Westinghouse Electric & Manufacturing Company
INSTRUCTIONS AND RENEWAL PARTS DATA
INDUSTRIAL DEPARTMENT

TYPES AT-4, AT-5, AT-6, AT-7, AT-8, AT-17 DOUBLE POLE TIMETACTORS

INSTRUCTIONS

Application

The "Timetactor" is a combination in one self-contained unit, of a contactor and a time limit relay. It is usually used as an accelerating switch for resistance type starters and the two pole types are made up particularly for A-C. starters. Since the time delay action depends on the decay of a unidirectional magnetic field, direct-current must always be applied to the coils although the contacts carry alternating-current.

The main contacts are designed to **close** a circuit and **carry** the current **only** and should not under any circumstances be used to rupture an arc. The control scheme should be arranged so that the current is removed by the opening of a contactor before the relay main contacts open.

The main contacts will carry 200 amperes A-C. or D-C. continuously and will **make** the accelerating current peaks usually associated with such a current without damage. The relay is insulated to withstand 600 volts maximum. The auxiliary contacts will carry 5 amperes continuously and will make and rupture 10 amperes in A-C. circuits. In D.C. circuits the current interrupted should not exceed 1.0 amperes at 125 volts, .5 amperes at 230 volts, and .1 ampere at 600 volts. The time delay may be varied between 1 and 6 seconds.

Construction

The double pole types are all alike in the arrangement of the magnet and main contacts, the frames representing differences in the auxiliary contacts only. The frames available are as follows:

Type AT-4 S#830306 with double break interlock.

Type AT-5 S#830307 with single break interlock.

Type AT-6 S#830308 with make and break interlock.

Type AT-7 S#830309 with double make interlock.

Type AT-8 S#830310 with single make interlock.

Type AT-17 S#856113 with two insulated make interlocks.

(**Note:** "Make" denotes circuit closed when main coil is energized).

The common parts comprise a core and yoke of heavy steel with a flat steel armature hinged to the yoke by a knife edge bearing at the top and retained in place by the pressure of a kickout spring. The armature carries two large silver-faced moving contacts which are held in contact with two silver-faced stationary contacts by the pressure of the kickout spring when the magnet is de-energized. Flexible shunts attached to the moving contacts connect them to a common stud at the top of the relay which is ordinarily connected to the middle bank of a three-phase secondary starting resistor, the stationary contacts being connected to the outside banks. The auxiliary contacts are made of copper-plated steel springs with silver tips working against adjustable silver-tipped stationary contacts. A special two-winding coil is used as explained below, and the position of mounting and general arrangement are shown in Fig. 1.

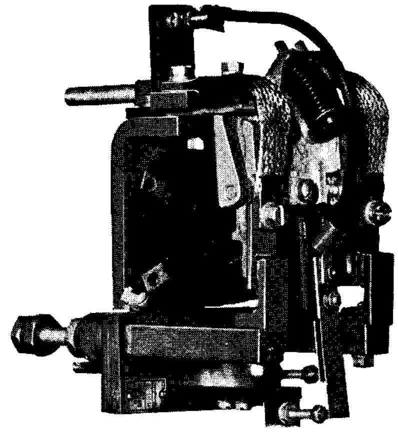

Fig. 1—The Type AT Double Pole Timetactor

Operation

The relay coil consists of two windings on an insulated copper tube, a strong main winding used for closing the armature, and a weak auxiliary winding permanently connected in opposition to the main winding for neutralizing residual magnetism so that the armature will be disengaged after the main coil is de-energized.

Control schemes employing AT Timetactors must always be arranged so that the main coil will be energized to open the contacts before power is applied to the main circuits. After the power current is established by closing of a line contactor with all of the starting resistance in circuit, operation of the master switch or interlocks on other relays or contactors successively de-energize the main coil circuits in the desired sequence. When the main coil of any relay is de-energized the magnetic flux will decrease, thereby inducing a strong current in the copper spool tube. This current will oppose any change in the field which consequently will decay slowly until the force of the kickout spring overcomes the magnetic pull, permitting the armature to release and close the main contacts. The degree to which demagnetization must proceed by natural flux decay is controlled by the demagnetizing action of the neutralizing coil so that the time of dropout can be closely controlled by adjusting the current in this coil. A potentiometer scheme is often used to facilitate adjustment of the neutralizing current.

The curve, Fig. 2, gives the relation between the time delay and the ampere-turns of the neutralizing coil. The time delay can be varied between 1 and 6 seconds. Beyond 6 seconds the timing becomes erratic and below 1 second the neutralizing current may be so large as to cause overheating.

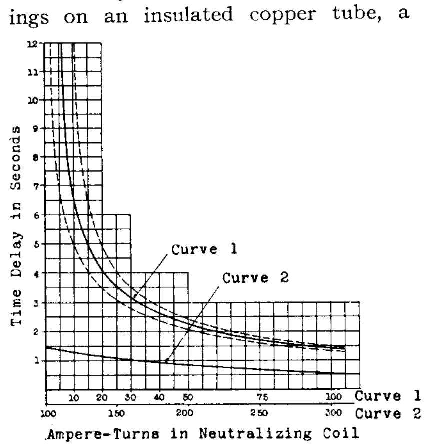

Fig. 2—Type AT Timetactor. Time Delay as a Function of Ampere Turns in Neutralizing Coil

Maintenance

The operating coil may be removed by removing the two stationary contact tips. This will permit the armature to be raised sufficiently to allow the spring shackle to be unhooked and the armature can then be lifted out of the way of the coil. Before removing coil connections mark for identification. The lower terminals connect the main section and the upper terminals connect the neutralizing section.

The pole face and hinge surfaces are chromium plated and are well protected

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against rust. Special care should be taken to prevent any accumulation of dirt on these surfaces as a very small increase in the air gap will cause a considerable decrease in the time delay.

Failure to **open** contacts may be caused by any of the following conditions:

1—Operating coil open-circuited.
2—Mechanical interference.
3—Voltage low.

Failure to **close** contacts may be caused by any of the following conditions:

1—Main coil circuit closed.
2—Neutralizing coil open-circuited.
3—Weak spring.
4—Mechanical interference.

Note: If the neutralizing coil is de-energized when the main coil is de-energized by power failure the armature may not release. This is a normal characteristic of the relay and the condition is corrected as soon as the coils are again energized and de-energized in their normal sequence, by the first operation of the controller after power returns. This characteristic must be carefully considered in checking the feasibility of any new connection scheme.

Adjustments

All Timetactors mounted on panels at the factory are carefully adjusted for correct time setting and should not need any changing when put in service. If conditions arise which make it necessary for the customer to change the time delay the change can be made by changing the neutralizing coil current either by changing the series resistance or adjusting the potentiometer if one is provided.

RECTOX SYSTEMS FOR TYPE AT TIMETACTORS

Table I
COIL APPLICATION DATA

Coil Style	Main Coil Section			Neut. Coil Section			Application
	D-C. Volts	Turns	Ohms	Volts	Turns	Ohms	
§832983	35 Cont.	1970	55	3	685	14.5	With 55-volt Rectox, Style No. 761817
†822191	125 Cont.	8000	584	11	2420	360.	125-volt D-C. or 220-volt A-C. Full-Wave Rectox
†822144	125 Int.	3760	204	6	1370	59.0	220-volt A-C. Half-Wave Rectox—Intermittent
822180	230 Cont.	11000	1530	25	3220	571.	230-volt D-C. or 440-volt A-C. Full-Wave Rectox
†822145	230 Int.	7500	800	12	2900	260	440-volt A-C. Half-Wave Rectox—Intermittent
822181	550 Int.	17200	4590	19	4350	590	550-volt D-C. Intermittent

†Potentiometer type resistor Style No. 846711, may be used.
Series resistor, Style No. 774002, 2000.0 ohms total, tapped 700-1300.
§Potentiometer type resistor, Style No. 846712, may be used.
Series resistor (Style No. 204657-A, 640 ohms total, 6 taps).

In applying Type AT Timetactors to A-C. control schemes the problem arises of providing a suitable rectifying system to energize the coils, as the Timetactor is inherently a D-C. device. In general, any type or make of rectifier will give good results when properly applied but the desirability of particular forms, is influenced by the D-C. power requirements and by other considerations.

Single-phase, half-wave Rectoxes allow the greatest simplicity of interlocking connections, but are less desirable than full wave Rectoxes in operation because the very large pulsation in the coil currents introduces troublesome features for some applications. Full-wave Rectoxes have smooth enough current characteristics to be considered the equivalent of genuine D-C. power sources but are likely to require twice as many Rectox units as half wave rectoxes for a small number of Timetactors and also require more complicated interlocking. For any line voltage Rectox a sufficient number of rectifying elements to balance the voltage must be used irrespective of the D-C. power requirements so that there is a definite minimum size of Rectox installation for every voltage. For a small number of Timetactors and usual Rectox ratings this minimum exceeds the requirements at 220 volts with half-wave rectification and the disproportion is still worse for higher voltages and full-wave rectification.

To make it possible to fit the rating of the power source to the Timetactor coil requirements more closely, and thus economize on Rectox cost and space, a system has been devised which comprises a self-contained single-phase full-wave Rectox which will supply 0.50 D-C. ampr. continuously at 35 D-C. volts and a line of very small cheap step-down transformers which will reduce the standard line voltages to a secondary voltage suitable to fit the requirements of the rectox unit. Secondary taps for 50-55-60 A-C. secondary volts are provided, so that the voltage applied to the Rectox can be started at a low value and later increased to compensate for a possible change in the characteristics of the Rectox as it ages.

The transformers are available in several power ratings to fit various numbers of Rectox units. The D-C. power output of the individual Rectox unit at its continuous rating matches the power requirements of one AT Timetactor coil, so the rule is to supply one Rectox unit per relay for continuous duty. It is safest to follow this rule for intermittent service also because even though a Rectox will not be injured by considerable overloading for short periods, the

Table II
TRANSFORMER APPLICATION TABLE

A-C. Volts	Frequency	Transformer Styles Per Number of Timetactors		
		1 Continuous or 1 Intermittent	2 to 4 Continuous or 2 to 7 Intermittent	5 to 8 Continuous or 8 to 15 Intermittent
110	50–60	845982	849089	849095
110	25–40	849086	849090	849096
220–440	50–60	845983	849091	849097
220–440	25–40	849087	849092	849098
575	50–60	845984	849093	849099
575	25–40	849088	849094	849100

Note:—When using transformers order one Rectox unit Style No. 761817 per Timetactor and one coil Style No. 832983 per Timetactor.

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RECTOX SYSTEMS FOR TYPE AT TIMETACTORS—Continued

voltage on overload will drop to a point which will require the use of a special low-voltage coil and restoration of full-voltage as the coils are disconnected may damage the last coil. Where more than one Rectox unit is needed the corresponding terminals are connected by buses to form one multiple unit.

A typical diagram for a single-phase half-wave control system is shown in Fig. 4. A Rectox having at least one standard 55-disc unit stack per Timetactor will have sufficient D-C. power to operate all the Timetactors continuously. Coils for standard voltages may be chosen from Table I. The neutralizing coil sections are designed for much lower voltages than the main coil sections so that they can be connected in series and the currents of all adjusted simultaneously. Potentiometer type resistors in parallel with each neutralizing coil are convenient for equalizing the times of the individual timetactors.

Typical diagrams for single-phase full-wave Rectoxes with transformers are shown in Figs. 5 to 9. The style of transformer and number of Rectoxes are indicated in Table II.

CAUTION:—The breakdown resistance of any copper oxide rectifier is very much reduced at only moderately high temperatures and it should be made a rule never to mount them or load them in such a way that their final temperature (not rise) will exceed 55°C. It is best to mount the Rectoxes as near the bottom of a panel as possible to take advantage of the cooler temperature.

Where transformers are used, a single 125-volt fuse connected in one secondary lead will protect the transformer in case of breakdown of a rectox unit.

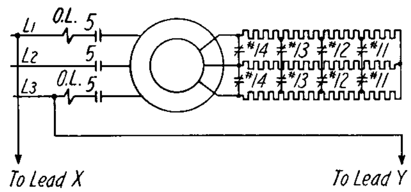

Fig. 3—Main Wiring for All Figures Shown Below.

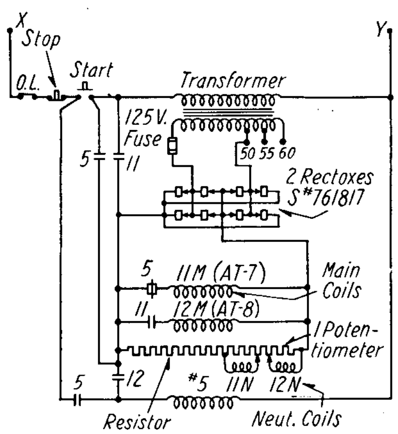

Fig. 5—Full Wave Rectox and Transformer (3 Points).

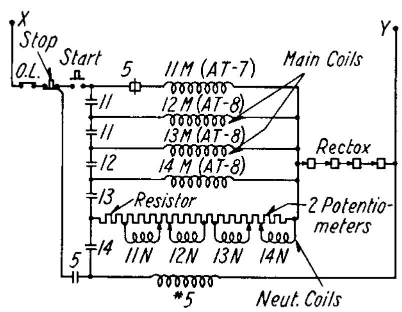

Fig. 4—Half-Wave Rectox (Any Number of Accelerating Steps).

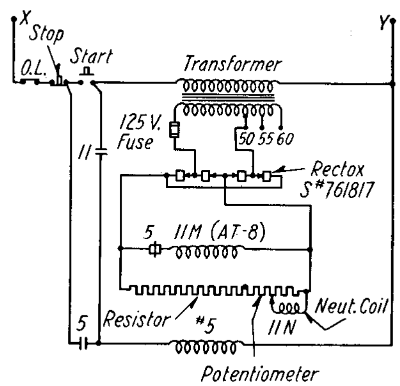

Fig. 6—Full-Wave Rectox and Transformer (2 Points).

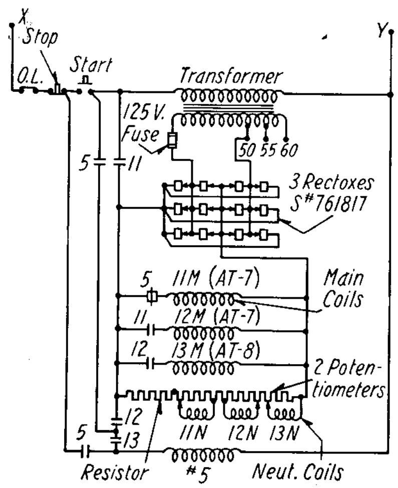

Fig. 7—Full-Wave Rectox and Transformer (4 Points).

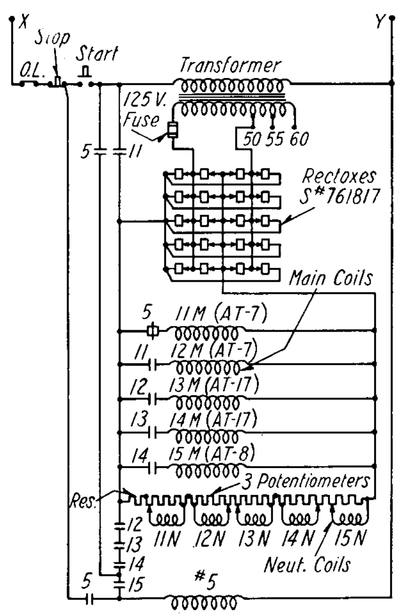

Fig. 8—Full-Wave Rectox and Transformer (5 Points).

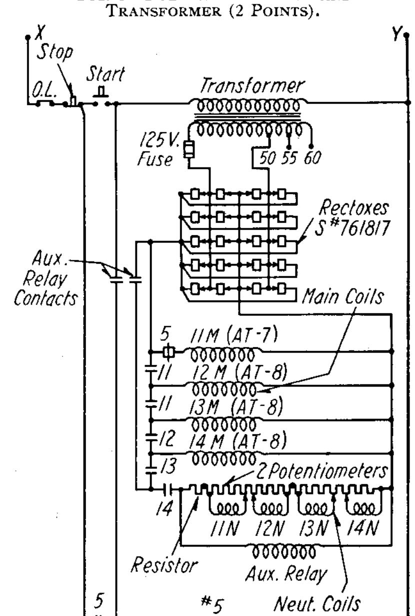

Fig. 9—Full-Wave Rectox and Transformer with Auxiliary D-C. Relay (5 Points).

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RENEWAL PARTS DATA

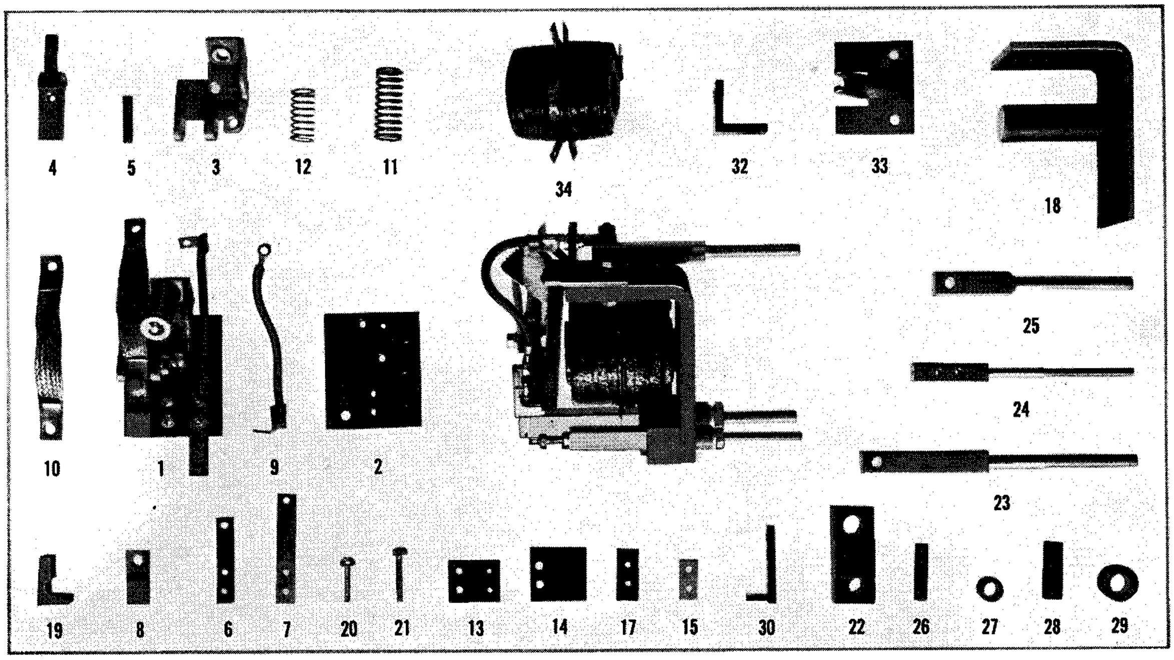

Fig. 10—Type AT Single Pole Timetactor and Renewal Parts (Double Pole Timetactor Parts are Similar)

Recommended Stock of Renewal Parts

Ref. No.	Name of Part	No. per Timetactor	Recommended for Stock		AT-4	AT-5	AT-6	AT-7	AT-8	AT-17
	Type of Timetactor				AT-4	AT-5	AT-6	AT-7	AT-8	AT-17
	Style Number of Timetactor				830306-A	830307-A	830308-A	830309-A	830310-A	856113
	For Timetactors in use up to and including		1	5	Style Number of Part					
1	Armature Complete	1	0	0	800342	830373	830401	830504	830509	830509
2	Bare Armature	1	0	0	830346	830346	830346	830346	830346	830346
3	Armature Bracket	1	0	0	830345	830345	830345	830345	830345	830345
4	Armature Lever	2	0	0	829687	829687	829687	829687	829687	829687
5	Armature Lever Pin	2	0	0	830297	830297	830297	830297	830297	830297
6	Interlock Moving Contact—Short	1 set	1 set	2 sets	793013	793013	793013	793013	793013	793013
7	Interlock Moving Contact—Long	1	1	2	793014	......	793014	793014	......	793014
8	Main Moving Contact	2	2	4	816937	816937	816937	816937	816937	816937
9	Interlocking Moving Contact Shunt	1	0	1	830344	830344	830344	830344	830344	830344
10	Main Moving Contact Shunt	2	0	1	808972	808972	808972	808972	808972	808972
11	Armature Spring	1	0	1	816888	816888	816888	816888	816888	816888
12	Contact Spring	2	2	2	830343	830343	830343	830343	830343	830343
13	Interlock Moving Contact Base	1	0	0	830349	830349	830349	830349	830349	869123
14	Interlock Moving Contact Base Shield	1	0	0	830350	830350	830350	830350	830350	869124
15	Interlock Moving Contact Spacer	1	0	0	809417	809417	809417	809417	......	......
17	Int. Mov. Cont. Insulation Channel—Short	1	0	1	......	......	......	......	......	869125
17	Int. Mov. Cont. Insulation Channel—Long	1	0	1	830351	830351	830351	830351	830351	830351
18	Frame with Core	1	0	0	830347	830347	830347	830347	830347	830347
19	Main Stationary Contact	2	2	4	793015	793015	793015	793015	793015	793015
20	Interlock Statinary Contact—Short	1 set	1 set	1 set	806276	806276	806276	......	......	......
21	Interlock Stationary Contact—Long	1 set	1 set	1 set	......	......	817517	817517	817517	817517
22	Stationary Contact Base	1	0	0	830348	830348	830348	830348	830348	869120
23	Main Stationary Contact Stud	2	0	0	830358	830358	830358	830358	830358	830358
24	Interlock Stationary Contact Stud	1	0	0	830359	830359	830359	830359	830359	830359
25	Main Moving Contact Shunt Stud	1	0	0	830360	830360	830360	830360	830360	830360
26	Micarta Tube—Long–Interlock Station	1	0	0	830354	830354	830354	830354	830354	830354
27	Micarta Tube—Short Contact Stud	1	0	0	830355	830355	830355	830355	830355	830355
28	Micarta Tube—Long–Main Stationary	2	0	0	830356	830356	830356	830356	830356	830356
29	Micarta Tube—Short–Contact Stud	2	0	0	830357	830357	830357	830357	830357	830357
30	Interlock Stat. Cont. Brkt.—Marked	1	0	1	830352	830352	830352	830352	......	869121
‡31	Interlock Stat. Cont. Brkt.—Brass—Short	1	0	1	830362	......	......	......	......	......
‡31-A	Interlock Stat. Cont. Brkt.—Brass—Long	1	0	0	830361	830361	830361	......	......	......
32	Interlock Moving Contact Shunt Bracket	1	0	0	830353	830353	830353	830353	830353	869122
33	Armature Support	1	0	0	597541	597541	597541	597541	597541	597541
§34	Operating Coil	1	0	0	§	§	§	§	§	§

‡Not illustrated.
§See Table on Page 2.

WESTINGHOUSE ELECTRIC & MANUFACTURING COMPANY

East Pittsburgh Works Printed in U.S.A. **East Pittsburgh, Pa.**

Distribution 64 and 78

*To be filed as an Instruction Leaflet and as Renewal Parts Data; for Instructions, see Pages 1 to 3.