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CHAPTER 1
Introduction

1.1 Purpose. This manual provides guidance for the mechanical and electrical design of navigation lock and spillway gate operating and control systems for both new construction and the rehabilitation of existing projects. Operation, maintenance and inspection information as it relates to equipment design and layout, is also provided.

1.2 Applicability. This manual applies to all HQUSACE elements, major subordinate commands, districts, laboratories, and field operating activities having responsibilities for the design and construction of civil works projects.

1.3 References. References are provided in Appendix A; terms and definitions are provided in the Glossary.

1.4 Distribution. This publication is approved for public release; distribution is unlimited.

1.5 Plates. Illustrative plates containing general layout information, typical details, design data are included in Appendix B. Sample computations are provided in Appendix C.

1.6 General. The lock gate operating equipment information presented in this document is a revision of the information previously presented in the 30 June 1994 version of EM 1110-2-2703. Additionally, this manual provides engineering and design information about computer control systems for locks and different types of gate operating equipment for spillways. The information presented herein is, for the most part, based on many years of actual experience of similar equipment and systems currently in use. The only exceptions are the information presented for the hydraulic cylinder operated wicket gate and the hinged crest gate. The wicket gate information is based on a full-scale test facility built to test different materials and operating arrangements, see report titled "Results of the Olmsted Hydraulic Operated Wicket Dam" for additional information. Information about the hinged crest gate came from Montgomery Point Lock and Dam, a recently (with respect to the publication date of this document) constructed project.

1.6.1 Types of gate operating equipment.

1.6.1.1 Miter Gate Operating Equipment. Four types of miter gate operating equipment for lock application are presented; Panama Canal linkage, Modified Ohio linkage, Ohio linkage and direct
connected linkage (hydraulic cylinder actuated). Although a discussion of all four types is presented, this manual recommends the Ohio and direct connected linkages. Miter gate description and design information is presented in EM 1110-2-2703.

1.6.1.2 Sector Gate Operating Equipment. A general discussion and design criteria for three types of sector gate operating equipment for lock application are presented. They are wire rope and drum, rack and pinion and direct acting hydraulic cylinder. Sector gate description and design information is presented in EM 1110-2-2703.

1.6.1.3 Tainter Gate Operating Equipment. Tainter gate operating equipment presented includes direct connected hydraulic cylinder, wire rope and electric motor driven gear sets for typical and submergible gate types, round link chain with pocket wheel or grooved drum, and Engineering Steel Chain. Tainter gate description and design information is presented in EM 1110-2-2702.

1.6.1.4 Vertical Lift Gate Operating Equipment. The operating machinery description and design requirements for vertical lift gates is provided for both lock and spillway gates. The type of equipment includes wire rope and electric motor driven gear sets, direct connected hydraulic cylinder, and a screw stem hoist operated by an electric motor driven, torque limiting gear set. Vertical lift gate description and design information is presented in EM 1110-2-2701.

1.6.2 Control systems. Chapter 4 presents detailed information on PLC based control systems. This information provides the means to develop control systems for new projects and for the replacement and upgrading of existing systems. It is written for lock application but much of the same technology and design information can be adapted to other Corps civil works projects.

1.6.3 Relationship to Other Manuals. If information presented in this manual conflict with other engineering manuals, this manual takes precedence.

1.6.4 Coordination. Design of gate operating and control equipment for locks and spillways is a team effort. The planning, design, selection and layout should be coordinated among all the disciplines involved. This includes but is not limited to architectural, structural, H&H, mechanical and electrical. In addition to the design features that are normally coordinated, e.g., equipment anchoring, gate opening and closing rate, etc, life safety issues such as fire protection, access, egress, fire detection and alarm, and security should be included in the design process. The design team should also include operations and construction personnel, and contracting specialists if a supply contract will be the procurement method.

1.7 Mandatory Requirements. This manual provides guidance for the protection of U.S. Army Corps of Engineers (USACE) structures. In certain cases guidance requirements, because of its criticality to project safety and performance, are considered to be mandatory as discussed in ER 1110-2-1150. Those cases will be identified as “mandatory”.