SPECIAL SPECIFICATION

A9001

Hardened Ethernet Switch

1. **Description.** Furnish, install, and make fully operational a Hardened Ethernet Switch at designated locations as shown on the plans and as detailed in accordance with these specifications. Use the same manufacturer and model for each Hardened Ethernet Switch.

2. **Materials.** Provide a Hardened Ethernet Switch unit that meets the following requirements.

   A. **General Requirements.** Provide only equipment that is new, corrosion resistant and in strict accordance with the details shown on the plans and in the specifications.

   B. **Ethernet Port Configuration.** Provide a Hardened Ethernet Switch with four Ethernet ports that have the following features:

   - 10/100Base-TX
   - RJ-45 female connector
   - Automatic and user-selectable speed setting
   - Automatic and user-selectable half/full duplex setting
   - Non-blocking full wire-speed forwarding rate
   - Drives up to 100 m of Category 3, 4, or 5 unshielded twisted-pair (UTP) cable at 10 Mbps
   - Drives up to 100 m of Category 5 UTP cable at 100 Mbps
   - Minimum of 4K Media Access Control (MAC) addresses
   - Minimum of 2 MB buffer memory
   - MAC-based trunking
   - Port Mirroring

   C. **Protocols Supported.** Provide a Hardened Ethernet Switch that supports the following protocols:

   - Institute of Electrical and Electronic Engineers (IEEE) 802.3
   - IEEE 802.3u
   - IEEE 802.3x Flow Control
   - IEEE 802.1Q Virtual Local Area Network (VLAN) Tagging
   - IEEE 802.1D Spanning Tree Algorithm
   - IP Multicast Filtering through Internet Group Management Protocol (IGMP) version 2 snooping

D. **Management:** Provide a Hardened Ethernet Switch that provides the following management capabilities:

- Hyper Text Transport Protocol (HTTP)/Web Browser device configuration interface
- Telnet device configuration interface
- Allow multiple simultaneous management sessions or automatically terminate existing session when a new session is requested
- Simple Network Management Protocol (SNMP) version 2 device status, diagnostic, and alarm monitoring and remote configuration
- Remote Monitoring (RMON) network monitoring
- Trivial File Transfer Protocol (TFTP) remote firmware upgrades
- Request for Comments (RFC)-1213-compliant Management Information Base (MIB) files
- Standard and device specific MIB2 files
- Command Line Interface (CLI)

E. **Regulatory Approvals.** Provide a Hardened Ethernet Switch that has been certified to the following regulatory standards:

- Product Safety: Underwriters Laboratories (UL) Standard 1950 or 60950
- Electromagnetic Emissions: Federal Communications Commission (FCC) Part 15, Class A
- National Electrical Manufacturers Association (NEMA) TS-1/2

F. **Operating Power:** Provide a Hardened Ethernet Switch that is designed to operate with the following power requirements:

- 120 V AC
- 60 Hz
- 15 W maximum power consumption

G. **Environmental.** Provide a Hardened Ethernet Switch that is designed to operate in the following environmental conditions:

- -30°C to 70°C operating temperature range
- -45°C to 90°C storage temperature range
- 10% to 95% relative humidity (non-condensing)

3. **Construction Methods.**

A. **General.** Provide equipment that utilizes the latest available techniques for design and construction with a minimum number of parts, subassemblies, circuits, cards, and modules to maximize standardization and commonality.

Design the equipment for ease of maintenance. Provide component parts that are readily accessible for inspection and maintenance. Provide test points that are for checking essential voltages and waveforms.

B. Electronic Components. Provide electronic components in accordance with Special Specification, "Electronic Components".

C. Mechanical Components. Provide external screws, nuts and locking washers that are stainless steel; no self-tapping screws will be used.

Provide parts made of corrosion resistant material, such as plastic, stainless steel, anodized aluminum or brass.

Protect materials from fungus growth and moisture deterioration.

Separate dissimilar metals by an inert dielectric material.

4. **Documentation Requirements.** Provide five complete sets of operation and maintenance manuals. Include the following:

- Complete and accurate schematic diagrams.
- Complete installation procedures.
- Complete performance specifications (functional, electrical, mechanical and environmental) on the unit.
- Complete parts list including names of vendors for parts not identified by universal part number such as JEDEC, RETMA, or EIA.
- Pictorial of component layout on circuit board.
- Complete maintenance and trouble-shooting procedures.
- Complete stage-by-stage explanation of circuit theory and operation.

5. **Testing Requirements.** It is the policy of the Texas Department of Transportation to require performance testing of all materials and equipment not previously tested and approved. If technical data are not considered adequate for approval, samples may be requested for test by the Engineer. The contract period will not be extended for time loss or delays caused by testing prior to final Texas Department of Transportation approval of any items.

The equipment referenced to this specification is subject to Design Approval Tests and Factory Demonstration Tests at the equipment manufacturer's facility to determine conformance with all the specification requirements except that the Engineer may accept certification by an independent testing laboratory in lieu of the design Approval Tests, to verify that the Design Approval Tests have previously been satisfactorily completed. The Contractor must arrange for and conduct the tests in accordance with the specification requirements stated herein.

Unless otherwise specified, the Contractor is responsible for satisfying all inspection requirements prior to submission for the Texas Department of Transportation's inspection and acceptance. The Engineer reserves the right to have his/her representative witness all Design Approval Tests and Factory Demonstration Tests.

Compare the results of each test with the requirements specified herein. Failure to conform to the requirements of any test shall be counted as a defect, and equipment shall be subject to rejection by the Engineer. Rejected equipment may be offered for retest provided all non-compliances have been corrected and retested by the Contractor and evidence thereof submitted to the Engineer.

6. **Warranty.** Guarantee that equipment furnished and installed for this project will perform according to the manufacturer's published specifications. Warrant equipment against defects and/or failure in design, materials and workmanship in accordance with the manufacturer's standard warranty. Assign to the Department all manufacturers' normal warranties or guarantees on all electronic, electrical, and mechanical equipment, materials, technical data, and products furnished for and installed on the project. Repair or replace defective equipment, at the manufacturer's option, during the warranty period at no cost to the Department. Provide equipment with 95% of the manufacturer's standard warranty remaining on the date that equipment invoices are submitted by the Contractor for payment. Any equipment with less than 95% of its warranty remaining will not be accepted by the Department.

7. **Experience Requirements.** Personnel involved in the installation and testing of the "Hardened Ethernet Switch" must meet the following requirements:

   - Three years experience in the installation and testing of Ethernet Switches.
   - Two installed systems where Ethernet Switches, as described within these specifications, are installed and the systems have been in continuously satisfactory operation for at least 2 years.
   - One system with Ethernet Switches (which may be one of the two in the preceding paragraph) which the Contractor can arrange for demonstration to the Engineer and/or his representatives.

8. **Training.** Conduct a training class (minimum of 4 hours) for up to 2 representatives designated by the Town of Addison on procedures of installation, operations, testing, maintenance and repair of all equipment specified within these specifications. Submit to the Engineer for approval 10 copies of the training material at least 30 days before the training begins. Conduct training within the local area unless otherwise authorized by the Engineer.

9. **Measurement.** This Item will be measured as each unit furnished, installed, and tested.

10. **Payment.** The work performed and materials furnished in accordance with this Item and measured as provided under "Measurement" will be paid for at the unit price bid for "Hardened Ethernet Switch". This price is for equipment, cables and connectors; documentation and testing; and labor, materials, warranty, training and incidentals.