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IEEE Recommended Practice for
Electrical Installations on
Packaging Machinery and Associated Equipment

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Electrical Installations on
Packaging Machinery and Associated Equipment

Sponsor

General Industry Applications Committee
IEEE Industry and General Applications Group

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Foreword

Packaging is a method of containing, protecting, enveloping, or enhancing an article for distribution from the manufacturer to the consumer. Since it is used on all sorts of goods for all groups of people, it is one of the world's largest businesses. In order to accomplish its function, it uses products of the paper, chemical, wood, glass, and can industries.

The term "packaging machine" covers an extremely wide variety of machinery. In an effort to establish a commonness in circuit design, electrical assembly, and types of devices, it seemed logical to prepare a recommended practice for the industry. It is believed that use of the recommended practice will aid materially in promoting the safety of personnel and equipment, and the reduction of fire and accident hazard, as well as the goals of uninterrupted production, long equipment life, and low maintenance cost.

The IEEE will maintain this document current with the state of the technology. Comments on this document and suggestions for additional material that should be included are invited. These shall be addressed to:

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IEEE Recommended Practice for Electrical Installations on Packaging Machinery and Associated Equipment

1. General

1.1 Purpose. The purpose of this recommended practice is to provide guidelines for the proper application of electrical equipment to packaging machinery which will promote:

(1) Safety to personnel and equipment, including the reduction of fire and accident hazard

(2) Uninterrupted production

(3) Long life and low maintenance cost

This is a minimum recommended practice and is not intended to limit or inhibit advancement in the areas of electrical or mechanical engineering.

1.2 Scope. This recommended practice covers the application of electrical equipment and wiring furnished as part of a packaging machine, and associated equipment commencing at the place of connection of the power supply. It shall apply to electrical equipment for use on circuits which operate from a supply voltage of 600 V or less. It shall not be considered adequate for machines intended for use in locations designated as hazardous by the NEC (National Electric Code), NFPA 70-1971 (ANSI C1-1971).

1.3 Applicable Codes and Standards. This recommended practice is specific to packaging machinery and associated equipment. In addition, the provisions of the NEC, state, and local codes shall be observed. Furthermore, the following standards also apply:

IEEE Std 15-1959, Industrial Control Apparatus (ANSI C19.1-1959)

NEMA ICS-1970, Industrial Controls and Systems

The codes and other standards cited in this Recommended Practice are those appropriate for application in the United States. For application outside the United States other codes and standards are to be observed as appropriate.

1.4 Definitions (See also Section 19, Glossary.)

packaging machine. Any automatic, semi-automatic, or hand-operated apparatus that performs one or more packaging functions such as, but not limited to, the fabrication, preparation, filling, closing, labeling and/or preparing for final distribution of any type of package or container used to protect and/or display any product.

associated equipment. Any attachment or component part that is not necessarily located on the packaging machine, but is directly associated with the performance of the machine. Limit switches and photoelectric devices are examples.

2. Diagrams, Instructions, and Nameplates

2.1 Diagrams.

2.1.1 Elementary (Schematic) Diagram. (See Fig 1.)

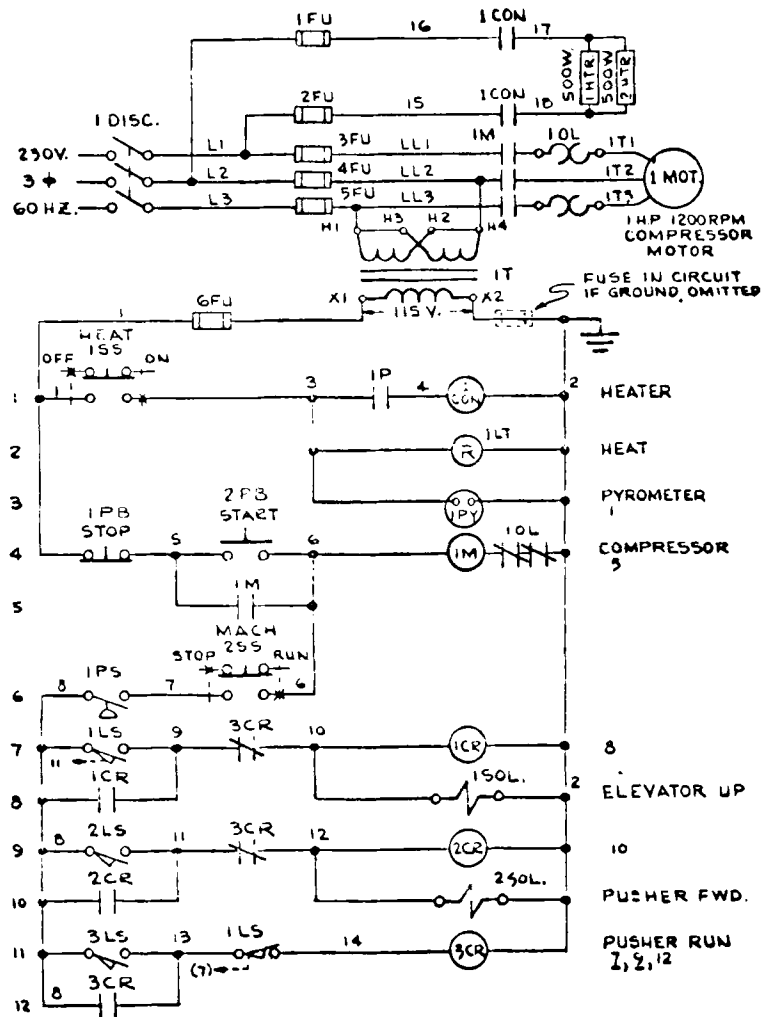
(1) On a packaging machine having only one motor and one starter, the diagram normally furnished with the starter shall be considered adequate, provided the diagram shows all of the electrical equipment on the apparatus.

(2) Where more than one motor starter or other electrical device is used (if the motor and controls are not entirely independent), an elementary diagram shall be furnished.

(3) The elementary diagram shall show all electrical equipment in the control system, using electrical symbols (see Section 2.1.6). Limit, pressure, float, flow, temperature-sensitive, and similar switch symbols shall be shown on the elementary diagram with all utilities turned off (electric power, air, gas, oil, water, lubrication, etc) and with the equipment at its normal starting position.

(4) The elementary diagram shall be marked with the machine manufacturer's name, issue date, and the machine model and

Fig 1
Elementary Diagram



Devices

- 1 MOT — 1-hp 1200 r/min open 230/460-V
3-phase compressor motor, 60 Hz
- 1OL — Overload relay for 1 hp, 1200 r/min,
230 V
- 1T — Transformer, 250 kV, 230/460 V
primary, 115 V secondary
- 1 DISC — Disconnect
- 1FU — Fuse, cartridge, 5 A, 250 V
- 2FU — Fuse, cartridge, 5 A, 250 V
- 3FU — Fuse, cartridge, 4 A, 250 V
- 4FU — Fuse, cartridge, 4 A, 250 V
- 5FU — Fuse, cartridge, 4 A, 250 V
- 6FU — Fuse, cartridge, 2 A, 250 V
- 1M — Starter, size 1, open, 115 V
- 1CON — Contactor, size 0, open, 115 V
- 1CR — Control relay
- 2CR — Control relay
- 3CR — Control relay
- 1PS — Pressure switch
- 1LS — Limit switch
- 2LS — Limit switch
- 3LS — Limit switch
- 1PB — Pushbutton
- 2PB — Pushbutton
- 1SS — Selector switch
- 2SS — Selector switch
- 1LT — Pilot light

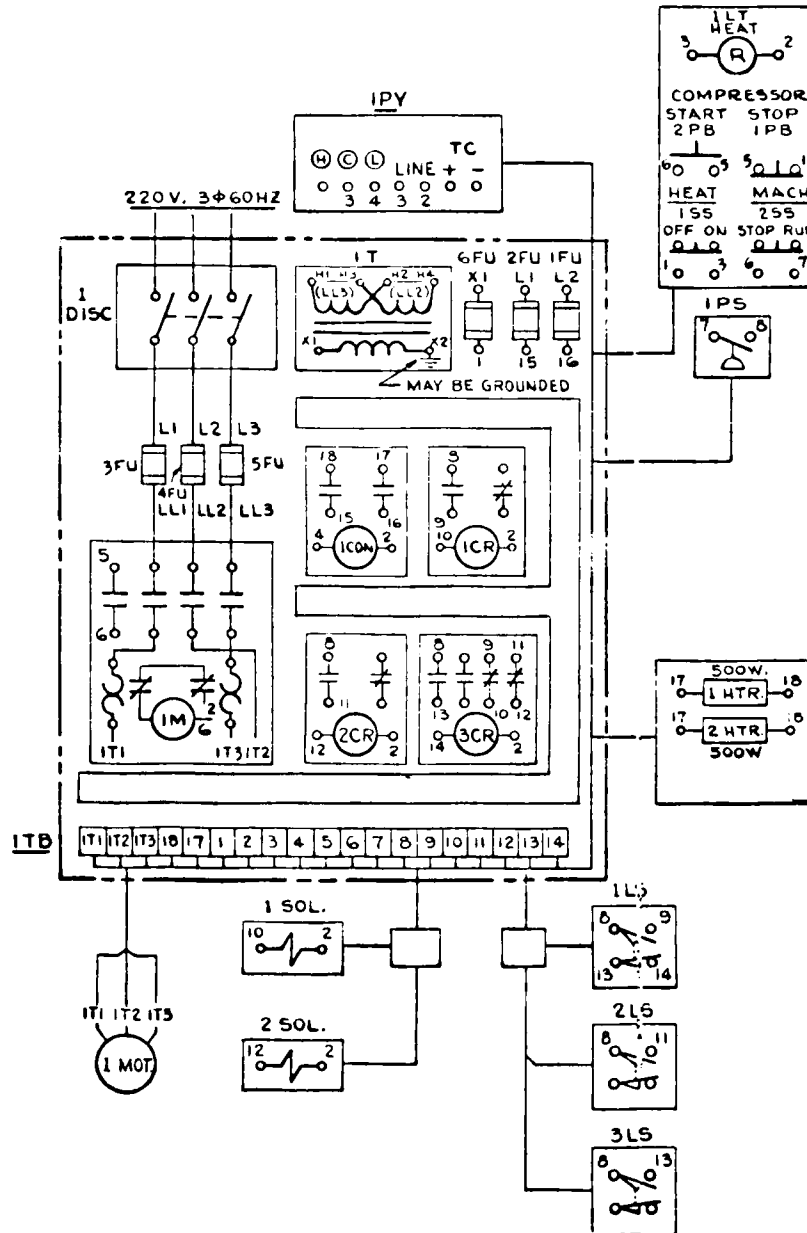
1PY — Pyrometer

- 1 HTR — Heater, 500 W, 230 V, 60 Hz
- 2 HTR — Heater, 500 W, 230 V, 60 Hz
- 1SOL — Solenoid
- 2SOL — Solenoid
- 1LS — (7,9) tripped by product in feed
chute, releases as elevator goes up
- 2LS — (9) tripped by elevator at top of
stroke
- 3LS — (11) tripped by pusher in forward
position

Sequence of Operation

1. Turn heat selector on. 1P, 1 CON, and 1LT energize.
2. Press compressor start button, energizing motor and control circuit.
3. Turn machine selector to run. With pneumatic circuit at 500 lbf/in² pressure switch 1PS closes.
4. Product entering infeed conveyor trips 1LS. 1CR and 1SOL energize raising elevator.
5. 2LS trips at top of stroke energizing 2CR and 2SOL Pusher goes forward.
6. 3LS trips at forward position, energizing 3CR and deenergizing 1CR, 2CR, 1SOL, and 2 SOL; pusher and elevator return.

Fig 2
Interconnection Diagram



serial number that identify the machine to which the diagram applies.

(5) The elementary diagram shall be drawn with vertical lines to represent the source of control power, and all control devices shall be shown between these lines. All actuating coils shall be shown on the right-hand side.

EXCEPTION: Electronic diagrams may be drawn between horizontal lines representing the source of power.

(6) The position of the symbols on the diagram should be arranged for clarity, and need not indicate their physical location on the apparatus.

(7) The symbols for all devices shall be identified by a letter or number-letter combination (see Figs 1 and 2 and Section 20).

(8) Each electrically common point shall be identified by a discrete number.

(9) All relay coils, actuating devices, etc., shall be identified and cross-indexed, so that their associated contacts can readily be located on the diagram.

(10) Voltage and/or current data that facilitate trouble shooting shall be indicated on the diagram. Oscilloscope traces, showing wave form with peak-to-peak voltages, should be given in cases where meter readings will not give an accurate indication of the performance of a component or circuit. The sensitivity of the measuring instruments and the condition of the circuit at the time of measurement shall be given when critical.

(11) Limit switch actuation and function shall be shown on the diagram.

(12) Additional charts or diagrams should be used to indicate the position of multiple-contact devices such as drum, cam, and selector switches.

2.1.2 Block Diagram. Where the complexity of the control system warrants, a block diagram of control functions should be furnished. Each block shall be identified and cross-referenced in such a manner that its internal circuitry may be readily found on the elementary diagram.

2.1.3 Logic Diagram. A logic diagram of the electrical system should be furnished where applicable.

2.1.4 Connection and Interconnection Information. (See Fig 2.)

(1) A connection diagram shall be furnished to show the general physical layout of

the electrical control panel with all devices comprising the panel.

(2) Interconnection information shall be furnished and may be shown as part of the connection diagram.

(3) Symbols for all electrical devices and their terminals, both in and external to the control panel, shall be identified as shown in the elementary diagram.

2.1.5 Component and Equipment Layout Drawings. Layout drawings should be furnished with all control systems, consisting of an outline drawing of the machine, not necessarily to scale, showing the electrical control enclosure, and control and power devices external to the control enclosure in their relative location. All devices shall be identified as shown on the elementary diagram.

2.1.6 Symbols. Symbols used on electrical diagrams shall be in accordance with IEEE Std 315-1971, Graphic Symbols for Electrical and Electronics Diagrams (ANSI Y32.2-1970). (See Section 18.)

2.2 Instructions.

2.2.1 General Instructions. Instructions referring to the installation, operation, and maintenance of the system shall be furnished as follows:

(1) A stock list giving the device or subassembly designation as it appears on the elementary diagram, and sufficient description of each device or subassembly so that replacement parts may be readily identified

(2) A sequence of operations, keyed to the elementary diagram, including all information necessary to describe the operation of the complete system. Graphic representation may be used to supplement the written description

(3) Set-up information, listing all information necessary for calibrating and adjusting all electrical devices or subassemblies

2.2.2 Trouble-Shooting Instructions. Trouble-shooting instructions, including information to aid in quickly locating the more common component failures, and maintenance instructions, including information regarding preventive maintenance and lubrication of electrical components, should be supplied.

2.3 Equipment Nameplates and Identification Plates.

2.3.1 The packaging machine shall be provided with a visible nameplate marked with