304 stainless] [_____]

2.1.2.7 Core Type

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

Independent wire rope core

2.1.2.8 Pre-Formed

****
NOTE: There is no reason not to preform.
****

[Yes] [No]

2.1.3 Pre-Stretching

****
NOTE: In the following paragraphs the manufacturer is tasked with some testing. 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. Pre-stretch the [wire rope.] [wire ropes before attaching their end terminations.] This is done by subjecting them to three cycles at 40 percent of its nominal strength. Hold the 40 percent loads for 5 minutes with 5 percent loads for 5 minutes between cycles. A method of dynamic pre-stretching may be proposed.

2.1.4 Wire Strength and Ductility

Perform testing in accordance with FS RR-W-410 to verify wire strength and ductility. Submit test results.

2.1.5 Pre-forming

Provide pre-formed wire rope, and perform testing in accordance with FS RR-W-410 to verify pre-forming. Submit test results.

2.1.6 Stress Relief "(Wrapping Test)"

Stress relieve the wire rope, and perform testing in accordance with FS RR-W-410 to verify stress relief. Submit test results.

2.1.7 Weld Distribution

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

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

2.1.9 Strand Pitch Length

Not be less than 4-1/2 times the nominal rope diameter.

2.1.10 Core Strand Wires

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

2.1.11 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. Sockets are usually selected from a catalog, however they can be custom fabricated. Spelter sockets are the Army Corp of Engineers standard for end terminations. Swaged sockets can be specified but are not suitable for lang lay rope. Both types should develop 100 percent of the wire rope strength. Molten zinc should not be used with stainless steel spelter sockets. Molten zinc or epoxy resin spelter sockets should not be used with stainless steel wire rope in saltwater applications due to susceptibility to crevice corrosion. If they are used, they must be inspected regularly. Swaged sockets can be used in saltwater applications.

****

Submit shop [fabrication] drawings, as specified. [The wire rope end terminations must be [an open] [a closed] spelter socket type with poured zinc or epoxy resin. Spelter sockets must be [forged] [cast alloy]

[galvanized steel] [stainless steel] [swaged type of carbon steel suitable for cold forming].] [Provide fabricated wire rope end terminations as indicated [on Drawing No. [_____]], and cast from [steel conforming to ASTM A148/A148M, Grade 105-85] [stainless steel conforming to ASTM A351/A351M CF8M] [_____]. Secure the wire rope in fabricated sockets with poured zinc or epoxy resin.]

2.1.12 Tension Testing

Submit rope tension test report. Perform a tension test to verify the wire rope meets the accepted industry standards for nominal strength. Test two rope samples to failure to be sure the expected performance level has been met. Perform the test using suitable tension testing equipment and by qualified personnel. Submit certification of rope tension testing device. Cut the rope samples 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 must 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 must attach the end terminations after pre-stretching the wire rope. The end termination attachment method must be as indicated on Drawing No. [_____]. After their attachment, proof load the wire ropes at 40 percent of nominal strength of the rope. Measure the length of the wire ropes 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: All frequently used wire rope should be lubricated, however, if operation is infrequent, it may be best to specify that it not be lubricated. Explained in EM 1110-2-3200, some cases where the wire rope is rarely operated, the presence of a heavy lubricant will increase corrosion on wire ropes. Carbon steel wire ropes in saltwater applications should have a durable protective lubricant coating.

If the end user has their own lubrication product, they may provide the lubricant.

****

Submit manufacturer's literature for factory and field lubricant. The field and factory lubricants must be compatible. [Lubricate the wire ropes at the manufacturing facility. Apply the lubricant with equipment

capable of forcing the lubricant between the rope wires, including the center strand.] [Do not lubricate the wire rope.] [Lubricant will be supplied by the Government.]

PART 3 EXECUTION

3.1 REMOVAL OF EXISTING WIRE ROPE

After its removal, the existing removed wire rope becomes the Contractor's property. Remove from the site following all federal, state, and local laws and regulations.

3.2 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.]

3.2.1 QA Inspections

Up to two representatives of the Contracting Officer will be present 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.

3.2.2 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.

3.3 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 [as indicated] [in accordance with Drawing No. [_____]] and the recommendations of WRTB.

3.4 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.

3.5 LUBRICATION

Lubricate the wire ropes after they are installed, but before break-in/testing. Submit the proposed method in the work plan.

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.

****

Attach the wire rope(s) to spools or pulleys as [indicated] [shown on Drawing No. [_____]]. Wind the wire rope under adequate tension and guide the each end of the rope(s) to its proper location. Wind the wire rope in the same direction it was bent during its manufacture. Ensure that no twists or loops occur. Do not install wire rope damaged during installation by kinking, and remove from the site. Submit the proposed method of un-reeling and installing in the work plan.

3.7 FIELD TENSIONING [SINGLE LINE] [MULTI-LINE] HOISTS

Adjust the wire rope tension of [single line][multi-line] hoists to ensure that they share load equally. Submit the proposed field tensioning methodin the work plan. [For each multi-line hoist rope drum, final tension values for each rope must be no more than plus or minus 5 percent from the average of the individual rope tension values. For two multi-line hoists on a gate, the total wire rope load on each hoist is computed by summing the measured tension values for all wire ropes on a hoist.] The total wire rope load on each hoist must be within a range less than or equal to 0.5 percent of the average of the two total wire rope loads. Measure and adjust wire rope tensions while keeping the gate properly positioned and aligned[in the slot]. After "break-in/testing" test the ropes to determine if they share load equally, and if not, re-tension.

3.8 BREAK-IN/TESTING

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

3.9 ORDERLY WORK AREA/SITE CLEANUP

Maintain neat and orderly storage and work areas. The Contract will not be considered complete until all the tools, equipment and property have been removed from the site, and the storage and work areas have been restored. Remove all dirt, debris, litter etc. from project and dispose of in a proper manner.

-- End of Section --