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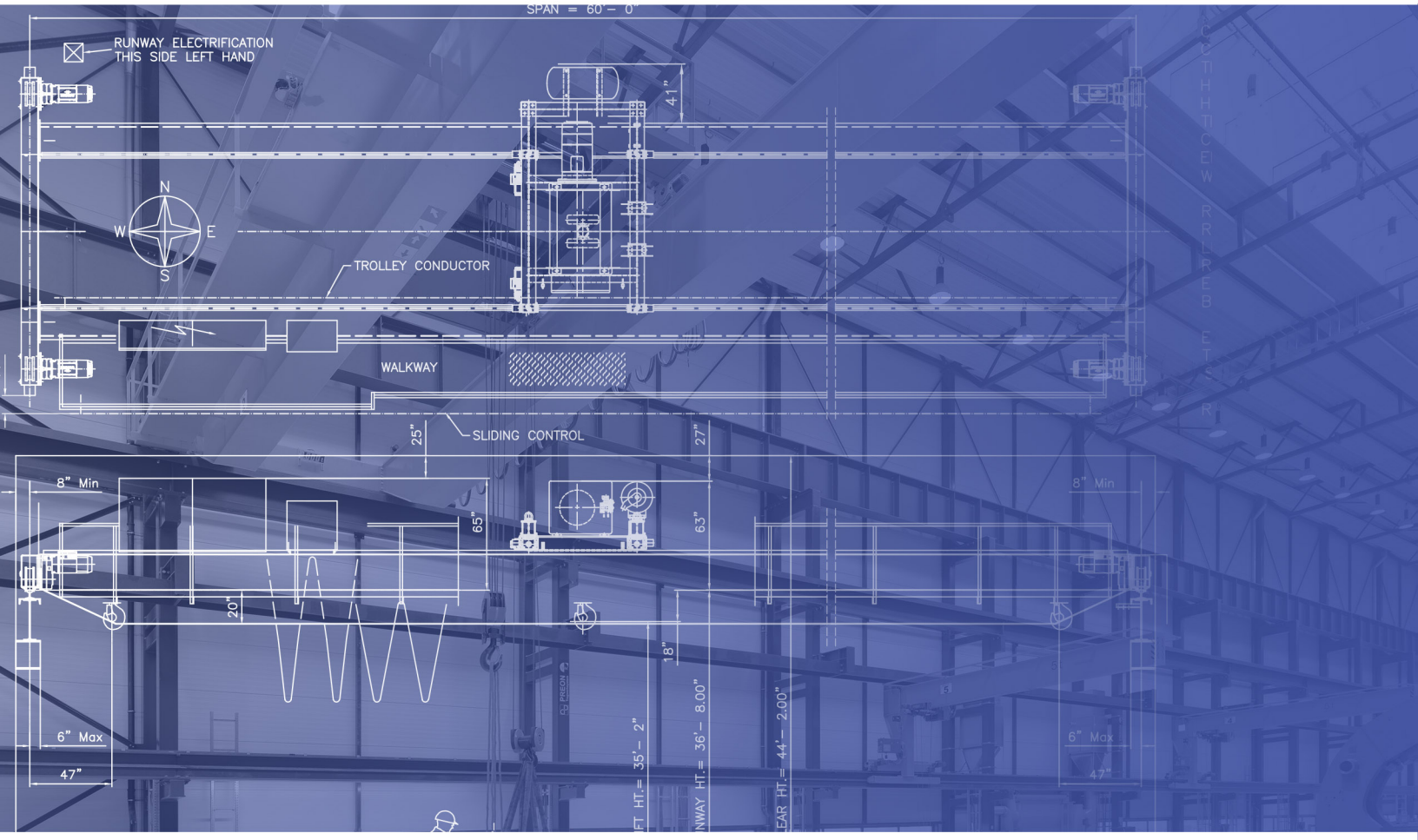

CMAA Specification No. 70 - 2020

MULTIPLE GIRDER CRANES

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CMAA SPECIFICATION NO. 70-2020
SPECIFICATIONS FOR TOP RUNNING BRIDGE AND GANTRY TYPE MULTIPLE GIRDER ELECTRIC OVERHEAD TRAVELING CRANES

INTRODUCTION

This Specification has been developed by the Crane Manufacturers Association of America, Inc. (CMAA), an organization of leading electric overhead traveling crane manufacturers in the United States, for the purpose of promoting standardization and providing a basis for equipment selection. The use of this Specification should not limit the ingenuity of the individual manufacturer but should provide guidelines for technical procedure.

In addition to Specifications, the publication contains information which could be helpful to the purchasers and users of cranes and to the engineering and architectural professions. While much of this information must be of a general nature, it may be checked with individual manufacturers, and comparisons may be made, leading to the selection of the proper equipment.

These Specifications consist of nine Sections, as follows:

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SUMMARY OF CHANGES SINCE THE 2015 REVISION OF SPECIFICATION #70

Article 1.4.2	Runway rail cleanliness
Table 1.4.2-1	Modification of runway rail straightness and elevation
Article 1.4.7, 3.14.1	Wind restraints
Article 1.5, 5.11, 5.12	Runway/bridge conductors combined in one article
Article 1.7	Revision of section
Article 1.7.3	FEA design statement
Article 3.3.2.6.3.2	Addition of in service wind load to collision load case
Article 3.4.7	Addition of load case for fatigue
Article 3.5.1	Bridge girder short depth diaphragms
Article 3.5.4.6, 3.10.1, 3.10.5	Shorter depth diaphragms / Rail bending stress
Article 3.5.5	Deflection and camber
Article 3.6.4	End truck deflection
Article 3.14	Restraint devices
Article 4.4.1	Hoist wire rope angle of loading
Article 4.4.3.2, 4.4.4, 4.5, 4.6.4, 4.6.5	Wire rope D/d ratio
Article 4.6.1, 4.6.3, 4.6.6	Hoist drum design requirement
Article 4.16	Keys and keyways
Article 5.1.6	Added reference to NEC
Article 5.2.1.3.1	Suitable motor design for use with VFD
Table 5.2.7-1, Footnote 4	Modified text
Table 5.2.7-1, Footnote 6	Continuous duty motors on intermittent duty
Article 5.2.8	Indication of motor design
Article 5.2.9.1.1.1	Variable change W to LL for clarity
Article 5.5.6	Dynamic braking resistors in conductive dust
Article 5.2.8	Low slip motor design (across-the-line starting)
Article 5.4.7.5	Practices inside enclosures (new)
Article 5.4.7.6	Practices outside enclosures (new)
Article 5.4.7.7	Suppression devices (new)
Article 5.5.5 & 5.13.2	Removed duplication and changed text
Article 5.5.6	Resistors in conductive dust (new)
Article 5.6.11	Modified text (additional of intentional reset)
Figures 5.7.3c, 5.8.1, 5.15.6	Added recommended layouts for cab, pendant and radio
Article 5.9.4.3	Added text for operation with molten metal
Article 5.13.12	Regenerative power considerations
Article 5.13.13	Application of IEEE 519 for cranes
Article 5.15	Wireless data (new)
Article 5.18	Magnet controls (new)
Article 5.19	Rail clamps (new)
Appendix	Added appendix for non-mandatory crane design information
Glossary	Anchorage
Glossary	Angle of loading
Glossary	Bridge rail
Glossary	Common mode failure
Glossary	Conductive dust
Glossary	Crane rail
Glossary	Critical load drop
Glossary	Drum
Glossary	EMC
Glossary	EMI
Glossary	Girder rail
Glossary	Hazardous locations
Glossary	Intentional reset
Glossary	Magnet
Glossary	Magnet controller
Glossary	Plain Reversing Control changed for Reversing Control
Glossary	Regenerative power system
Glossary	Restraint
Glossary	RFI
Glossary	Runway rail (modified)
Glossary	Trolley rail
Glossary	Modified Undervoltage Protection definition

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1. CMAA assigns an Action Alert Inquiry number to each written inquiry.
2. CMAA immediately forwards the inquiry to the CMAA Engineering Vice President. Based on the nature and substance of the inquiry, the Vice President selects either a non-balloted or balloted response. Non-balloted responses generally will be selected for simple obvious replies and for inquiries to be declined. Inquiries for interpretation of CMAA Specifications will be balloted.
3. Response time for inquiries typically range from one week to one month, if balloted.

This Specification is accompanied by explanatory commentaries.

The commentaries in this Specification are not a part of the Specification and do not constitute a formal interpretation of the Specification (which can be obtained only through requests as indicated above). The commentaries, therefore, solely reflect the personal opinions of the editor or other contributors and do not necessarily represent the official position of CMAA or its technical committees.

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TABLE OF CONTENTS

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70-1 GENERAL SPECIFICATIONS

1.1. SCOPE

1.1.1. This Specification shall be known as the Specifications for Top Running Bridge & Gantry Type Multiple Girder Electric Overhead Traveling Cranes - CMAA Specification No. 70 - Revised 2020.

1.1.2. The Specifications and information contained in this publication apply to top running bridge and gantry type multiple girder electric overhead traveling cranes. It should be understood that the Specifications are general in nature and other Specifications may be agreed upon between the purchaser and the manufacturer to suit each specific installation. **These Specifications do not cover equipment used to lift, lower, or transport personnel suspended from the hoist rope system.**

1.1.3. This Specification outlines in Chapter 70-2 six different classes of crane service as a guide for determining the service requirements of the individual application. In many cases there is no clear category of service in which a particular crane operation may fall, and the proper selection of a crane can be made only through a discussion of service requirements and crane details with the crane manufacturer or other qualified persons.

1.1.4. Service conditions have an important influence on the life of the wearing parts of a crane, such as wheels, gears, bearings, wire rope, and electrical equipment, and must be considered in specifying a crane to assure maximum life and minimum maintenance.

1.1.5. In selecting overhead crane equipment, it is important that not only present, but future operations be considered, which may increase loading and service requirements and that equipment be selected which will satisfy future increased service conditions, thereby minimizing the possibility of overloading or placing in a duty classification higher than intended.

1.1.6. Parts of this Specification refer to certain portions of other applicable Specifications, codes or standards. Where interpretations differ, CMAA recommends that this Specification be used as the guideline. Mentioned in the text are publications of the following organizations:

AGMA — American Gear Manufacturers Association
1001 N. Fairfax Street, Suite 500
Alexandria, VA 22314-1587

- ANSI/AGMA 2001-D04 (R2010) Fundamental Rating Factors and Calculation Methods for Involute Spur and Helical Gear Teeth
- ANSI/AGMA 2000-A88 Gear Classification and Inspection Handbook - Tolerances and Measuring Methods for Unassembled Spur and Helical Gears
- ANSI/AGMA 2015-1-A01 Accuracy Classification System - Tangential Measurements for Cylindrical Gears

AISC — American Institute of Steel Contruction
One East Wacker Drive, Suite 700
Chicago, IL 60601-1802
AISC 9th Edition ASD

AIST — Association for Iron and Steel Technology
186 Thorn Hill Rd
Warrendale, PA 15086

Technical Report TR-01-1991

ANSI — American National Standards Institute
25 West 43rd Street
New York, NY 10036
ANSI ASC A14.3-2008 - Safety Requirements for Fixed Ladders and Workplace Surfaces
ANSI B17.1-1967 - Keys and Keysets
ANSI C84.1-2011 - Electric Power Systems and Equipment Voltage Ratings (60Hz)

ASCE — The American Society of Civil Engineers
1801 Alexander Bell Drive
Reston, VA 20191

- ASCE/SEI 7-10 - Minimum Design Loads for Buildings and Other Structures

ASME — The American Society of Mechanical Engineers
Two Park Avenue
New York, NY 10016-5990

- ASME B30.2-2015 - Overhead & Gantry Cranes (Top Running Bridge, Single or Multiple Girder, Top Running Trolley Hoist)

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ASTM American Society for Testing & Materials
100 Barr Harbor Drive, P.O. Box C700
West Conshocken, PA 19428-2959

AWS American Welding Society
8669 NW 36 Street, #30
Miami, FL 33166-6672
D14.1-97 - Specification for Welding of Industrial and Mill Cranes and other Material Handling Equipment

CMAA Crane Manufacturers Association of America, Inc.
8720 Red Oak Blvd., Suite 201
Charlotte, NC 28217-3996
Overhead Crane Inspection and Maintenance Checklist
Crane Operator's Manual - Specifiction No 79-2012
Crane Operator's Training Video

ECMA Electrification and Controls Manufacturers Association
8720 Red Oak Blvd., Suite 201
Charlotte, NC 28217-3996
ECMA 15-2018 - Specification for Cable-less Controls for Electric Overhead Traveling Cranes
ECMA 25-2019 - Specification for AC Inverters for use on Electric Overhead, Monorail, and Gantry Traveling Cranes
ECMA 35-2018 - Electrification Systems for Electric Overhead Traveling Cranes

IEEE Institute of Electrical and Electronics Engineers
445 Hoes Lane
Piscataway, NJ 08854
IEEE Standard 519-2014 - Recommended Practice and Requirements for Harmonic Control in Electric Power Systems
IEEE Standard 141-1993 - Recommended Practice for Electric Power Distribution for Industrial Plants

NFPA National Fire Protection Association
1 Batterymarch Park
Quincy, MA 02269-7471
NFPA 70 - National Electrical Code, 2014 Edition
NFPA 780 - Standard for the Installation of Lightning Protection Systems

NEMA National Electrical Manufacturers Association
1300 North 17th Street, Suite 900
Arlington, VA 22209
ICS 1-2000 (R2005, R2008) - Industrial Control Systems and Electrical Requirements
NEMA MG-1-2011 - Motors and Generators

OSHA U.S. Department of Labor
Directorate of Safety Standards Programs
200 Constitution Avenue, N.W.
Washington, DC 20210
29 CFR Part 1910 - Occupational Safety & Health Standards for General Industry (Revised 7/1/97)
Peterson's Stress Concentration Factors
Walter D. Pilkey OR Walter D. Pilkey & Deborah F. Pilkey
2nd Edition; 1997 3rd Edition; 2008
Copyright John Wiley & Sons, Inc.

1.2. BUILDING DESIGN CONSIDERATIONS

1.2.1. The building in which an overhead crane is to be installed must be designed with consideration given to the following points:

1.2.1.1. The distance from the floor to the lowest overhead obstruction must be such as to allow for the required hook lift, plus the distance from the saddle or palm of the hook in its highest position to the high point on the crane, plus clearance to the lowest overhead obstruction.

1.2.1.2. In addition, the distance from the floor to the lowest overhead obstruction must be such that the lowest point on the crane will clear all machinery or when necessary provide railroad or truck clearance under the crane.

1.2.1.3. After determination of the building height, based on the factors above, the crane runway must be located with the top of the runway rail at a distance below the lowest overhead obstruction equal to the height of the crane plus clearance.

1.2.1.4. Lights, pipes, or any other objects projecting below the lowest point on the building truss must be considered in the determination of the lowest overhead obstruction.

1.2.1.5. The building knee braces must be designed to permit the required hook approaches.

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1.2.1.6. Access to the cab or bridge walkway should be a fixed ladder, stairs, or platform requiring no step over any gap exceeding 12 inches. Fixed ladders shall be in conformance with ANSI ASC A14.3-2008 – Safety Requirements for Fixed Ladders and Workplace Surfaces.

1.3. CLEARANCE

1.3.1. Clearance shall be maintained between the crane and the building, as well as cranes operating at different elevations, under all normal operating conditions. In the design of new cranes, all factors that influence clearance, such as roof / ceiling deflection, girder camber, trolley positions and configurations shall be considered. As a minimum, the clearance between the highest point of the crane and the lowest overhead obstruction shall not be less than 3 inches with the crane unloaded. Pipes, conduits, lights, etc., must not reduce this clearance.

1.3.2. Clearance shall be maintained between the crane and the building, as well as parallel running cranes, under all normal operating conditions. In the design of new cranes, all factors that influence clearance, such as wheel float, bridge skewing, or trolley positions and configurations shall be considered. As a minimum, the clearance between the end of the crane and the closest side obstruction shall not be less than 2 inches with crane centered on runway rails. Pipes, conduits, lights, etc., must not reduce this clearance.

1.3.3. Where passageways or walkways are provided on the structure supporting the crane, obstructions on the supporting structure shall not be placed so that personnel will be struck by movement of the crane. The accuracy of building dimensions is the responsibility of the owner or specifier of the equipment.

1.4. CRANE RUNWAY

1.4.1. The crane runway, runway rails, and crane stops are typically furnished by the purchaser unless otherwise specified. The crane stops furnished by the purchaser are to be designed to suit the specific crane to be installed.

1.4.2. Rails shall be straight, parallel, free of paint on the wheel running surface, level, at the same elevation and at the specified center to center distance, within the tolerances given in Table 1.4.2-1.

1.4.3. The runway rails should be standard rail sections, or other commercial rolled section of equivalent specifications and of a proper size for the crane. Rail sizes shall be selected in accordance with Section 4.13.3.

1.4.4. Crane rail splices shall be bolted or welded. Rail joints on opposite sides of the runway should be staggered. Properly selected hold-down devices shall be used to anchor the rail to the runway. Lateral “floating” type rail fastening is not recommended.

1.4.5. Rail joint misalignment can be a significant factor in wheel, axle, and bearing failures. It is recommended that horizontal rail separation at joints not exceed $1/16$ inch. Vertical and horizontal alignment at joints should be maintained as closely as possible. Rail joints should be ground flush as necessary to provide a smooth transition from each rail segment to the next.

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