

# Special Specification 6153

## Hardened Ethernet Switch



### 1. DESCRIPTION

Furnish and install Hardened Ethernet Switch (HES) at designated locations as shown on the plans, as detailed in accordance with these specifications, and as directed. Provide all HES from the same manufacturer.

### 2. MATERIALS

2.1. **General Requirements.** Provide all new equipment in strict accordance with the details shown on the plans and in the specifications.

Provide a high-performance, modular hardened Ethernet switch to support standard Ethernet, and Fast Ethernet connectivity. Ensure dedicated bandwidth to the desktop and guarantees that each end-user receives a full 10 or 100 Mbps connection, as configured, enabling applications to operate reliably, and with low latency.

Include licenses for all equipment, where required, for any software or hardware in the system.

2.2. **Adherence to Standards.** Furnish, assemble, fabricate, or install HES under this item that is in compliance with the following:

- IEEE 802.3, 802.3u, 10BASE-T, 100BASE-TX, 100BASE-FX
- Auto-sensing for speed: IEEE 802.3u
- UL, cUL, FCC and CE

2.3. Functional Requirements.

2.3.1. **Physical Design Requirements.** Ensure HES physical design conforms to the following requirements:

- For HES Type 1 provide 2 built-in 100 MB full-duplex switched multi-mode fiber ports, coupled with 6 switched 10/100 MB copper (RJ 45) ports all in 1 compact rugged unit.
- For HES Type 2 provide 2 built-in 100 MB full-duplex switched single-mode fiber ports, coupled with 6 switched 10/100 MB copper (RJ 45) ports all in 1 compact rugged unit.
- Ensure daisy-chainable for a fiber optic Ethernet network.
- Designed to operate in abnormal temperature applications, and are suitable for use in harsh environments with inhospitable high and low temperatures.
- Ease to install and use. Addresses of attached nodes are automatically learned and maintained, adapting the switching services to network changes and expansions.
- Ensure plug-and-play installation, and operation is transparent to software.
- Ensure unit has high-strength 18-gauge steel enclosure to seal out insects, dirt, smoke, and other contaminants. Ensure steel enclosure operates as heat sinks, drawing heat away from internal components.
- Identify clearly all modules and assemblies with name, model number, serial number, or any other pertinent information required to facilitate equipment maintenance.

2.3.2. **Electrical and Mechanical Requirements.** Provide the following functionality and features:

- Parts Performance:

- Fiber, and when an auto-negotiating port is operating at 100 Mbps: Data Rate: 100 Mbps.
- RJ-45 auto-negotiating port is operating at 10 Mbps: Data Rate: 10 Mbps.
- Packet-Processing Between Domains:
  - Filtering and forwarding rate from 100 Mbps ports: 148,800 pps max.
  - Filtering and forwarding rate from 10 Mbps ports: 14,880 pps max.
  - Processing type: store and forward.
  - Auto-learning: 16K address table, shared for all traffic domains.
  - Packet buffers: 1.0 Mb, dynamically shared on all domains.
  - Latency (not include packet time): 100 to 10 Mbps and 10 to 100: < 15 microsecond.
- Path Delay Value: 50 BT on all ports.
- Network Cable Connectors:
  - Six RJ-45 shielded female ports.
  - Two fiber ports. For HES Type 1 provide multi-mode. For HES Type 2 provide single-mode.
  - 100 Mbps: Category 5 UTP/STP; Fiber: 62.5/125 micron multimode fiber with SC connectors for HES Type 1. (8.0-8.3)/125 micron singlemode fiber with SC connectors for HES Type 2.
  - 10 Mbps: Category 3, 4, 5 UTP (Auto-sensing).
- Full-duplex/Half-duplex on copper (RJ-45) switched ports:
  - All the RJ-45 ports support full/half duplex and 10/100 speed, each independently auto-negotiating.
  - The switched fiber ports must be fixed at full-duplex only, 100 MB speed.
- Mean Time Between Failure: > 10 years.
- LED Indicators: 1 LED for power, 3 LEDs per port for speed, link activity, full- or half-duplex.
- Power Requirements: The Hardened Ethernet Switch furnished, assembled, fabricated, or installed under this Item must meet all of its specified requirements when the input power is 115 VAC  $\pm$ 10%, 60  $\pm$ 3 Hz.
  - AC power connector: IEC-type, male recessed at rear of power supply chassis.  
 Input Voltage: 85 to 260 VAC (auto-ranging).  
 Input Frequency: 47 to 63 Hz (auto-ranging).  
 Power Consumption: 15 watts typical.  
 Power Supply Rating: 3 amps at 5 VDC.  
 Input Fuse for overload and short protection: 3 AG type, 0.5 amp.  
 Power Capacity: 15 watts output, 70% min efficiency.  
 Surge Protection: Over 150 joules, with clamping at 800V 50A min.  
 Operating Shock and Vibration: Meets Bellcore GR-63-CoreSections 4.4.1 and 4.4.3.

Provide equipment operations that are not affected by the transient voltages, surges and sags normally experienced on commercial power lines. Check the local power service to determine if any special design is needed for the equipment. The extra cost, if required, must be included in the bid of this item.

- Wiring: Provide wiring that meets the requirements of the National Electric Code. Provide wires that are cut to proper length before assembly. Provide cable slacks to facilitate removal and replacement of assemblies, panels, and modules. Do not double-back wire to take up slack. Lace wires neatly into cable with nylon lacing or plastic straps. Secure cables with clamps. Provide service loops at connections.
- Transient Suppression: Provide DC relays, solenoids and holding coils that have diodes or other protection devices across the coils for transient suppression.
- Power Service Protection: Provide equipment that contains readily accessible, manually resettable or replaceable circuit protection devices (such as circuit breakers or fuses) for equipment and power source protection.

Provide and size circuit breakers or fuses such that no wire, component, connector, PC board or assembly must be subjected to sustained current in excess of their respective design limits upon the failure of any single circuit element or wiring.

- Fail Safe Provision: Provide equipment that is designed such that the failures of the equipment must not cause the failure of any other unit of equipment.

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### 3. CONSTRUCTION

- 3.1. **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.
- 3.2. **Electronic Components.** Provide electronic components in accordance with Special Specification 6006, "Electronic Components."
- 3.3. **Mechanical Components.** Provide external screws, nuts and locking washers that are stainless steel; no self-tapping screws with 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.
- 3.4. **Documentation Requirements.** Provide documentation in accordance with Special Specification 6005, "Testing, Training, Documentation, Final Acceptance, and Warranty."
- 3.5. **Testing.** Perform testing in accordance with Special Specification 6005, "Testing, Training, Documentation, Final Acceptance, and Warranty."
- 3.6. **Experience Requirements.** The Contractor or designated subcontractors involved in the installation and testing of the Ethernet equipment must, as a minimum, meet the following requirements:
- Three year experience in the installation of Ethernet equipment.
  - Two installed systems where Ethernet switches are installed and the systems have been in continuously satisfactory operation for at least 2 yr. The Contractor must submit as proof, photographs or other supporting documents, and the names, addresses and telephone numbers of the operating personnel who can be contacted regarding the system.
  - Provide necessary documentation of subcontractor qualifications pursuant to contract award.
- 3.7. **Technical Assistance.** Ensure that a manufacturer's technical representative is available on site to assist the Contractor's technical personnel at each installation site and with Ethernet equipment installation and communication system configuration.
- Do not execute the initial powering up of the Ethernet equipment without the permission of the manufacturer's representative.
- 3.8. **Training.** Provide training in accordance with Special Specification 6005, "Testing, Training, Documentation, Final Acceptance and Warranty."
- 3.9. **Warranty.** Provide a warranty in accordance with Special Specification 6005, "Testing, Training, Documentation, Final Acceptance and Warranty."

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**4. MEASUREMENT**

This Item will be measured as each unit furnished, installed, made fully functional and tested in accordance with these Special Specifications or as directed by the Engineer.

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**5. 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 each "Hardened Ethernet Switch Type 1" or "Hardened Ethernet Switch Type 2." This price will include all equipment described under this Item with all cables and connectors; all documentation and testing and must also include the cost of furnishing all labor, materials, software, warranty, training, equipment, and incidentals.