APPENDIX

SECTION C

E. I. DU PONT DE NEMOURS AND COMPANY, INC.
FABRICS AND FINISHES DEPARTMENT
FINISHES DIVISION
PHILADELPHIA PLANT

PROCESS AND METHODS GROUP
June 22, 1953

"48 PROCESS"
MEMORANDUM REPORT

INSTRUMENTATION AND CONTROL OF OPERATING CONDITIONS

STUDY P-10

Prepared by

D. G. BOSSE

ABSTRACT

This memorandum covers installation of ammeter and pyrometer recommended as standard instrumentation for "48 Process" and co-ordinated specifications for standard operating conditions.

Exhibit C-2

"48 PROCESS" MEMORANDUM REPORT
P-10
INSTRUMENTATION AND CONTROL OF OPERATING CONDITIONS

PROBLEM UNDER INVESTIGATION:

"48 Process" operation is controlled on the basis of power input, which is feasible as the agitator functions as a reliable indicator of the effective viscosity of heavy pastes.

Esterline Wattmeter charts, which have been obtained on a large number of experimental batches and have proven extremely useful for analysis of operating conditions, indicate that a properly installed and marked ammeter will be a satisfactory power indicator for control of manufacturing operations.

As "48 Process" manufacture is extended to include an increasing range of products, close control of manufacturing operations becomes more essential, particularly in certain cases where very small pigment additions can result in a large increase in flow resistance and power consumption. Location and marking of the ammeter to facilitate easy accurate observation of the power consumption by the operator while engaged in loading of pigments and liquids is essential for practical operation.

Temperature markedly influences the flow resistance of "48 Process" dispersion mixtures and operating temperatures in the range of 120° to 150°F are desirable.

Since the power requirements are higher at low operating temperatures, the power indicator and formulation serve indirectly to control minimum operating temperatures in a satisfactory manner.

Maximum temperature control is necessary for plant scale operations, particularly with the products more difficult to manufacture.

Ordinary thermometer types having liquid filled bulbs or tubes, or long shielded thermocouples which extend into the mixture are not satisfactory as they are subject to failure from repeated flexing. The special thermocouple unit mounted flush with the inside surface of the tank wall in the 150-gallon pilot plant "48 Process" mixer provided satisfactory readings with the stipulation that the thermocouple be located sufficiently distant from the cooling jacket, in an active shear zone, and in the path of material moving outward from the center toward the jacketed portion of the wall.

RESULTS AND RECOMMENDATIONS:

The problems of power consumption and temperature control have been studied on the Philadelphia Plant 1000-gallon "48 Process" Unit and recommendations are made on the basis of practical operating requirements.

An ammeter mounted above the manhole at approximately operator eye level when loading pigment, and color coded for simple accurate reading is required for practical "48 Process" operation. Heavy concentration of solvent vapor and dust in the vicinity of the manhole and vibration caused by ball mills operating in the same buildings require the specification of an explosion-proof instrument condulet suspended from the connecting conduit which is, in turn, attached to the mixer through rubber padded clips. This rubber padded mounting is sufficiently simple and inexpensive to warrant use even though the actual increase in instrument life may be debatable.

A temperature indicator with an accuracy of not less than ± 5°F at 150°F is required to control maximum operating temperature. The same protection against dust solvent vapor, and vibration, as required for the ammeter, must be provided for the indicator. In addition, magnetic insultion is required for operation of a low temperature direct driven thermocouple pyrometer in the vicinity of the electric motor, and cold junctions compensation is desirable to eliminate the necessity for frequent adjustment.

The indicating instrument specified has the required features and is relatively inexpensive. The instrument construction also permits simple mounting at the desired location and the use of a quick-acting dust-tight thermocouple lead connection which makes it possible to remove, check and replace the instrument without disturbing the wiring installation.

The thermocouple unit specified is an improved design utilizing as many standard parts as practical. The teflon packed reducer tank fitting provides thermal isolation of the thermocouple tip and acts as a support to prevent failure of the protective tube by flexure. The flexible rubber-covered thermocouple lead section, compression-type tank fitting, and cannon plug assembly simplifies removal and replacement of the thermocouple in the event of failure.

Specifications for standard operating conditions coordinated with the recommended instrumentation, are covered in the list of "48 Process" Precautions" included in this report and designed for mounting on or near the "48 Process" Units for guidance of the operators.

It will be noted that these precautions specify that the cooling water for the gear reducer should be turned on. Although at present an automatic solenoid valve to control the cooling water to the gear reducer, recommended by South San Francisco Finishes Plant, is not specified as Standard Equipment, it is desirable and we recommend adoption of this proposal by all plants using "48 Process" Units equipped with water cooled gear reducers.

Exhibit C-4

"48 PROCESS"
INSTRUMENT ARRANGEMENT

SPECIFICATIONS

AMMETER: Suitable ammeter with full scale reading not less than 1.5 or more than 2.5 rated full load motor amps, in Crouse and Hinds Explosion Proof Instrument Condulet Type EMH for GE, Westinghouse, Hickok, or Weston Instruments. The unit is mounted by suspension from conduit which is attached to mixer by clips over rubber gromets to provide vibration insulation.

Meter scale is to be color-banded as follows:

0	to 3/4	rated	full	load	motor	amp - White
3/4	to 1.0	"	"	"	"	" - Green
1.0	to 1.2	"	"	"	"	" - Yellow
over	1.2	"	"	"	"	" - Red

(Scale marking not to be obscured by color band)

Wiring diagrams are attached.

PYROMETER ASSEMBLY: (Ref. attached schematic)

1. Special model 30 Surface Pyrometer Range 0-300°F - 5° sub-divisions without handle, and calibrated for 16 feet lead wire.- Manufactured by The Pyrometer Instrument Co., Inc., Bergenfield, New Jersey - Philadelphia Agent, John C. Whiddett Co., 19 Union Avenue, Bala-Cynwyd, Pa. - Quote of 6/16/53 - $91.00.

2. Special Model 12 Extension Arm with 1-1/2" stub shaft and 16 feet braided I.C. Lead Wire.- Manufacturer and Agent same as above.- Quote of 6/19/53 - $14.00

3. Compression Sleeve of 1/2" conduit with side slot and lugs for 3/16" bolt with lock washer, finished inside for 5/8" O.D. stub shaft and welded at 90°angle to 6-1/2" length of 1/2" conduit, threaded one end.

4. Rubber gromet approximately 1/4" thick - 2 required.

5. Conduit mounting clip - 2 required.

6. Brace of 1" x 1/4" strap from mixer frame to stub base of instrument and attached by compression loop around rubber gromet of approximately 1/4" thickness.

7. Condulet Crouse and Hinds Type LB-17 or equivalent.

8. Conduit 1/2" (standard rigid electrical).

9. Thermocouple lead wire.

10. Frame of mixer drive.

11. & 12. Iron Constantan Thermocouple - Brown Instrument Div., Minneapolis-Honeywell Regulator Company. No. 3D14K - 6" -X-R1-12" 6 inch pencil type thermocouple with 12" rubber covered lead wire extension and 1/8" S.P.T. Compression fitting.
Quote 6/22/53 (Tel.) - $34.00

*13. Reducer 1/2" to 1-1/8" S.P.T. Mild steel installed in tapped opening in tank bottom midway between tank center and wall, flush with inside tank bottom surface, and machined to provide a straight inside bore and a 45° angle on the end (high side adjacent to bore) for subsequent peening as noted on Item 14 below.

*(Revised Aug. 1954 D.G.B.)

*14. Heat insulator and thermocouple support consisting of Teflon discs or solid plug pressed into the reducer and held in place by peening the beveled end of the reducer down flat to produce a retaining lip. The hold for the thermocouple (light push fit) is then drilled, and the 1/8" S.P.T. compression fitting (Item 12 above) installed.

15. Cannon Plug - WK-M2 - 21C - 5/16" - Manufactured by Cannon Electric Development Co., 3209 Humboldt Street, Los Angeles 31,

16. Cannon Plug Mating Receptacle - WK-M2-22C - with clamp removed for installation - source same as plug.

17. Round head bolts 1/8" x 3/16" through sleeve into tapped holes in skirt of Mating Receptacle -- 3 required.

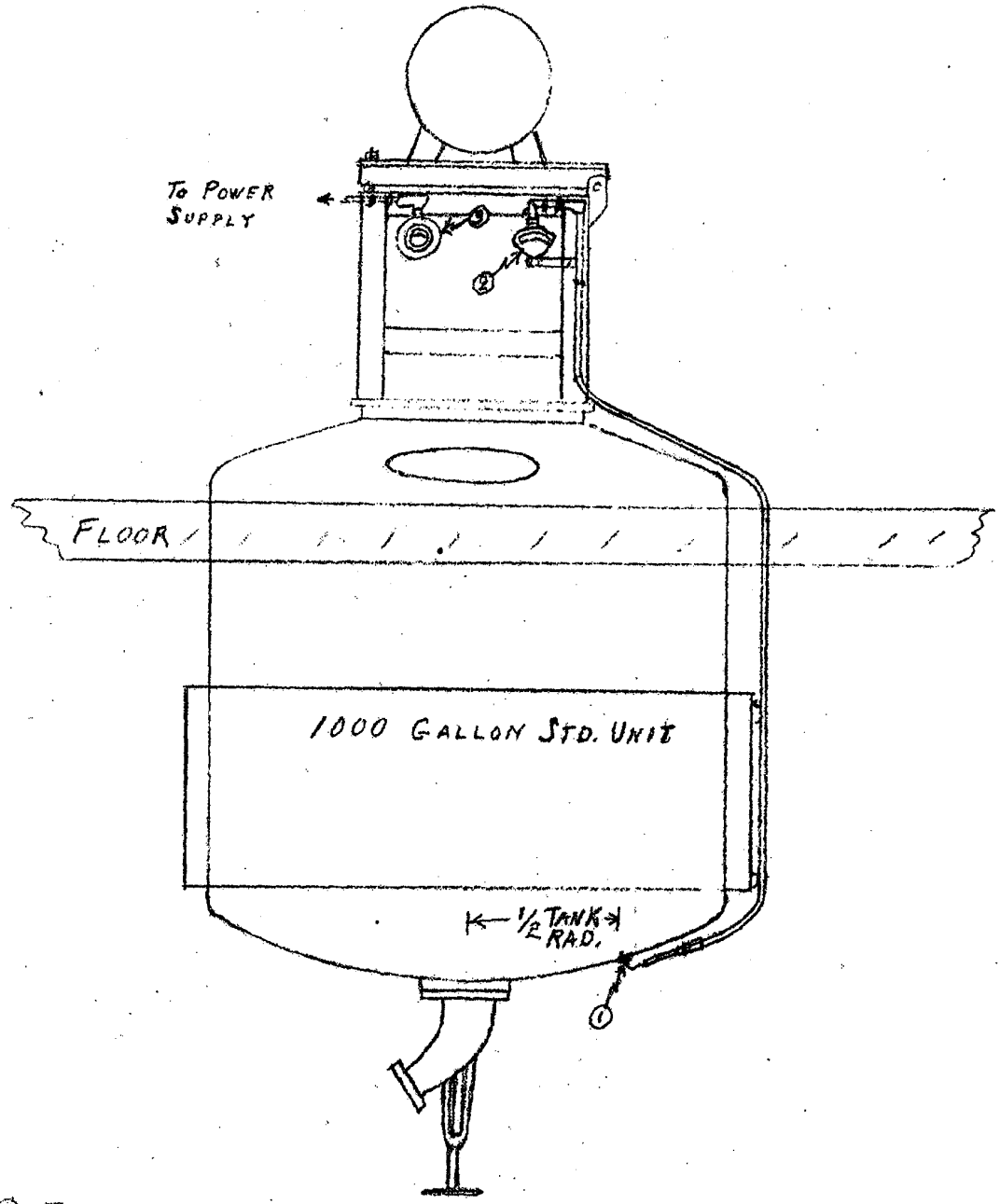
18. Sleeve 1" long welded to conduit, bored 13/16" I.D. for Cannon Plug Mating Receptacle.

19. Conduit 1/2"

20. Thermocouple lead wire.

Notes: Installation thermocouple unit in tank bottom to be made carefully to obtain tight reducer fit without projection through inside surface of tank bottom.
All lead wire joints carefully soldered with non-corrosive flux, maintaining maximum possible cleanliness of surfaces.

EXHIBIT C-6



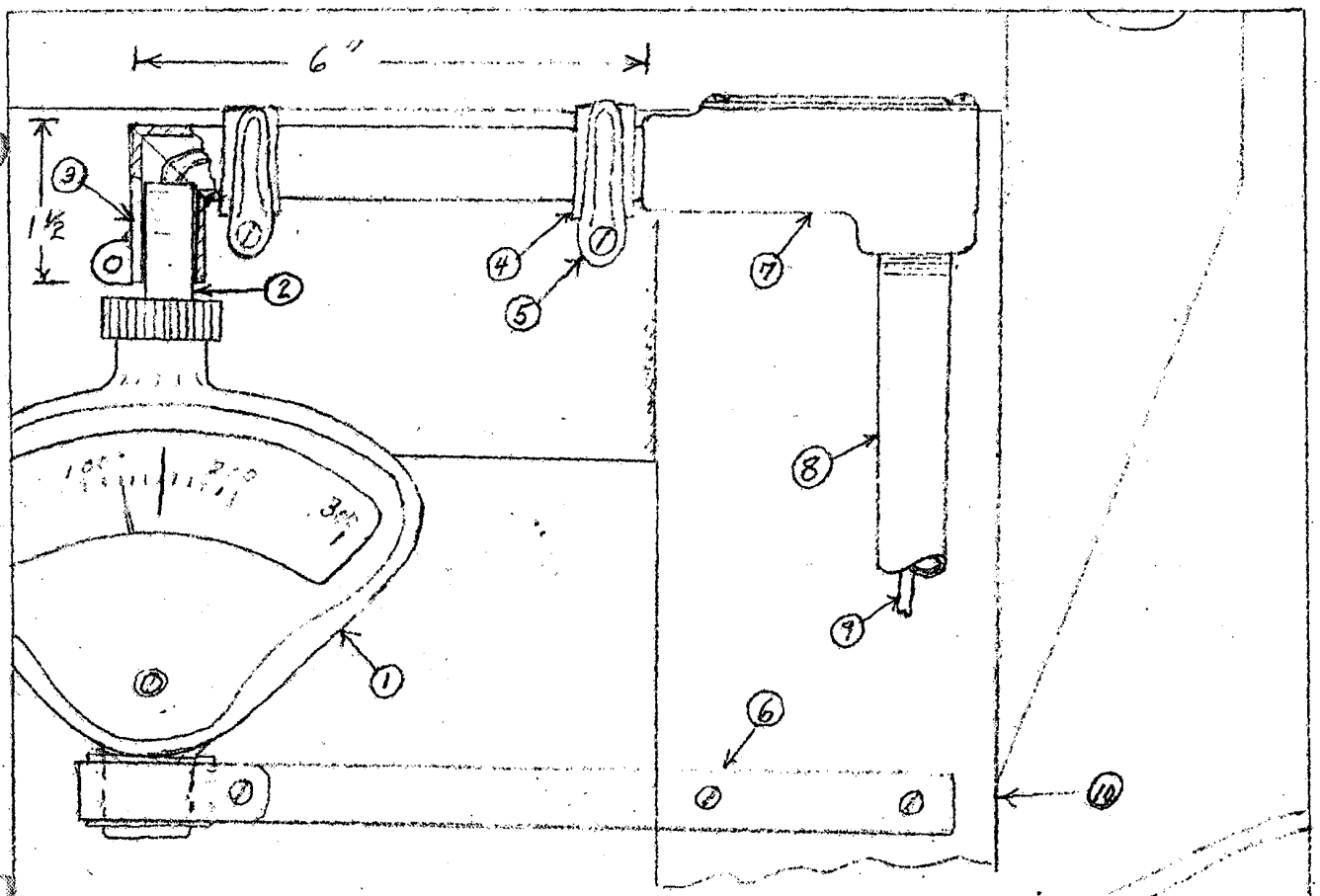
① Thermocouple
② Temperature Indicator
③ Ammeter in Crouse + Hinds Expl. Prf. Condulet Type EMM.

48 PROCESS
INSTRUMENT ARRANGEMENT SCHEMATIC I

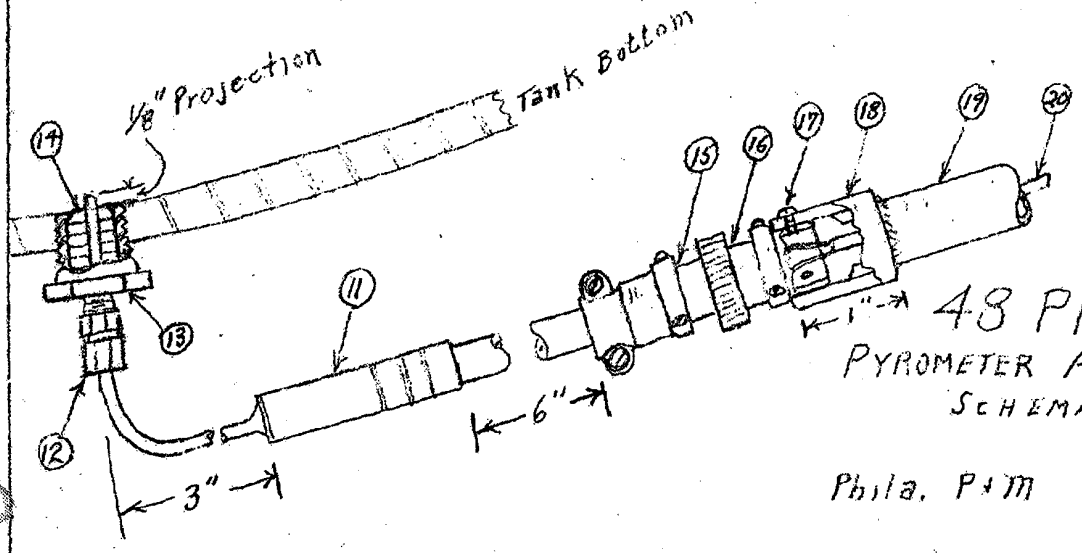
Phila. P+M

June 15 1953
D.G. Bosse

EXHIBIT C-7



THERMOCOUPLE INSTALLATION

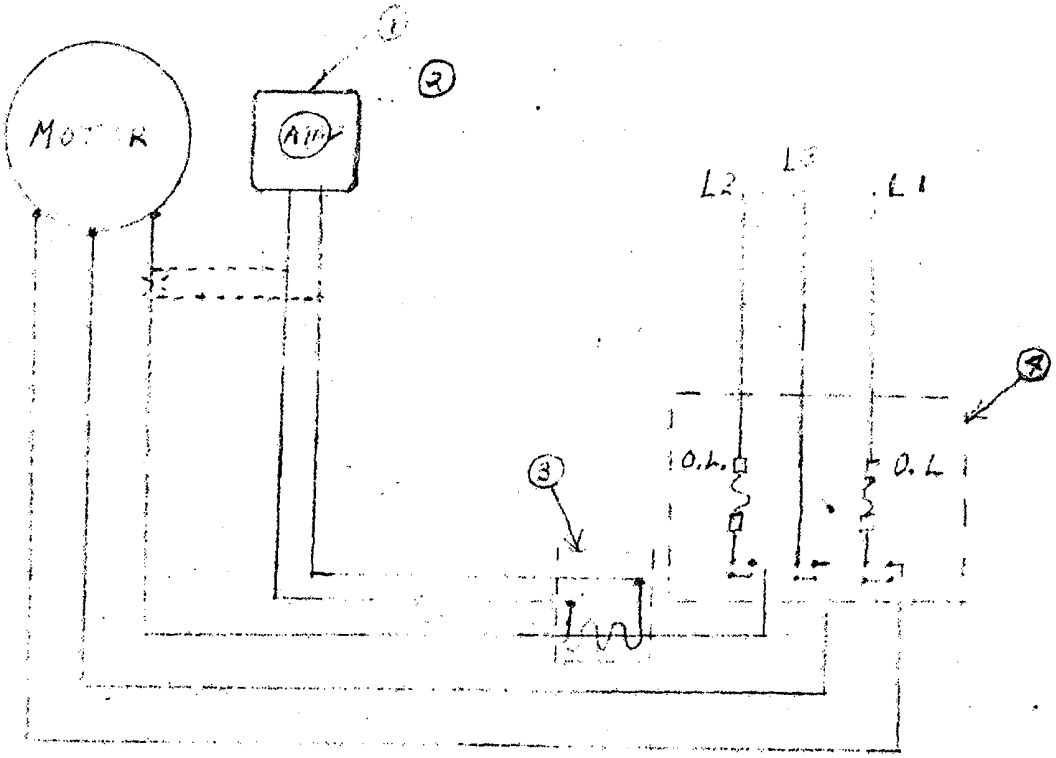


48 PROCESS
PYROMETER ASSEMBLY
SCHEMATIC II

Phila. P+M June 16, 1953
D.G.B-55e

EXHIBIT C-8

SCHEMATIC
AMMETER WIRING DIAGRAM
(LOW SPEED, 440 VOLT 3 PH.)



	20-30 HP*	40-60 HP*
(1) CROUSE & HINDS INSTRUMENT CONNECT FOR EMH	TYPE EMH CAT. No. 521	TYPE EMH CAT. No. 521
(2) AMMETER A.C.	G.E. K.4372	WESTON MOD. 476 A.C.
(3) TRANSFORMERS	NONE DIRECT CONNECT LINE 1 OR 3 (DOTTED LINES)	WESTON MOD. 604 RATIO 200-5 TYPE 2
(4) MOTOR CONTACTOR		

* SPECIFICATIONS PER B. HILL PLANT ENG., FLINT FOR 440 VOLT 3 PHASE

48 PROCESS
AMMETER WIRING DIAGRAM
SCHEMATIC III

Phila P+M. JUNE, 22, 1953
D.G. Bosse

"48 PROCESS" PRECAUTIONS

(1) BEFORE STARTING BATCH:

GEAR REDUCER COOLING WATER ON;
TANK JACKET COOLING WATER OFF.

(2) FOLLOW FORMULA AND DIRECTIONS IN DETAIL.

(3) CAUTION:

DO NOT OVERLOAD.
FULL LOAD LIMIT - END OF GREEN BAND.
TEMPORARY OVERLOAD LIMIT - END OF YELLOW BAND.

(4) PIGMENT ADDS MUST BE MADE BY POURING NOT DUMPING.

DO NOT LOAD WITH POWER IN YELLOW BAND.

(5) CHECK TEMPERATURE PERIODICALLY.

START COOLING WHEN MAXIMUM OF 150°F. IS REACHED, UNLESS OTHERWISE SPECIFIED.

(6) DO NOT STOP MIXER FOR MORE THAN TWO MINUTES WHEN POWER IS OVER THE WHITE BAND, AND NOT UNLESS NECESSARY.

ALSO, DO NOT JOCKY AGITATOR.

(7) LETDOWN PORTIONS MUST BE ADDED SLOWLY WITH MIXER RUNNING.

MAXIMUM RATE 1 AMPERE POWER DROP EVERY 2 MINUTES.

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FP-01-B-48
2/18/55

EXHIBIT H

1000 GALLON
"48 PROCESS" OPERATING INSTRUCTIONS

(1) BEFORE STARTING BATCH: GEAR REDUCER COOLING WATER ON; TANK JACKET TANK JACKET COOLING WATER OFF.

(2) FOLLOW FORMULA & DIRECTIONS IN DETAIL.

(3) CAUTION: DO NOT OVERLOAD.
40 HP FULL LOAD LIMIT - END OF GREEN BAND.
48 HP TEMPORARY OVERLOAD LIMIT - END OF YELLOW BAND.

(4) PIGMENT ADDS MUST BE MADE BY POURING NOT DUMPING.
DO NOT LOAD WITH POWER IN YELLOW BAND (ABOVE 40 HP.)

(5) CHECK TEMPERATURE PERIODICALLY.
START COOLING WHEN MAXIMUM OF 150°F IS REACHED, UNLESS OTHERWISE SPECIFIED.

(6) DO NOT STOP MIXER UNLESS NECESSARY, AND NOT FOR MORE THAN TWO MINUTES WHEN POWER IS OVER THE WHITE BAND (ABOVE 20 HP) ALSO, DO NOT JOCKEY AGITATOR.

(7) LETDOWN PORTIONS MUST BE ADDED SLOWLY WITH MIXER RUNNING.
MAXIMUM RATE 1 AMP. POWER DROP EVERY 2 MINUTES FOR 40 AMP. INDICATED FULL LOAD.
(1.25% OF FULL LOAD AMPERAGE DECREASE PER MINUTE)

NOTE: POWER INPUT IS MEASURED BY AMMETER READINGS. COLOR CODING OF METER IS RECOMMENDED TO SUPPLEMENT NUMBERS

WHITE - 0 to 20 HP EQUIVALENT IN AMPS.
GREEN - 20 to 40 HP " " "
YELLOW- 40 to 48 HP " " "
RED - ABOVE 48 HP " " "

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