

AMENDMENT OF SOLICITATION/MODIFICATION OF CONTRACT

1. CONTRACT ID CODE	PAGE	OF	PAGES
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2. AMENDMENT/MODIFICATION NO.	3. EFFECTIVE DATE	4. REQUISITION/PURCHASE REQ. NO.	5. PROJECT NO. <i>(If applicable)</i>
6. ISSUED BY	CODE	7. ADMINISTERED BY <i>(If other than Item 6)</i>	CODE

8. NAME AND ADDRESS OF CONTRACTOR <i>(No., street, county, State and ZIP Code)</i>	(X)	9A. AMENDMENT OF SOLICIATION NO.
		9B. DATED <i>(SEE ITEM 11)</i>
		10A. MODIFICATION OF CONTRACT/ORDER NO.
		10B. DATED <i>(SEE ITEM 11)</i>
CODE		FACILITY CODE

11. THIS ITEM ONLY APPLIES TO AMENDMENTS OF SOLICITATIONS

The above numbered solicitation is amended as set forth in Item 14. The hour and date specified for receipt of Offers is extended, is not extended. Offers must acknowledge receipt of this amendment prior to the hour and date specified in the solicitation or as amended, by one of the following methods:
 (a) By completing items 8 and 15, and returning _____ copies of the amendment; (b) By acknowledging receipt of this amendment on each copy of the offer submitted; or (c) By separate letter or telegram which includes a reference to the solicitation and amendment numbers. FAILURE OF YOUR ACKNOWLEDGMENT TO BE RECEIVED AT THE PLACE DESIGNATED FOR THE RECEIPT OF OFFERS PRIOR TO THE HOUR AND DATE SPECIFIED MAY RESULT IN REJECTION OF YOUR OFFER. If by virtue of this amendment your desire to change an offer already submitted, such change may be made by telegram or letter, provided each telegram or letter makes reference to the solicitation and this amendment, and is received prior to the opening hour and date specified.

12. ACCOUNTING AND APPROPRIATION DATA *(If required)*

13. THIS ITEM ONLY APPLIES TO MODIFICATION OF CONTRACTS/ORDERS. IT MODIFIES THE CONTRACT/ORDER NO. AS DESCRIBED IN ITEM 14.

CHECK ONE	A. THIS CHANGE ORDER IS ISSUED PURSUANT TO: <i>(Specify authority)</i> THE CHANGES SET FORTH IN ITEM 14 ARE MADE IN THE CONTRACT ORDER NO. IN ITEM 10A.
	B. THE ABOVE NUMBERED CONTRACT/ORDER IS MODIFIED TO REFLECT THE ADMINISTRATIVE CHANGES <i>(such as changes in paying office, appropriation date, etc.)</i> SET FORTH IN ITEM 14, PURSUANT TO THE AUTHORITY OF FAR 43.103(b).
	C. THIS SUPPLEMENTAL AGREEMENT IS ENTERED INTO PURSUANT TO AUTHORITY OF:
	D. OTHER <i>(Specify type of modification and authority)</i>

E. IMPORTANT: Contractor is not, is required to sign this document and return _____ copies to the issuing office.

14. DESCRIPTION OF AMENDMENT/MODIFICATION *(Organized by UCF section headings, including solicitation/contract subject matter where feasible.)*

Except as provided herein, all terms and conditions of the document referenced in Item 9A or 10A, as heretofore changed, remains unchanged and in full force and effect.

15A. NAME AND TITLE OF SIGNER <i>(Type or print)</i>	16A. NAME AND TITLE OF CONTRACTING OFFICER <i>(Type or print)</i>
15B. CONTRACTOR/OFFEROR	16B. UNITED STATES OF AMERICA
15C. DATE SIGNED	16C. DATE SIGNED
<i>(Signature of person authorized to sign)</i>	<i>(Signature of Contracting Officer)</i>

Item 14. Continued.

CHANGE TO SF1442.

1) **Standard Form 1442, First Page, Item No. 13.A.- Change the bid opening time and date from “1400 local time 25 April 2001” to “1400 local time 2 May 2001”.**

CHANGES TO THE BID SCHEDULE.

1) Replace the Bidding Schedule with the attached new Bidding Schedule, bearing the notation "ACCOMPANYING AMENDMENT NO. 0003 TO SOLICITATION NO. DACA63-01-B-0003."

CHANGES TO THE SPECIFICATIONS.

1) Replacement Sections - Replace the following section with the accompanying new section of the same number and title, bearing the notation "ACCOMPANYING AMENDMENT NO. 0003 TO SOLICITATION NO. DACA63-01-B-0003."

SECTION 14601 CRANE, GANTRY, TOP RUNNING, 4-TON MAXIMUM CAPACITY

CHANGES TO THE DRAWINGS.

1) Replacement Drawings.- Replace the drawings listed below with the attached new drawings of the same number, bearing the notation "AM #0003":

C53_3.CAL	SEQ 53	C53	PAVING DETAILS 2A
A207_3.CAL	SEQ 168	A2.07	WALL SECTIONS
C510_3.CAL	SEQ 238A	C5-10	"DRRF FACILITY, OVERALL PLAN, SANITARY SEWER (BASE BID)"
A601_3.CAL	SEQ 276	A6.01	"FLOOR PLAN, ELEVATIONS & SECTIONS"
E1001_3.CAL	SEQ 304	E10.01	"LIGHTNING PROTECTION PLAN, NORTH, BID OPTION #10"
E1002_3.CAL	SEQ 305	E10.02	"LIGHTNING PROTECTION PLAN, SOUTH, BID OPTION #10"
E1003_3.CAL	SEQ 306	E10.03	"LIGHTNING PROTECTION POLE, DETAILS I, BID OPTION #10"
E1004_3.CAL	SEQ 307	E10.04	"LIGHTNING PROTECTION POLE, DETAILS II, BID OPTION #10"

END OF AMENDMENT

ACCOMPANYING AMENDMENT NO. 0003 TO SOLICITATION NO. DACA63-01-B-0003

Railhead Phase III (Project)
 Fort Hood, Texas (Location)

Solicitation No. DACA63-01-B-0003

BIDDING SCHEDULE
 (To be attached to SF 1442)

Item No.	Description	Estimated Quantity	Unit	Unit Cost	Estimated Amount
BASE BID: All work required by the plans and specifications for the construction of the Railhead Phase III <u>excluding</u> all Options.					
0001	Engine Maintenance Facility complete (Including all utilities to the 1524mm (5-Ft) line exclusive of all work listed separately)	Job	Sum	***	\$_____
0002	Vehicle Wash Facility complete (Including all utilities to the 1524mm (5-Ft) line exclusive of all work listed separately)	Job	Sum	***	\$_____
0003	DRRF Facility; complete (Including all utilities to the 1524mm (5-Ft) line exclusive of all work listed separately)	Job	Sum	***	\$_____
0004	Scale House; complete Including all utilities to the 1524mm (5-Ft) line exclusive of all work listed separately)	Job	Sum	***	\$_____
0005	Yard Shelter; complete (Including all utilities to the 1524mm (5-Ft) line exclusive of all work listed separately)	Job	Sum	***	\$_____
0006	Drilled Piers				
0006AA	460mm (18-In) Drilled Piers	499.2	M	\$_____	\$_____
0006AB	610mm (24-In) Drilled Piers	40.0	M	\$_____	\$_____
0007	Connector and Wye Tracks	Job	Sum	***	\$_____
0008	Clear Creek Bridge	Job	Sum	***	\$_____

ACCOMPANYING AMENDMENT NO. 0003 TO SOLICITATION NO. DACA63-01-B-0003
Solicitation No. DACA63-01-B-0003

BIDDING SCHEDULE (cont)

Item No.	Description	Estimated Quantity	Unit	Unit Cost	Estimated Amount
0009	<u>305mm Container Loading Pavement</u> <u>(Excluding Base and Subgrade) (am#2)</u>	<u>4700</u>	<u>M3</u>	\$ _____	\$ _____
0010	<u>230mm Vehicle Staging Hardstand</u> <u>and Vehicle Wash Hardstand</u> <u>(Excluding Base and Subgrade) (am#2)</u>	<u>1800</u>	<u>M3</u>	\$ _____	\$ _____
0011	<u>254mm Container Storage Area</u> <u>(Excluding Base and Subgrade) (am#2)</u>	<u>2620</u>	<u>M3</u>	\$ _____	\$ _____
0012	All Exterior Work outside the building's 1524mm (5-Ft) line (Including of all utilities, earthwork, paving sidewalk, curb and gutter, demolition, turfing and all other work not listed separately)	Job	Sum	***	\$ _____
0013	Mobilization & Demobilization	Job	Sum	***	\$ _____
0014	Final Record Drawings	Job	Sum	***	\$ 50,000.00
TOTAL BASE BID				\$ _____	

OPTION NO. 1: All work required by the plans and specifications for the construction of the Control Tower.

0015AA	Control Tower complete (Including all utilities to the 1524mm (5-Ft) line exclusive of all work listed separately)	Job	Sum	***	\$ _____
0015AB	760mm (30-In) Drilled Piers	29	M	\$ _____	\$ _____
TOTAL OPTION NO. 1				\$ _____	

OPTION NO. 2: All work required by the plans and specifications for the construction of the Locomotive Shelter.

0016	Locomotive Shelter (complete)	Job	Sum	***	\$ _____
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OPTION NO. 3: All work required by the plans and specifications for the construction of the Lumber Storage Shed.

0017	Lumber Storage (Complete)	Job	Sum	***	\$ _____
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ACCOMPANYING AMENDMENT NO. 0003 TO SOLICITATION NO. DACA63-01-B-0003
Solicitation No. DACA63-01-B-0003

BIDDING SCHEDULE (cont)

Item No.	Description	Estimated Quantity	Unit	Unit Cost	Estimated Amount
OPTION NO. 4: All work required by the plans and specifications for the installation of the Gantry Crane in the pit area of the Engine Maintenance Shop.					
0018	Gantry Crane (Complete)	Job	Sum	***	\$_____
OPTION NO. 5: All work required by the plans and specifications for the installation of the 500 Gallon Fuel Tank.					
0019	500 Gallon Fuel Tank	Job	Sum	***	\$_____
OPTION NO. 6: All work required by the plans and specifications for the Relocation of the Temporary Scale at the DRRF Facility to the permanent location.					
0020	Scale Relocation	Job	Sum	***	\$_____
OPTION NO. 7: All work required by the plans and specifications for the installation of the fence at the Container Storage Area.					
0021	Fencing	Job	Sum	***	\$_____
OPTION NO. 8: All work required by the plans and specifications for the installation of the Air Break Switches.					
0022	Air Break Switches	Job	Sum	***	\$_____
OPTION NO. 9: All work required by the plans and specifications for the construction of the POV Parking at the DRRF Facility.					
0023	POV Parking	Job	Sum	***	\$_____
<u>OPTION NO. 10: All work required by the plans and specifications for the construction of Lightning Protection.</u>					
<u>0024</u>	<u>Lightning Protection (Am#3)</u>	<u>Job</u>	<u>Sum</u>	<u>***</u>	<u>\$_____</u>

TOTAL BASE BID PLUS OPTIONS 1 THRU 10 \$_____

ACCOMPANYING AMENDMENT NO. 0003 TO SOLICITATION NO. DACA63-01-B-0003
Solicitation No. DACA63-01-B-0003

BIDDING SCHEDULE (cont)

NOTES:

1. ARITHMETIC DISCREPANCIES: (1989 JUL)

(a) For the purpose of initial evaluation of bids, the following will be utilized in resolving arithmetic discrepancies found on the face of the bidding schedule as submitted by bidders:

(1) Obviously misplaced decimal points will be corrected;

(2) In case of discrepancy between unit price and extended price, the unit price will govern;

(3) Apparent errors in extension of unit prices will be corrected; and

(4) Apparent errors in addition of lump-sum and extended prices will be corrected.

(b) For the purposes of bid evaluation, the Government will proceed on the assumption that the bidder intends his bid to be evaluated on the basis of the unit prices, extensions, and totals arrived at by resolution of arithmetic discrepancies as provided above and the bid will be so reflected on the abstract of bids. (EFARS 14.406-2)

2. If a modification to a bid based on unit prices is submitted, which provides for a lump sum adjustment to the total estimated cost, the application of the lump sum adjustment to each unit price in the bid schedule must be stated. If it is not stated, the bidder agrees that the lump sum adjustment shall be applied on a pro rata basis to every unit price in the bid schedule.

3. Bidders must bid on all items.

4. Costs attributable to Division 01 - General Requirements are assumed to be prorated among bid items listed.

5. Responders are advised that this requirement may be delayed, canceled or revised at any time during the solicitation, selection, evaluation, negotiation and/or final award process based on decisions related to DOD changes in force structure and disposition of the Armed Services.

6. For the purpose of this solicitation, the word "item" shall be considered to mean "schedule" as used in Provision 52,214-0019, CONTRACT AWARD--SEALED BIDDING--CONSTRUCTION, in Section 00100 INSTRUCTIONS, CONDITIONS, AND NOTICES TO BIDDERS, excluding additives, deductives or options

ACCOMPANYING AMENDMENT NO. 0003 TO SOLICITATION NO. DACA63-01-B-0003
Solicitation No. DACA63-01-B-0003

BIDDING SCHEDULE (cont)

NOTES (CONT)

7. EVALUATION OF OPTIONS (JUL 1990) (FAR 52.217-5)

Except when it is determined in accordance with FAR 17.206(b) not to be in the Government's best interests, the Government will evaluate offers for award purposes by adding the total price for all options to the total price for the basic requirement. Evaluation of options will not obligate the Government to exercise the option(s).

8. OPTION FOR INCREASED QUANTITY - SEPARATELY PRICED LINE ITEM (MAR 1998)
(FAR 52.217-7)

The Government may require the completion of the numbered line item, identified in the Bidding Schedule as an option item, in the quantity and at the price stated in the Bidding Schedule. The Contracting Officer may exercise the option by written notice to the Contractor within the period specified in the Bidding Schedule. Completion of added items shall continue at the same schedule as the Base Bid unless otherwise noted in the SPECIAL CONTRACT REQUIREMENTS, paragraph 1 entitled COMMENCEMENT, PROSECUTION AND COMPLETION OF WORK.

9. The Government reserves the right to exercise the option(s) either singularly or in any combination for up to 90 calendar days after award of the Base Bid without an increase in the Offeror's Bid Price.

10. ABBREVIATIONS

mm	millimeter
M	meter
In	inch
Ft	foot

END OF BIDDING SCHEDULE

SECTION 14601

CRANE, GANTRY, TOP RUNNING, 4-TON MAXIMUM CAPACITY

04/94

Amendment 0001 & Amendment 0003

PART 1 GENERAL

1.1 REFERENCES

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

AMERICAN BEARING MANUFACTURERS ASSOCIATION (AFBMA)

AFBMA Std 9 (1990) Load Ratings and Fatigue Life for Ball Bearings

AFBMA Std 11 (1990) Load Ratings and Fatigue Life for Roller Bearings

AMERICAN GEAR MANUFACTURERS ASSOCIATION (AGMA)

AGMA 390.03a (1980; Errata 1983; R 1988) Gear Handbook Gear Classification, Materials and Measuring Methods for Bevel, Hypoid, Fine Pitch Wormgearing and Racks Only as Unassembled Gears (Partially replaced by AGMA 2000-A)

AGMA 2000-A (1988; Errata Jan 89, Errata Jul 90) Gear Classification and Inspection Handbook, Tolerances & Measuring Methods for Unassembled Spur and Helical Gears (including Metric Equivalents)

AGMA 2001-C (1995) Fundamental Rating Factors & Calculation Methods for Involute Spur and Helical Gear Teeth

AGMA 6010-F (1997) Standard for Spur, Helical, Herringbone and Bevel Enclosed Drives

AGMA 6019-E (1989; R 1994) Gearmotors Using Spur, Helical, Herringbone, Straight Bevel, or Spiral Bevel Gears

AGMA 6021-G (1989; R 1994) Shaft Mounted and Screw Conveyer Drives Using Spur, Helical and Herringbone Gears

AMERICAN INSTITUTE OF STEEL CONSTRUCTION (AISC)

AISC Pub No. S329 (1985; Appx A Jun 1994) Allowable Stress Design Specification for Structural Joints Using ASTM A 325 or A 490 Bolts

AMERICAN NATIONAL STANDARDS INSTITUTE (ANSI)

ANSI C80.1 (1995) Rigid Steel Conduit - Zinc Coated

AMERICAN SOCIETY FOR TESTING AND MATERIALS (ASTM)

ASTM A 159 (1983; R 1993) Automotive Gray Iron Castings

ASTM A 325 (1997) Structural Bolts, Steel, Heat Treated, 120/105 ksi Minimum Tensile Strength

ASTM A 325M (1997) High-Strength Bolts for Structural Steel Joints (Metric)

ASTM A 490 (1997) Heat-Treated Steel Structural Bolts, 150 ksi Minimum Tensile Strength

ASTM A 490M (1993) High-Strength Steel Bolts, Classes 10.9 and 10.9.3, for Structural Steel Joints (Metric)

ASTM A 668/A 668M (1996) Steel Forgings, Carbon and Alloy, for General Industrial Use

ASTM B 209 (1996) Aluminum and Aluminum-Alloy Sheet and Plate

ASTM B 209M (1995) Aluminum and Aluminum-Alloy Sheet and Plate

ASTM B 438/B 438M (1995a) Sintered Bronze Bearings (Oil-Impregnated)

ASTM B 439 (1995) Iron-Base Sintered Bearings (Oil-Impregnated)

ASTM B 612 (1996) Iron Bronze Sintered Bearings (Oil-Impregnated)

ASME INTERNATIONAL (ASME)

ASME B30.2 (1996) Overhead and Gantry Cranes Top Running Bridge, Single or Multiple Girder Top Running Trolley Hoist

AMERICAN WELDING SOCIETY (AWS)

AWS D1.1 (1998) Structural Welding Code - Steel

AWS D14.1 (1997) Welding Industrial and Mill Cranes and Other Material Handling Equipment

COMMERCIAL ITEM DESCRIPTIONS (CID)

CID A-A-55810

(Apr 1996) Conduit, Metal, Flexible

ELECTRONIC INDUSTRIES ASSOCIATION (EIA)

EIA 397

(1972; R 1979; 397-1 1980) Recommended
Standard for) Thyristors

FEDERAL SPECIFICATIONS (FS)

FS RR-W-410

(Rev D; Am 1) Wire Rope and Strand

INSTITUTE OF ELECTRICAL AND ELECTRONICS ENGINEERS (IEEE)

IEEE Std 597

(1983; R 1992) Practices and Requirements
for General Purpose Thyristor for DC Drives

MATERIAL HANDLING INDUSTRY (MHI)

MHI CMAA 70

(1994) Electric Overhead Traveling Cranes

NATIONAL ELECTRICAL MANUFACTURERS ASSOCIATION (NEMA)

NEMA AB 1

(1993) Molded Case Circuit Breakers and
Molded Case Switches

NEMA ICS 1

(1993) Industrial Controls and System

NEMA ICS 2

(1993) Industrial Control and Systems:
Controllers, Contactors and Overload
Relays, Rated Not More Than 2000 Volts AC
or 750 Volts DC

NEMA ICS 3

(1993) Industrial Control and Systems:
Factory Built Assemblies

NEMA ICS 4

(1993 Rev Industrial Control and Systems:
Terminal Blocks

NEMA ICS 6

(1993) Industrial Control and Systems:
Enclosures

NEMA MG 1

(1993; Rev 1; Rev 2; Rev 3; Rev 4)) Motors
and Generators

NEMA ST 1

(1988; R 1994) Specialty Transformers
(Except General-Purpose Type)

NEMA WC 3

(1992; Rev 1) Rubber-Insulated Wire and
Cable for the Transmission and
Distribution of Electrical Energy

NEMA WC 7

(1988; Rev 1; Rev 2)
Crosslinked-Thermosetting-
polyethylene-insulated Wire and Cable for
the Transmission and Distribution of
Electrical Energy

NEMA WC 8 (1988; Rev 1; Rev 2; Rev 3)
Ethylene-Propylene-Rubber- Insulated Wire
and Cable for the Transmission and
Distribution of Electrical Energy

NATIONAL FIRE PROTECTION ASSOCIATION (NFPA)

NFPA 70 (1999) National Electrical Code

UNDERWRITERS LABORATORIES (UL)

UL 489 (1996) Molded-Case Circuit Breakers,
Molded-Case Switches, and Circuit-Breaker
Enclosures

UL 943 (1993; Rev thru May 1998) Ground-Fault
Circuit-Interrupters

UL 1004 (1994; Rev thru Dec 1997) Electric Motors

UL 1449 (1996; Rev thru Oct 1998) Transient
Voltage Surge Suppressors

1.2 SYSTEM DESCRIPTION

1.2.1 General Requirements

1.2.1.1 Standard Products

Materials and equipment shall be standard products of manufacturers regularly engaged in the fabrication of cranes and shall essentially duplicate items which have been in satisfactory use for at least 2 years prior to bid opening. Any company licensed by a crane manufacturer to manufacture cranes bearing their name shall have the design and components approved by the licensor prior to submission to the Government for approval.

1.2.1.2 Nameplates

Each major component of equipment shall have the manufacturer's name, address, type or style, model or catalog number, and serial number on a metal plate secured to the equipment.

1.2.1.3 Verification of Dimensions

The Contractor shall verify all dimensions in the field and shall advise the Contracting Officer of any discrepancy before performing any work.

1.2.1.4 Welding

Welding shall be in accordance with qualified procedures using AWS D14.1 as modified. Written welding procedures shall specify the Contractor's standard dimensional tolerances for deviation from camber and sweep and such tolerances shall not exceed those specified in AWS D14.1. All welding shall be performed indoors. Welders and welding operators shall be qualified in accordance with AWS D1.1 or AWS D14.1. Allowable stress values shall be in accordance with MHI CMAA 70.

1.2.2 Design Criteria

The cranes shall be designed to operate in the spaces. (AM#1)

1.2.2.1 Classification

The crane shall be designed and constructed to MHI CMAA 70 Class B, Service requirements for operation in outdoor nonhazardous environment. **(AM#3) Gantry shall be 3-way adjustable type with true "A Frame" design.**

1.2.2.2 Rated Capacity and Speeds

The rated capacity of the crane shall be **(AM#3) 1.8** metric tons. The lower load block and hook shall not be considered part of the rated capacity. Rated speeds (in mm/s) for the hoist, **(AM#3)** and trolley shall be as follows:

Rated Speeds	
Maximum	
Main Hoist	50
Trolley	100
<u>(AM#3) Delete Gantry Rated Speed</u>	

1.2.2.3 Capacity Plates

Two capacity plates shall be provided, one for each side of the gantry. Each plate shall be lettered to indicate the total rated hoisting capacity of the crane. All lettering shall be of sufficient size to be easily read from the floor. Each lower load block shall be marked with the hoist rated capacity.

1.2.2.4 Stability

The gantry crane shall have a minimum factor of safety of 1.25 against overturning under each condition of loading stated in paragraph 3.3.2.4 of MHI CMAA 70. Counterweights shall be provided if necessary to obtain the required stability.

1.3 SUBMITTALS

Government approval is required for submittals with a "GA" designation; submittals having an "FIO" designation are for information only. The following shall be submitted in accordance with Section 01330 SUBMITTAL PROCEDURES:

SD-01 Data

Gantry Crane System; GA.

A complete list of equipment and materials, including manufacturer's descriptive data and technical literature, performance charts and curves, catalog cuts, and installation instructions.

Spare Parts; FIO.

Spare parts data for each different item of material and equipment

specified, after approval of the detail drawings and not later than 3months prior to the date of beneficial occupancy. The data shall include a complete list of parts and supplies, with current unit prices and source of supply.

SD-06 Instructions

Gantry Crane System; FIO.

Diagrams, instructions, and other sheets proposed for posting.

SD-09 Reports

Acceptance Testing; GA.

Test reports in booklet form showing all field tests performed to adjust each component and all field tests performed to prove compliance with the specified performance criteria, upon completion and testing of the installed system. The report shall include the information as required by paragraph ACCEPTANCE TESTING.

SD-18 Records

Hooks; GA.

Record of hook material and any heat treatment performed shall be stamped on the hook shank or documented in certification papers furnished with the hooks.

SD-19 Operation and Maintenance Manuals

Gantry Crane System; GA.

Six copies of operation manuals and six copies of maintenance manuals shall be supplied for the equipment furnished. One complete set shall be furnished prior to performance testing and the remainder upon acceptance. Operation manuals shall detail the step-by-step procedures required for system startup, operation, and shutdown. Operation manuals shall include the manufacturer's name, model number, parts list, and brief description of all equipment and their basic operating features. Operation manuals shall include a copy of the acceptance test report for information and future reference. Operation manuals shall include an overall description of the system describing any unique features that may need special attention. Maintenance manuals shall provide step-by-step description of routine maintenance procedures, possible breakdowns and repairs, and troubleshooting guides. Maintenance manuals shall include piping layout diagrams, equipment layout diagrams, and detailed wiring and control diagrams of the system as installed. Maintenance manuals shall include a spare parts list of manufacturer's recommended spare parts that should be maintained on-site and any long lead time items should be clearly identified. Operation and maintenance manuals shall be approved prior to the field training course.

1.4 DELIVERY AND STORAGE

Equipment delivered shall be placed in indoor storage, protected from the

weather, humidity and temperature variations, dirt and dust, or other contaminants.

PART 2 PRODUCTS

2.1 STRUCTURAL MATERIALS

2.1.1 Bolts, Nuts, and Washers

Bolts, nuts, and washers shall conform to ASTM A 325M bolts. High strength bolted connections shall conform to the requirements of AISC Pub No. S329, except that ASTM A 490M bolts shall not be used. No galvanized bolts shall be used.

2.1.2 Gantry Girders

Gantry girders shall be wide flange beams, standard I-Beams, reinforced beams or sections fabricated from rolled plates and shapes.

2.1.3 Gantry Rails

The gantry rail shall be fastened to the top cover plate with welded clips. Gantry rail joints shall be bolted using standard joint bars. Rail joints shall be staggered.

2.1.4 End Ties and Gantry Girder End Connections

Horizontal gusset plates shall be provided at the elevation of the top and bottom end tie flanges for connection to girder ends. End connections shall be made using high-strength bolts. Body bound bolts fitted in drilled and reamed holes shall be used to maintain the crane square.

2.1.5 delete (AM#3)

2.1.6 Trolley Frame

Trolley frame shall consist of two structural steel side frames or trucks welded together with one or more structural steel load girts to form a one-piece unit. Pads shall be provided for the use of jacks or wedges when changing truck wheels.

2.1.7 Stops and Bumpers

(AM#3) Bumpers shall be provided on the trolley to engage bumpers located at the ends of the gantry rails. Stops shall be located to permit maximum (AM#3) trolley travel. Structural stops and bumpers shall be designed and installed in accordance with MHI CMAA 70.

2.1.8 deleted (AM#1)

2.1.9 Runway Rails

(AM#3) Gantry Crane shall be mounted on casters with 4 position swivel locks.

2.1.10 delete (AM#1)

2.2 MECHANICAL EQUIPMENT

2.2.1 Drives

2.2.1.1 (AM#3) delete

2.2.1.2 Trolley Drives

The trolley shall have a drive arrangement that has two wheels driven.

2.2.2 Load Blocks

2.2.2.1 Main Hoist Load Blocks

Load blocks shall be of steel construction. The load block frame shall be completely enclosed except for rope openings. Load blocks shall be provided with a forged steel crosshead, separate from the sheave pin, with swivel mounting for the hook. Sheave bearing lubrication fittings shall be recessed within the sheave pin or adequately guarded to prevent damage.

2.2.2.2 Hook Assembly

Hooks shall be single barbed and shall be made of forged steel complying with ASTM A 668/A 668M. All hooks shall be fitted with safety latches designed to preclude inadvertent displacement of slings from the hook saddle. No painting or welding shall be performed on the hook. Hooks are required to be periodically disassembled, inspected, and nondestructively tested; therefore the hook nut shall be secured by a set screw or other similar, easily removable securing device, but shall not be welded. Hooks shall be commercially rated and shall have a minimum proof load of twice the safe working load and have a minimum straightening load of four times the safe working load.

2.2.3 Hoisting Ropes

Hoisting ropes shall be regular lay, preformed, uncoated, improved or extra improved plow steel, 6 by 37 construction, with independent wire rope core conforming to FS RR-W-410, Type I, Class 3. The hoisting ropes shall be selected such that the rated capacity load plus the load block weight divided by the number of parts of rope shall not exceed 20 percent of the certified breaking strength of the rope. Hoisting ropes shall be secured to the hoist drum so that no less than three wraps of rope remain at each anchorage of the hoist drum at the extreme low position (limit switch stop).

2.2.4 Sheaves

Sheaves shall be of cast steel, forged, rolled, or welded structural steel. Sheave grooves shall be accurately machined, smoothly finished, and free of surface defects.

2.2.5 Hoist Drums

Hoist drums shall be of welded rolled structural steel, cast steel, or seamless steel pipe. Drums shall be machined and provided with grooves, including two dead grooves at each of the two anchor points.

2.2.6 Gearing

Gearing shall be of the enclosed (gear reducers) or open type. The gears and pinions shall be spur, helical, or herringbone type only, and shall be forged, cast or rolled steel, except that drum gears may be of welded construction.

2.2.6.1 Gear Reducers

Gear reducers shall be the standard items of manufacturers regularly engaged in the design and manufacture of gear reducers, or they shall be integral components of standard hoists or hoist/trolley units of manufacturers regularly engaged in the design and manufacture of hoists or hoist/trolley units. Gear reducers shall be designed, manufactured, and rated in accordance with AGMA 6010-F, AGMA 6019-E, or AGMA 6021-G (for trolley drives only), as applicable.

2.2.6.2 Open Gearing

Open gears shall be enclosed with safety guards provided with openings with covers for inspection and access for grease lubrication.

2.2.7 Brakes

Brakes shall be shoe or disc with thermal capacity suitable for Class B Service. Shoe and disc brakes shall be spring set and electrically released by a continuously rated direct acting magnet. All brakes shall be self-aligning and provide for easy adjustment for torque setting and lining wear. Brake wheels shall be cast iron conforming to ASTM A 159 or shall be the manufacturer's standard high-strength ductile cast iron, provided that the material exhibits wear characteristics in the form of powdered wear particles and is resistant to heat checking. Disc brakes shall be totally enclosed and have multiple discs with stationary releasing magnets. Brake torque shall be easily adjustable over a 2:1 torque range.

2.2.7.1 Hoist Holding Brakes

Each hoist shall be equipped with at least two holding brake(s). The holding brake shall be a friction brake of the shoe design and shall be applied to the motor shaft or to the gear reducer shaft.

2.2.7.2 Hoist Control Brake

Each hoist shall be equipped with an integral mechanical load brake-"Weston" or multiple-disc. The multiple-disc brake shall be provided with external adjustment for wear. Each hoist shall be provided with an electric control brake to prevent overspeeding.

2.2.7.3 Trolley Brake

The trolley braking system shall have shoe or disc brakes that are spring applied and electrically released.

2.2.7.4 Gantry Brakes

The gantry braking system shall provide a single-shoe. (AM#3) The gantry

brakes shall be **(AM#3) manually** applied and **(AM#3)** released.

2.2.8 Wheels

The wheels shall be made of rolled or forged steel. The wheel treads and flanges shall be rim toughened to between 320 and 370 Brinell hardness number. **(AM#3)** Trolley wheels shall have straight treads. Gantry wheels shall have straight treads.

2.2.9 Bearings

All bearings, except those subject only to small rocker motion, shall be of the antifriction type. Load ratings and fatigue life shall be in accordance with AFBMA Std 9 and AFBMA Std 11. Equalizer sheaves shall be equipped with sintered oil impregnated type bushings in accordance with ASTM B 438/B 438M, ASTM B 439, or ASTM B 612.

2.2.10 Antidrip Provisions

The cranes shall be designed to preclude leakage of lubricants onto the lifted loads or the floor. Equipment and components which cannot be made leak-proof shall be fitted with suitable drip pans. The drip pans shall be made of steel and shall be designed to permit removal of the collected lubricant.

2.2.11 Lubrication System

A splash oil lubrication system shall be provided for the hoist, trolley **(AM#3)** gear cases, except that an oil pump shall be used on vertical mounted gear cases exceeding two reductions. Oil pumps shall be reversible and capable of maintaining the same oil flow direction and volume while being driven in either direction. Electric motor-driven pumps may be used when the input shaft speed is too low at any operating condition to ensure adequate oil flow. In such applications, the pump shall be energized whenever the drive mechanism brakes are released.

2.2.11.1 Electrically Driven Oil Pump Alarm

If an electric-driven lubricating pump is used, an audible alarm and red indicating light shall be provided and shall be energized in the event of pump malfunction.

(AM#3) 2.2.12 Gantry Adjustment

The Gantry height shall be adjustable from 5400 mm to 6000 mm.

2.3 ELECTRICAL COMPONENTS

2.3.1 Power Supply

2.3.1.1 General

Electric power for the normal operation of the crane will be supplied by a Government furnished and installed feeder from the nominal 480 volt, three-phase, 60-Hz, AC, ungrounded power distribution system. The main contact conductor system will be located as shown the drawings. The power shall be brought into the crane by a suitable collector. The main contact conductor and collector system shall be furnished by the Contractor and the contact conductor system and all the required mounting accessories shall be

provided and installed.

2.3.1.2 Incoming Power Supply

a. General - Incoming power from the above power receptacles shall be brought into the crane by means of a Type G, three-conductor, 600-volt rubber or rubber-like insulated and extra-heavy-duty neoprene-jacketed portable power cable. The cable shall have a usable length of not less than 75 meters, and shall be wound upon the cable reel to be furnished and mounted on the crane. The power plug shall be installed on the free end of the cable and an anchorage shall be provided to relieve the power plug and receptacle from the strain of reeling and unreeling the cable. The grounding conductors shall make electrical connection to the crane structure through the fourth collector ring and brush of the cable reel and shall be connected to the ground terminal of the power plug.

b. Cable Reel - The cable reel shall be rated for constant duty, 50 amperes continuous, 600-volt AC, shall be provided with four collector rings and brushes, shall be of weather-proof construction, shall maintain approximately uniform tension in the cable, and shall automatically "pay out" and "take up" the cable as required by the crane travel. The cable reel shall be provided with a positive driven or actuated limit switch that will prevent excess "takeup". The reel shall be mounted on the crane in a location, as approved, that will allow ready maintenance and inspection as well as satisfactory operation.

2.3.1.3 Main Contact Conductors and Collectors

The contact conductor system shall be furnished complete with collector and all necessary accessories for mounting the contact assembly as shown.

a. Conductor - The contact conductor system shall be enclosed and shall be rated for 600 volts AC. It shall have a continuous current carrying capacity as required by the connected load of the crane and as required to hold the voltage drop to not more than 1 percent from the power input connection at the main contact conductors to the input terminals of the crane main circuit breaker when the crane is operating with the greatest load condition and is at the maximum distance from the point of connection of the power feeder. Mounting supports shall provide means to accommodate contraction and expansion due to temperature changes and to permit installation with proper alignment. The mounting supports shall be spaced at intervals that will limit the maximum deflection of the contact conductors to not more than 2 mm, but in no case shall the spacing intervals of the supports be more than 3 m. All mounting bolts and screws shall be of a suitable corrosion resisting material. Standard products of the manufacturer furnishing the conductors shall be provided to connect the power supply to the conductors. Contraction and expansion sections shall be provided at each monolith joint. Except as otherwise specified, the contact conductor system shall conform to the following:

- (1) Conductor insulation shall be nonburning and suitable for outdoor service at an ambient temperature of 40 degrees C. It shall be designed and installed to accommodate independent and/or unequal movements of the conductors and enclosures.

(2) Stainless steel hanger clamps with insulators shall be used to support the insulated conductor.

(3) An ice shield shall be provided and arranged to prevent icing of the conductors or collectors. The shield, shield straps, and strap nuts shall be made of aluminum conforming to ASTM B 209M, Alloy 3003, Temper H14. The shields shall be not less than 1.25 mm in thickness and the shield strap nuts shall be not less than 3.20 mm in thickness. Bolts and screws shall be made of stainless steel. The ice shield shall be provided with expansion and contraction joints.

b. Collector - Collector shall have two individually spring loaded conductor contact shoes for each phase or for each main conductor, shall have no exposed current carrying surfaces, and shall be articulated, if necessary, to maintain full contact against the contact conductor. Contact shoes shall be of graphite bronze or other suitable material as approved and shall be suitable for use with contact conductors furnished. The collector mounting shall provide means for adjustment as required to make proper contact and to travel properly on the contact conductors. Supporting wheels, if required, shall be provided with self-lubricating bearings.

2.3.1.4 Incoming Power Circuit Breaker

The crane's normal power supply shall be controlled by means of a 460volt, three-pole, manually operated air circuit breaker having a suitable ampere rating. Short circuit protection only shall be provided. The breaker shall be mounted on the protective panel.

2.3.2 TROLLEY CONDUCTORS AND COLLECTORS

2.3.2.1 Festoon Conductors

Power and control circuits may be brought to the crane trolley by means of a "festoon" system consisting of jacketed and color coded multiple conductor power and control cables which shall be bundled and supported by four-wheel trolleys running on "I" beam rails mounted on the inside of the main trolley girders. Trolley wheels shall be provided with antifriction bearings. The conductors of all cables shall be terminated at each end by terminal lugs connected to terminal blocks conforming to NEMA ICS 4 mounted in cast iron junction boxes of NEMA Type 4 construction conforming to Part ICS-1-110 of NEMA ICS 1. Power and control circuits shall be segregated and terminated in separate junction boxes. Two extra conductors shall be provided in each control cable. All cable of a given "festoon" group shall be bundled together using nylon lacing material. All cables shall be supported with sufficient trolleys to maintain a minimum of 900 mm from the top of the lifting beam.

2.3.3 Control Systems

A separate controller shall be provided for each motor (**AM#3**). Overload protection shall be in conformance with the requirements of NEMA ICS 2. Contactors that are used for starting, stopping, and reversing shall be mechanically and electrically interlocked.

2.3.3.1 Hoist Control System

- a. Motion Control - The main hoist motion control system shall be single - speed, with AC magnetic control of AC squirrel cage motors
- b. Motor Control - The hoist motor control shall provide five-speed AC magnetic control of AC wound rotor motor with eddy-current braking. The eddy-current brake shall provide an adjustable varying artificial loading of the wound rotor hoist motor on at least two hoisting points and on four lowering points. Operation of the hoist shall be prevented upon loss of eddy-current brake excitation. Eddy-current brake shall be excited with reduced voltage when the hoist control is in the OFF position. There shall be positive drive down on all lowering points. On the first speed-point hoisting, the hook shall not lower with 100 percent of rated load and the no-load hook speed shall not exceed 30 percent of rated speed. On the first speed-point lowering, the full-load hook speed shall not exceed 18 percent of rated speed. As an additional feature, a self-excited alternator shall be mounted on the electric load brake housing to excite the load brake if the power supply fails.
- c. Motor Control - The hoist motor control shall provide AC static stepless control. The control shall provide for continuously adjustable speeds throughout the range from minimum speed to maximum speed. Eddy-current braking shall provide a retarding torque for control of light loads in the hoisting direction and all loads in the lower direction of subsynchronous speed. To reduce holding brake wear, the control shall be arranged so that the electric load brake is effective in slowing the motion when the control is in the OFF position. The minimum hoist position of the control shall not allow the hook to lower with full rated load on the hook. Minimum lowering speed at rated hook load shall not exceed 15 percent of rated speed. Minimum speed hoisting with an empty hook shall not exceed 20 percent of synchronous motor speed. All loads up to 100 percent rated capacity shall raise on the minimum speed point of the master.

2.3.3.2 Travel Control System

The gantry and trolley motion control system shall be single-speed with AC magnetic control of squirrel cage motors

- a. (AM#3)Trolley Control - The (AM#3) trolley main control systems shall provide two speeds in each direction by means of an electrically operated, full magnetic, across-the-line reversing type starter. Centrifugal switches shall be provided and used in the control circuit to prevent the plugging of trolley (AM#3) drive motors; each switch shall be arranged to set the associated drive's brake while attempts are made to plug. The (AM#3) trolley main control system shall be provided with primary resistor reduced voltage starting, acceleration, and deceleration for all speed points.
- b. Drift Point - With the master switch in the "Off" position, operation of a thumb-operated auxiliary switch in the operating lever shall actuate the drift position. In the "Drift" position, the electric brakes shall be released and the crane travel motor or motors de-energized to allow full control of drifting travel.

2.3.3.3 Magnetic Control Equipment

The primary and accelerating contactors and/or static devices shall be

mounted on one or more panels and shall be enclosed in a cabinet or cabinets. The control circuits shall be wired to terminal blocks or studs complete and ready for making all external connections. Insulated wire shall conform to the requirements of paragraph CONDUIT AND WIRING. Magnetic contactors for individual motor controls shall have a rating the equivalent of the motor controlled, but in no case shall a contactor less than NEMA size 1 be used. The protective panel main line contactor shall be rated in accordance with NEMA ICS 3 for Service Class I, except that in no case shall the rating be less than one NEMA size greater than the largest individual motor contactor used.

2.3.3.4 Control Panels

Control panels shall be fabricated of solid sheet steel designed and constructed to conform to the requirements of NEMA ICS 6 Type 4. Thermostatically controlled heaters shall be provided in each panel. Control panel doors shall be hinged, equipped with gaskets, and shall be fitted with key-lock handles designed to latch the door at top, center, and bottom. A single key shall open all locks.

2.3.3.5 Pendant Control Station

a. Design - The pendant control station shall be suspended from the crane by a strain chain or 6 mm (minimum) wire rope strain lead of corrosion resistant steel. The pendant station shall be attached to the underside of the crane gantry **(AM#3)**. The pendant control station enclosure shall be NEMA Type 4 in accordance with NEMA ICS 6. Pushbuttons shall be heavy duty, dust-and-oil-tight type having distinctly felt operating positions. Pushbuttons shall be so constructed that they cannot become hung-up in the control case. Pendant shall include a separate set of pushbuttons for each motion and for POWER ON-POWER OFF. One yellow pilot light to indicate excessive hoist motor temperature shall be provided on the pendant station. A blue pilot light to indicate that the main contactor is energized and a white pilot light to indicate that power is available on the load side of the crane disconnect switch shall also be provided. The POWER OFF pushbutton shall have a bright red mushroom head. Operating pushbuttons and pilot lights shall meet the heavy-duty requirements of NEMA ICS 2. Pushbuttons shall be as follows:

Hoist - up
 Hoist - down
(AM#3)
 Trolley - LEFT
 Trolley - RIGHT
 POWER OFF
 POWER ON

(AM#3) delete b,c,d & e

2.3.3.6 Protection

a. Main Line Disconnect - A main line disconnect consisting of a combination circuit breaker and nonreversing starter (main line contactor) in NEMA Type 4 enclosure shall be provided. The main line disconnect shall be controlled by a control circuit such that all crane

motions shall be stopped upon main line undervoltage, overload, control circuit fuse failure, or operation of the POWER OFF pushbutton.

b. Circuit Breakers - Circuit breakers shall meet the requirements of UL 489 and NEMA AB 1.

c. Overloads -AC circuit overload relays shall be of the ambient compensated, automatic reset, inverse time type located in all phases of the main line and individual motor circuits and arranged to open the main line contactor.

2.3.3.7 Limit Switches

Limit switches shall be heavy duty quick-break double-pole double-throw type and shall conform to NEMA ICS 2. Geared limit switch interruption of a motion in one direction shall not prevent the opposite motion. Geared limit switches shall reset automatically. Limit switch housings shall be NEMA Type 4. Limit switches shall interrupt power to the control systems.

a. Hoist Upper Limit Switches - Two limit switches shall be provided for each hoist. A rotating adjustable geared control circuit interrupt limit switch shall provide hoist-up limiting. A secondary hoist upper limit shall be provided with a weight operated limit switch, to prevent raising beyond their safe limit. This secondary limit switch shall operate to interrupt power to all hoist motor conductors and set the hoist holding brakes.

b. Hoist Lower Limit Switches - Hoists shall be provided with a rotating adjustable geared control circuit interrupt limit switch for hoist-down travel limiting.

c. (AM#3)Trolley Travel Limit Switches - Runway (track) limit switches shall be mounted to the crane (AM#3)trolley. (AM#3) Adjacent to one runway rail to interrupt current to the (AM#3) trolley controls. Adjustable limit switch actuators shall be installed on both ends of those rails to actuate the limit switches and stop the crane (AM#3) trolley prior to contacting the runway bumpers.

(AM#3) delete d.

2.3.3.8 (AM#3) delete

2.3.3.9 Load Limit System

A load limit system shall be provided for the main hoist. The primary purpose of the load limit system is to (AM#3)interrupt hoist motor when the preset load has been exceeded. The system shall consist of a load cell, and load sensing electronics(AM#3).

2.3.4 Motors

2.3.4.1 General Requirements

Motors shall be designed specifically for cranes and hoist duty. Drain holes shall be provided at low points near each end. Inspection and service covers shall be provided with gaskets. All hardware shall be corrosion resistant. Motors shall conform to the requirements of NFPA 70 and UL 1004. Motors shall be provided with a suitable heater to prevent

condensation during long periods of inactivity. One thermal sensitive device embedded in the hoist motor windings shall be provided. (AM#3)The set point shall be set below the Class B insulation temperature limit. The thermal-sensitive device and associated circuits shall be self-restoring (automatic reset).

2.3.4.2 Main Hoist Motor

The hoist motor shall be industrial single-speed; single-winding.

2.3.4.3 (AM#3)Trolley Drive Motors

The (AM#3) trolley drive motors shall be industrial single-speed; single-winding wound rotor AC induction

2.3.4.4 Motor Enclosures

Motor enclosures shall be totally enclosed, fan cooled (TEFC).

2.3.4.5 Hoist Motor Insulation and Time Rating

The hoist motors shall be provided with Class B insulation with a 60-minute minimum motor time rating to satisfy NEMA permissible motor temperature rise above 40 degrees C ambient permitted by Class B insulation.

2.3.4.6 (AM#3) Trolley Motor Insulation and Time Rating

The (AM#3) trolley drive motor shall be provided with Class B insulation with a 60-minute minimum motor time rating to satisfy NEMA permissible motor temperature rise above 40 degrees C ambient permitted by Class B insulation.

2.3.5 Electric Brakes

2.3.5.1 Hoist Brake Time Delay

One of the hoist holding brakes shall be provided with a time delay setting (from 1 to 3 seconds). Such time delay shall be initiated upon release of the control pushbutton or return of the master switch to OFF.

2.3.5.2 Automatic Stop System

All electrically controlled brakes shall be applied automatically when power is interrupted. Brakes shall be wired so that the brakes release upon operation of a pushbutton for the associated drive and shall set upon release of that pushbutton, return of the master switch to OFF, operation of POWER OFF pushbutton, de-energization of main line contactor, or power failure. Electric brakes shall be designed so that they can be mechanically released. Enclosures for brake electrical components shall be NEMA ICS 6. DC shunt magnetic shoe brakes shall be provided with an electrical forcing circuit for rapid release of the brake. Each shunt coil brake shall be circuited so that both conductors supplying the brake are opened simultaneously when the brake is de-energized.

2.3.6 delete (AM#3)

2.3.6.1 Transformers

Transformers shall be dry type and shall carry full load continuously at rated voltage and frequency without exceeding an average temperature rise of 115 degrees C above an ambient temperature of 40 degrees C. The transformer shall have a totally enclosed case which shall be finished with manufacturer's standard coating system. Transformers shall be fully encapsulated, except for those specifically designed for use as an isolation transformer for static power conversion units.

2.3.6.2 delete (AM#3)

2.3.6.3 Anticondensation Heaters

All motors and control panels shall be equipped with thermostatically controlled anticondensation heaters. The circuit breaker combination magnetic starter shall be NEMA 4 enclosure in accordance with NEMA ICS 6. The magnetic starter shall be equipped with manually reset overload relays and shall be interlocked with the main line disconnect so that all anticondensation heaters are de-energized when the main line disconnect is energized; and shall be energized when the main line disconnect is de-energized.

2.3.7 Conduit and Wiring

2.3.7.1 General

All wiring between equipment units or components, except where flexible connections are specified, shall be installed in rigid, steel conduit with threaded conduit fittings and zinc-coated NEMA 4 outlet and pull boxes. Conduit connections to motors, brakes, limit switches, wheel trucks, and other items where flexible connections are required shall be made using short lengths of liquid-tight flexible conduit. The conduit shall be securely mounted and fastened to the crane framework and shall be installed in a neat and workmanlike manner. Change of direction of a conduit run shall be made by means of threaded conduit fittings and the conduit shall be installed to fit close to the crane framework. Conduit unions shall be used where standard couplings cannot be used to join conduits or as required to permit dismantling for shipment. No running threads will be permitted. Ends of conduits shall be carefully reamed.

All threaded connections shall be made up with a compound composed of colloidal copy and rust inhibitors. Separate conduit systems shall be provided for power, control, and lighting circuits. The entire conduit system shall be grounded and shall be installed so that any moisture will be drained from terminal boxes and equipment. All conduit connections to equipment enclosures shall be watertight threaded. Suitable "drain-breather" devices shall be provided at all low points of the conduit system to allow water to escape continuously. The conduit system shall be installed in the shop, complete and ready for installing wire and after inspection shall be dismantled as necessary for shipment to the site.

2.3.7.2 Conduit

- a. Rigid Conduit - Rigid steel conduit shall conform to ANSI C80.1 and shall, in addition, be zinc-coated (galvanized) both inside and outside by the hot-dip method.
- b. Flexible Conduit - Flexible conduit shall conform to CID A-A-55810, shall have a hot-dipped galvanized steel core, copper ground wire, and

a waterproof extruded PVC cover.

2.3.7.3 Insulated Wire and Cable

a. Materials, Construction and Tests - Materials, construction, and tests, unless otherwise specified, shall conform to the applicable requirements of NEMA WC 7 or NEMA WC 8, as applicable. Parts, tables, sections, appendices, grades, and classes specified will refer to the above NEMA standards, unless otherwise stated.

b. Conductors - Conductors shall be annealed copper wire. Copper conductors shall be tin or lead alloy coated, or bare, as required by the type of insulation used. All conductors shall have class B or C standing. Solid conductors will not be permitted.

c. Insulation

(1) Material

Insulation shall be a cross-linked polyethylene meeting the dimensional, electrical, and physical requirements of Part 3 of NEMA WC 7 or NEMA WC 8. Type I or Type II grade of EPR insulation shall be used for single-conductor cables with a jacket and for the individual conductors of a multiple-conductor cable with an overall jacket.

(2) Insulation Thickness

Insulation thickness shall be as required by Table 3-1, Part 3 of NEMA WC 7 or NEMA WC 8 as applicable, for rated circuit voltage of 0-600 volts. Single-conductor cross-linked polyethylene insulated cables with Column A thickness only will be permitted without a jacket. Single-conductor ethylene-propylene-rubber insulated conductors with Column A thickness will not be permitted.

d. Type - Unless otherwise specified or approved, all wire and cable for power, control, and lighting shall be single conductor.

e. Jackets - An outer jacket of a synthetic thermosetting material shall be applied over multiple-conductor cables. Single-conductor cables and individual conductors of a multiple-conductor cable may have a jacket. The jacket shall be tightly and concentrically formed around the core of the cable. Single-conductor cables shall have jackets when insulation thickness is in accordance with Column B, Table 3-1, Part 3 of NEMA WC 7 or NEMA WC 8. The jacket shall be a synthetic thermosetting compound and shall conform to one of the following:

(1) Heavy-duty black neoprene in accordance with paragraph 4.4.3 of NEMA WC 8.

(2) Heavy-duty black chlorosulfonated polyethylene in accordance with paragraph 4.4.9 of NEMA WC 8.

f. Dimensional Tolerance - The outside diameter of single-conductor wires and cables shall not vary more than 5 percent from the calculated outside diameter based on the thickness, including tolerance, of the component materials specified.

- g. Wires - Near resistors, wiring exposed to heat shall have flame retardant, heat and moisture resistant insulation, and conform to the requirements of NFPA 70 and the following: Maximum operating temperature for conductors generally shall be 90 degrees C except that maximum operating temperature for internal wiring conductors in resistor cabinets shall be 125 degrees C.
- h. Control Panel Wiring - Control panel wiring shall be stranded copper switchboard wire with 600-volt insulation and except for type SIS shall be coated. The wire shall be AVB or SIS. Hinge wire shall have Class K stranding. Hinge wire shall be used between stationary and hinged equipment and shall be formed in wire loops or bundles at least 600 mm long which shall provide rotation around the longitudinal axis of the conductors.
- i. Festoon System Cable - The connections to the trolley shall be made using type G cables with 75 degrees C, 600-volt insulation and heavy-duty "Neoprene" jacket for the power circuits and type SO cord with 60 degrees C, 600-volt insulation and "Neoprene" jacket for control and lighting circuits. Type G cables and SO cords shall conform to the applicable requirements of NEMA WC 3, Part 7, paragraphs 7.6 and 7.7, respectively. Conductors shall have not less than class H stranding.
- j. Current Carrying Capacity - Wire for power and motor circuits shall have a current carrying capacity of not less than the full-load current of the motor or the circuit but in no case less than No. 10 AWG. Wire for control circuits shall not be smaller than No. 14 AWG. Wires exposed to heat or in resistor cabinets shall be sized as required but in no case less than No. 10 AWG.
- k. Terminations and Continuity - All conductor connections, except for splices in lighting conductors which are made in junction boxes, shall be terminated at terminal studs or terminal blocks using approved indented terminal ring-tongue connectors. All screw terminals shall have lockwashers and all stud terminals shall have contact nuts and either locking nuts or lock washers. Splices will be permitted only in accordance with NFPA 70.

PART 3 EXECUTION

3.1 SHOP ASSEMBLY AND TESTS

The hoists, trolleys, trolley drives (AM#3) shall be shop assembled and operated under their own power. Reeving of drums and sheaves will not be required. Permanent wiring except wire which would be disassembled or partly disassembled for shipment shall be installed. Permanent conduit except conduit attached to walkways, ladders, stairs, and machinery housing shall be installed. The gantry structural frame shall be assembled and checked for fit and alignment. The test shall demonstrate that the various parts and components are correctly fabricated, assembled, and fitted. The Contractor shall notify the Contracting Officer 15 days prior to testing operations.

3.2 PREPARATION FOR SHIPMENT

After completion of the shop tests, the crane shall be match-marked and prepared for shipment with electrical connections tagged. Four copies of a

diagram of match-marks shall be furnished. All parts and equipment at the site shall be protected from weather, damage, abuse, and loss of identification.

3.3 ERECTION

Erection shall be in accordance with the manufacturer's instructions. (AM#1)

3.3.1 Erection Procedures

Major components of the crane shall be shop assembled as completely as possible. The erection procedures shall ensure that the crane is erected without initial stresses, forced or improvised fits, misalignments, nicks of high-strength structural steel components, stress-raising welds, and rough burrs. After the crane is erected, any damaged painted surfaces shall be cleaned and repainted. After erection is complete, the equipment shall be serviced. All necessary grease and oil of approved quality and grade for the initial servicing and field test shall be provided by the Contractor.

3.3.2 Mechanical Alignment

All motors, couplings, brakes gear boxes, and drive components shall be aligned when reinstalled, in accordance with manufacturer's instructions.

3.3.3 Electrical Alignment

The control system shall be aligned in accordance with manufacturer's instructions. Alignment data shall include timer settings, resistor tap settings, potentiometer settings, test point voltages, supply voltages, motor voltages, motor currents, and test conditions such as ambient temperature, motor load, date performed, and person performing the alignment. A copy of the final alignment data shall be stored in control panel door.

3.4 ACCEPTANCE TESTING

3.4.1 Crane Test

The Contractor shall provide all personnel necessary to conduct the tests including but not limited to crane operators, riggers, rigging gear, and test weights. Testing shall be performed in the presence of Contracting Officer. The Contractor shall notify the Contracting Officer 15 days prior to testing operations.

3.4.1.1 Test Sequence

The crane shall be tested according to the applicable paragraphs of this procedure in the sequence provided.

3.4.1.2 Test Data

Operating and startup current measurements shall be recorded for electrical equipment (motors and coils) using appropriate instrumentation. Speed measurements shall be recorded as required by the facility evaluation tests (normally at 100 percent load). Recorded values shall be compared with design specifications or manufacturer's recommended values; abnormal

differences shall be explained in the remarks and submitted for approval or appropriate adjustments performed. In addition, high temperatures or abnormal operation of any equipment or machinery shall be noted, investigated, and corrected. Hoist, trolley, and gantry speeds should be recorded during each test cycle.

3.4.1.3 Equipment Monitoring

During the load test, improper operation or poor condition of safety devices, electrical components, mechanical equipment, and structural assemblies shall be monitored. Observed defects critical to continued testing shall be reported immediately to the Contracting Officer, and testing shall be suspended until the deficiency is corrected. During and immediately following each load test, the following inspections shall be made:

- a. Inspect for evidence of bending, warping, permanent deformation, cracking, or malfunction of structural components.
- b. Inspect for evidence of slippage in wire rope sockets and fittings.
- c. Check for overheating in brake operation; check for proper stopping. All safety devices, including emergency stop switches and POWER OFF pushbuttons, shall be tested and inspected separately to verify proper operation of the brakes.
- d. Check for abnormal noise or vibration and overheating in machinery drive components.
- e. Check wire rope sheaves and drum spooling for proper operation, freedom of movement, abnormal noise, or vibration.
- f. Check electrical drive components for proper operation, freedom from chatter, noise, or overheating.
- g. Inspect external gears for abnormal wear patterns, damage, or inadequate lubrication.

3.4.1.4 Hooks

Hooks shall be measured for hook throat spread before and after load test. A throat dimension base measurement shall be established by installing two tram points and measuring the distance between these tram points (to within 0.4 mm). This base dimension shall be recorded. The distance between tram points shall be measured before and after load test. An increase in the throat opening by more than 1 percent from the base measurement shall be cause for rejection.

3.4.2 No-Load Testing

3.4.2.1 Hoist Operating and Limit Switch Test

The load hook shall be raised and lowered through the full range of normal travel at rated speed and other speeds of the crane. The load hook shall be stopped below the geared limit switch upper setting. In slow speed only, proper operation of upper and lower limit switches shall be verified. The test shall be repeated a sufficient number of times (minimum of three) to demonstrate proper operation. Brake action shall be tested in each

direction. The proper time delay shall be verified between the actuation of the dual brakes.

3.4.2.2 Trolley Travel

The trolley shall be operated the full distance of the gantryrails exercising all drive speed controls in each direction. Brake operation shall be verified in each direction. In slow speed the trolley bumpers shall contact the trolley stops located on the gantrygirders.

3.4.2.3 deleted (AM#3)

3.4.2.4 Hoist Loss of Power No-Load Test

The hooks shall be raised to a height of approximately 3.5 m or less. While slowly lowering the hook, the main power source shall be disconnected verifying that the hook will not lower and that both brakes will set.

3.4.2.5 Travel Loss of Power No-Load Test

With the hook raised to clear obstructions and the trolley traveling in slow speed, the main power source shall be disconnected verifying that the trolley will stop and that the brake will set. (AM#3)

3.4.3 Load Test

3.4.3.1 Hoist

Unless otherwise indicated, the following tests shall be performed using a test load of 125 percent of rated load.

a. Hoist Static Load Test: Holding brakes and hoisting components shall be tested by raising the test load approximately 900 mm and manually releasing one of the holding brakes. The load shall be held for 10 minutes. The first holding brake shall be reapplied and the second holding brake released. The load shall be held for 10 minutes. Any lowering that may occur indicates a malfunction of the brakes or lowering components.

b. Dynamic Load Test: The test load shall be raised and lowered at each speed through the full operating range. The machinery shall be completely stopped at least once in each direction to ensure proper brake operation.

c. Hoist Load Brake: With test load raised approximately 1.5 m and with the hoist controller in the neutral position, the holding brake shall be released. The load brake shall be capable of holding the test load. With the holding brake in the released position, the test load shall be lowered (first point) and the controller shall be returned to OFF position as the test load lowers. The load brake shall prevent the test load from accelerating.

d. Hoist Loss of Power Test: After raising the test load to approximately 2.5 m, begin slowly lowering the test load, the main power source and the control pushbutton shall be released verifying that the test load will not lower and that both brakes will set.

e. Trolley Dynamic Load Test: While operating the trolley the full

distance of the gantry rails in each direction with test load on the hook (one cycle), the proper function of all speed control points and proper brake action shall be tested.

f. delete (AM#3)

3.4.3.2 Trolley (AM#3) Loss of Power Test

Using a test load of 100 percent of rated load, the load shall be raised clear of any obstructions on the operating floor. Starting at a safe distance from walls or other obstructions, a slow speed shall be selected using the trolley and gantry drive. While maintaining a safe distance to obstructions, the main power source shall be disconnected and the brakes shall be verified to have set and that the equipment stops within the distance recommended by the manufacturer.

3.5 FRAMED INSTRUCTIONS

Framed instructions under acrylic plastic or in laminated plastic, including wiring and control diagrams showing the complete layout of the entire system, shall be posted where directed. Condensed operating instructions explaining preventive maintenance procedures, methods of checking the system for normal safe operation, and procedures for safely starting and stopping the system shall be prepared in typed form, framed as specified above for the wiring and control diagrams, and posted beside the diagrams. The framed instructions shall be posted before acceptance testing of the systems.

3.6 MANUFACTURER'S SERVICES

Services of a manufacturer's representative who is experienced in the installation, adjustment, erection, and operation of the equipment specified shall be provided. The representative shall supervise the installation, adjustment, and testing of the equipment.

3.7 FIELD TRAINING

A field training course shall be provided for designated operating staff members. Training shall be provided for a total period of 8 hours of normal working time and shall start after the system is functionally complete but prior to final acceptance tests. Field training shall cover all of the items contained in the operating and maintenance instructions. The Contracting Officer shall be given at least 2 weeks advance notice of such training.

3.8 SPARE PARTS

One set of manufacturer's recommended spare parts shall be furnished and delivered to the site. The spare parts shall be suitably packaged for long-term protection and storage. The packaging shall be legibly labeled to identify the spare parts. A list of the furnished spare parts shall be included in the Maintenance manual.

-- End of Section --