Information and Installation Instructions
for UL and CSA cables

UL/CSA cables must be protected against mechanical, thermal and chemical damages.

Installation in switchboards and control boards

- Inside switchboards, flexible single conductor cables must be installed in plastic cable channels.
- As American cables are not as flexible, the minimum bending radius must be taken into consideration during flexible installation.

For machinery and equipment connections

- Permissible tube and conduit ø:
  minimum Ø = 1/2" (inch)
  maximum Ø = 4" (inch)
  Minimum wall-thickness of the conduit = 1,9 mm
- Normal steel armored tubes with transition socket PG-NPT is used. Additional metal cable channels must also be used.
- The cables are permitted to fill a max. 50% of the cross section of the cable channel.
- Flexible single conductors must be installed in PVC tubes inside the conduits.
- If connectors are used, both the main and the control cables should be installed separately.

Delivery program:

- PVC tubes
- Metal tubes and glands
- Fixed material
- Steel armored tubes.

Cable channels

- Cable channels in switchboards must be made out of a flame resistant PVC and must have enough spare space.
- Cable channels on machines and equipment must be made out of metal. They must also be closed and oil resistant.

Cable identification

- Cable identification is achieved through continuous numbers, letters or number/letter combinations. The beginning and end of the cable have the same identification system.

Connecting cable to an apparatus

- **Main and control cables**

  The type of connection to the apparatus determines if screw or press clamps are used.

- In USA, it is normal to install cables without using cable lugs or crimped ferrules. The connection is only possible with the UL-sized wires. These sizes are not designed with a fine-wire stranding make-up.

Conductor cross section

General rules	**Minimum cross section**
• Motor Cables	AWG 14
• Control Cables	
– in switchboards	AWG 18
– in the installed system	AWG 16

This rule does not apply to electronic devices and systems.

In case, electronic cables and other circuits are installed together, all cables must be set for maximum voltage.

Color identification

- **Black**
  For main circuits, control and subcircuits, directly connected to main voltage.
- **Blue**
  For direct voltage (D/C), control and subcircuits, which are connected to the main circuit.
- **Red**
  For alternating voltage (A/C), control and subcircuits.
- **Yellow or brown**
  For interlock circuits from an external power source.
- **White or gray**
  For current carrying ground conductors at main, control and subcircuits.
- **Green or green-yellow**
  For insulated grounds as a protective conductor.

Voltages
200 / 230 / 460 / 575 V, 60 Hz

Driving voltage
Normally the driving voltage is 120 V, 60 Hz or lower. Transformers must be operated with separate windings.