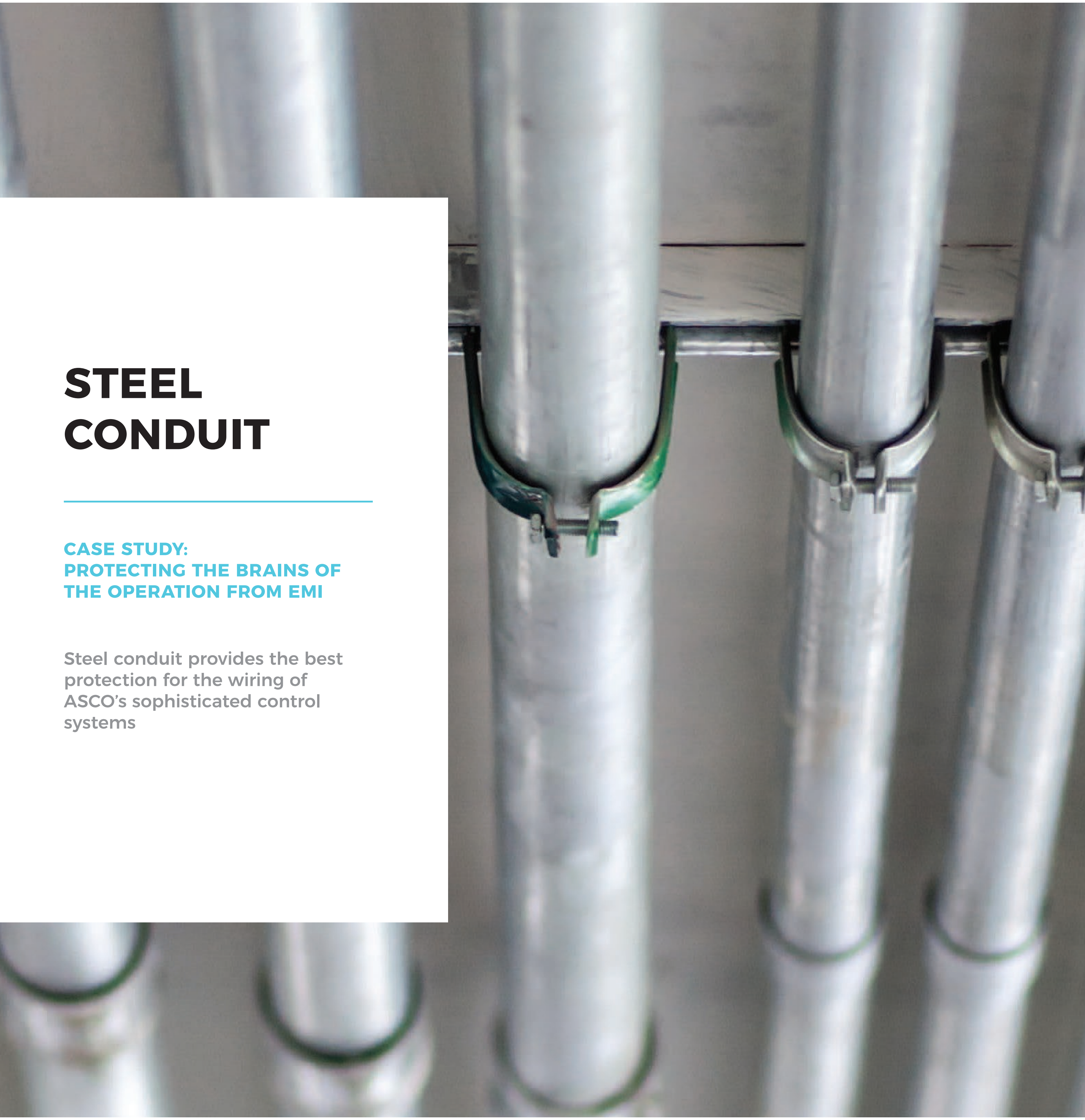
STEEL TUBE INSTITUTE



STEEL CONDUIT

CASE STUDY: PROTECTING THE BRAINS OF THE OPERATION FROM EMI

Steel conduit provides the best protection for the wiring of ASCO's sophisticated control systems

ASCO, A LARGE DATA PROCESSING FIRM, RECENTLY LEARNED THAT STEEL CONDUIT PROVIDES EXCELLENT PROTECTION FOR THE WIRING OF SOPHISTICATED CONTROL SYSTEMS.

ASCO, a large data processing firm, recently learned that steel conduit provides excellent protection for the wiring of sophisticated control systems. It shields the control circuits from electromagnetic interference (EMI) from nearby power conductors that can induce current, causing them to operate improperly.

The company's new processing center was equipped with five Caterpillar 3416B, 2 MVA standby generators. All control and power conductors linking the generators with switchgear and control cabinets were installed in PVC conduit encased in a common concrete duct bank. The control wiring was in separate conduits located about 18 inches above the power conduits. Conduit runs were about 350 feet in length.

The individual generators were controlled by a Woodward DSLC, and utility paralleling was controlled by a Woodward MSLC. The Cat units had ECMPII electronic controls. The DSLC controls engine speed using a pulse width modulated (PWM) signal, ± 3 V, on-duration 70 percent. The signal travels from the DSLC to the engine on a single twisted-pair shielded conductor.

When the standby generators were first tested and commissioned, access was limited to a temporary load bank of 2 MW for just one week. That allowed time for individual, on-site, factory load testing, but not load testing with the units in parallel.

Five months later, a permanent 3 MW load bank, data floor load banks and increased building load were in place, and load testing of the standby generators was done in parallel. But when they approached a 60 percent load with two units on the bus, one or both units began to experience speed control problems. As a temporary fix, both ends of the speed signal conductor shield were grounded. Re-routing the speed signal conductors was suggested, but never done.

When the data center was completed, the speed control issue was raised again. Testing showed the DSLC output signal was rock solid, but that the same signal at the engine experienced erratic voltage. Eventually, the company found that the interference was caused by a magnetic field surrounding the power conductors.

The solution proved to be the installation of rigid steel conduit between ASCO's controls and each engine — a problem that could have been avoided entirely by using steel conduit initially.

The company later encountered a similar problem at one of its Dallas data center sites, where control circuits had been placed in PVC conduit embedded in concrete. The problem, again, was solved by re-routing the control circuits in steel conduit.

"EMI is an issue that should be considered in planning new facilities where sophisticated electronic and mechanical equipment will be operated," said Dr. Sakis Meliopolis, head of a project team at Georgia Tech that conducted extensive research on the subject over a three-year period.

While some designers attempt to save their clients money by basing the selection of a wiring system only on initial cost, that approach fails to capitalize on steel conduit's significant long-term advantages — one of which is not having to retrofit to provide EMI shielding. Such a retrofit can more than make up for any initial cost advantage of other types of conduit.

Dr. Meliopolis' research indicates that steel conduit is the most effective raceway, by a wide margin, in reducing electromagnetic field (EMF) levels from encased power distribution circuits. According to the study, steel conduit can reduce EMF at 60 Hz power frequency levels by as much as 95 percent. It showed that aluminum conduit reduced EMF by just 10 percent, and that nonmetallic conduit was ineffective in reducing field levels.