CAUTION: Before placing relay in service remove all blocking.

REFERENCE DRAWINGS

Internal Schematic 553A324

Outline and Drilling 57-D-7902

CONSTRUCTION

The KFC relay is made up of 5 basic elements.

2 - High speed telephone relays (R and L).
1 - Slow pick-up telephone relay (Y).
1 - Slow drop-out telephone type relay (X).
2 - Directional elements.
2 - Neon lamp assemblies.

OPERATION

The relay determines whether the incoming voltage lags or leads the bus voltage when the two voltages are 90° apart.

Referring to Figure 1, the voltage of the bus is assumed to be fixed, the voltage of the incoming machine will rotate clockwise if the incoming machine frequency is too low, or counter-clockwise if the incoming machine frequency is too high.

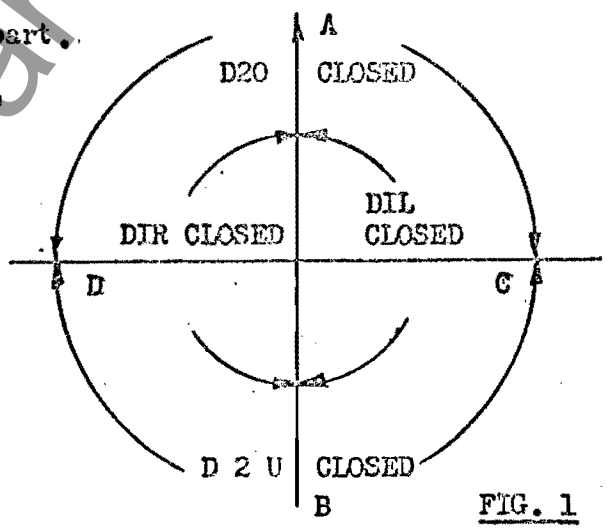


FIG. 1

The Directional element D1 has zero torque when the incoming and bus voltages are in phase, and contact D1L (right hand) is closed when the incoming voltage lags the bus voltage by any angle between 0 and 180 degrees. Conversely D1R is closed when the incoming voltage leads by any angle between 0 and 180 degrees.

The D2 element is so adjusted that D2O is closed when the incoming voltage lags by 90° to 270°, and D2U is closed when the incoming voltage leads or lags by 90° or less.

Assuming now that the incoming machine is running slow, and that at the beginning of a slip cycle both voltages lie along the line OA, the operation through a complete slip cycle is as follows. Refer to Fig. 2.

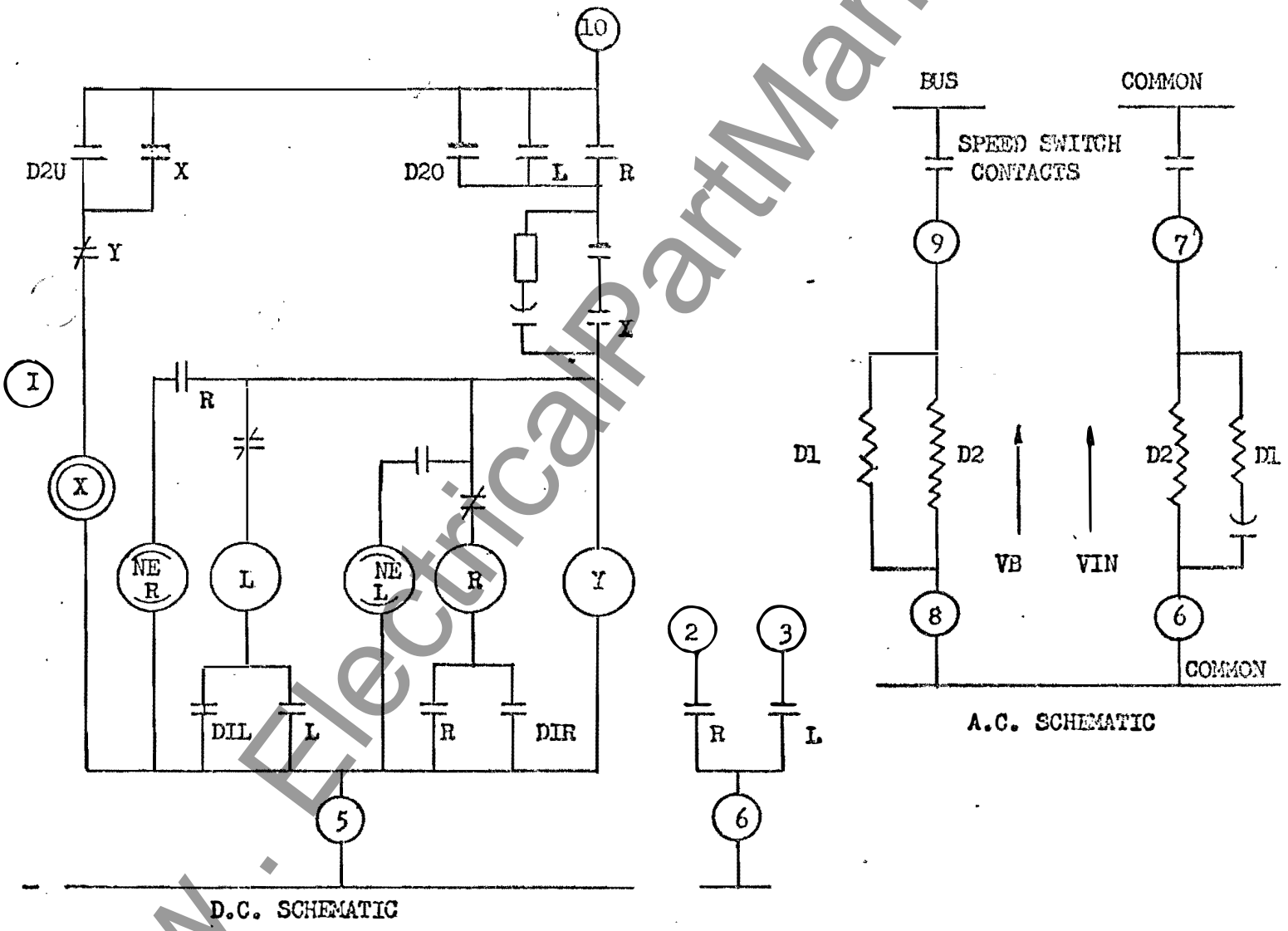


FIG. 2

Starting off with both voltages along OA, D2O is closed and directional element D1 produces zero torque. The incoming machine voltage rotates clockwise and closes D1L. D2O remains closed.

When the incoming machine voltages passes (clockwise) the line OC, D2U is closed and energizes the X relay.

When the incoming machine voltage lies along the line OB, the directional element (D1) produces zero torque again, and, as the incoming voltage progresses farther clockwise, D1R is closed.

When the incoming machine voltage passes (clockwise) the line OD, D2O is closed and D2U opened, but X relay remains closed by a contact of X across D2U. A circuit to the "raise" control terminal of the governor motor is completed. The "raise" Neon lamp is also energized., The "raise" signal will be given until relay X has dropped out. Relay X is de-energized when the relay Y opens. The relay R also seals in D1R and blocks D1L. This blocking of D1L is necessary because when the incoming generator voltage again passes the line OA, the contact D1L would close thus sending out an incorrect "Lower" signal. The relay R must therefore be fast enough to seal in contact D1R and block contact D1L in the 90° interval between OD and OA. The X relay must pick-up in the 180° interval CBD. Based on a 10 cycle drop out time of relay X, the speed matcher will give a 10 cycle (60 cycle basis) raise impulse each slip cycle for slip frequencies of 3 cycles or less.

For high slip frequencies, the contact D2O of the D2 relay would interrupt the signal each slip cycle, and provide too short a signal. For this reason, D2O contact is sealed in by a contact of relay R, and relay Y has been added to maintain the pulsing action of relay X. Relay Y is energized

each time contact X and D2O close. After a time delay of approximately 1.5 cycles, relay Y opens and opens the coil circuit of relay X. After a time delay of 10 cycles relay X opens and interrupts the raise impulse.

For incoming machine speeds higher than bus speed, the operation is similar except that "Lower" signals are given, and relay L blocks the D1R contacts.

Effect of Frequency on Directional Operation

The characteristic of zero directional torque on the relay D1 when the running and incoming voltages are along line OA or OB is accomplished by the use of series capacitor in one the directional potential circuits of the relay D1. When a frequency lower than 60 cycles is applied to this circuit, the effect is to rotate the zero torque line AB toward the dotted position A'B' of Figure 1. This gives relay R slightly more time to operate and thus is an advantage. A frequency higher than 60 cycles rotates the directional zero torque line towards the dotted position A"B". This provides more time for relay L to operate and again is a slight advantage.

Frequency Range

The KFC operates correctly for incoming machine frequencies within ± 10% of the running machine frequency.

Loss of Incoming or Running Machine Voltage

With only one voltage applied to the speed matcher, no signals will be given.

KFC Relay - Adjustments

Relays R and L: (Westinghouse Style No. 529C969H14).

The R and L relays should close their make contacts in 1/2 cycle

(60 cycle basis) or less when energized at 80% of rated D.C. voltage.

Relay Y: (Westinghouse Style No. 391P400H03).

Relay Y should operate at 80% of rated D.C. voltage and when energized at rated D.C. voltage should operate in 1.5 cycles or more.

Slow Release Relay (X): (Westinghouse Style No. 5293502H08).

The pick-up time at 80% rated voltage should be 1.5 cycles or less.

The drop out time is adjusted at the factory by means of the residual adjusting screw to be 10 to 11 cycles (60 cycle basis).

Directional Elements

Adjust the stationary contacts to allow a gap of .015" to .020" between stationary contacts and the moving element blade.

Zero torque should occur on the directional element D1 when V incoming, V running are ($90^\circ \pm 10^\circ$) out of phase. And zero torque should appear on directional element D2 when V incoming and V running are in phase($\pm 10^\circ$).

Neon Lamps

The Neon lamp assembly is Westinghouse Style No. 55D8913P7.

The NE-51 Neon bulbs are Westinghouse Style No. 55D8913P8.

CANADIAN WESTINGHOUSE COMPANY LIMITED

SWITCHGEAR AND CONTROL DIVISION

HAMILTON - ONTARIO - CANADA

August 19, 1965

ISSUE	DATE		
1	9/11/45	Kendrick	L.A.
2	9/2/46	L.A.	A. A. D.

EDITIONS

2 RESISTORS TO CONNECTED TO Ⓟ & L WERE NOT ON. PHOTO NO. WAS 50515S.

2/25/46 K.S. / G.D. L.A.

1-851

SCALE - | DWG. 553 A 324

CANADIAN WESTINGHOUSE CO. LIMITED HAMILTON CANADA

TYPE KFC FREQUENCY COMPARATOR - INTERNAL SCHEMATIC

ALL DIMENSIONS IN INCHES | FOR LIMITED TOLERANCES SEE

SLOW DROP OUT TELEPHONE RELAY

NEON LAMP

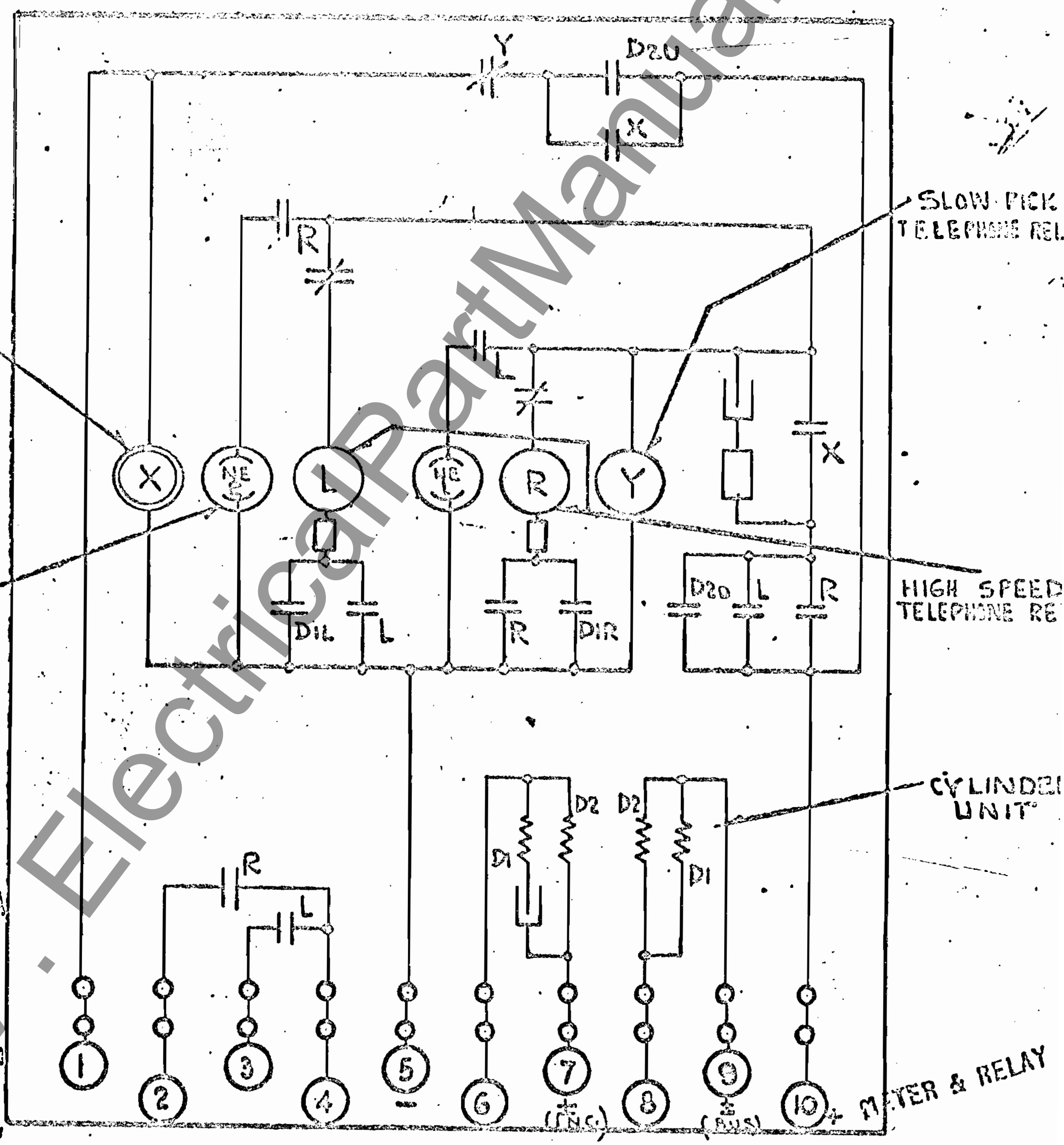


PHOTO B-15,282-A
FILE H41-1702

REF. DWGS.
530C025
WIRING DIAGRAM
A329
EXTERNAL DWG.

METER & RELAY ENG.

510

F.T. 3

ASSEMBLY DWG 680D956

FRONT VIEW

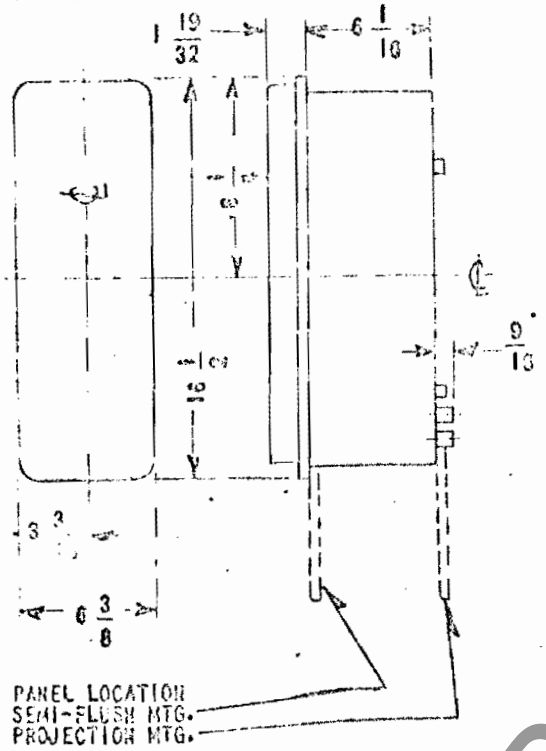
DPC

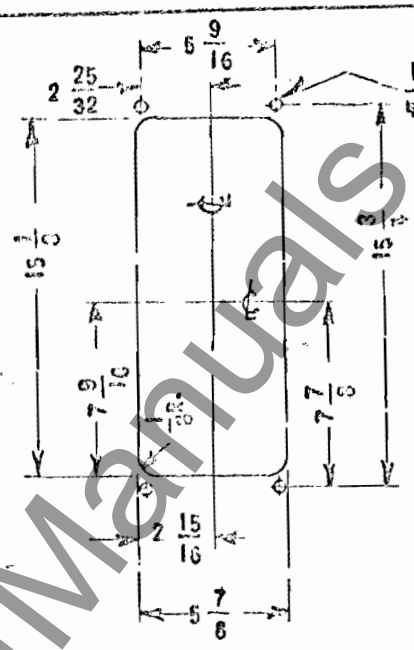
553 A 324

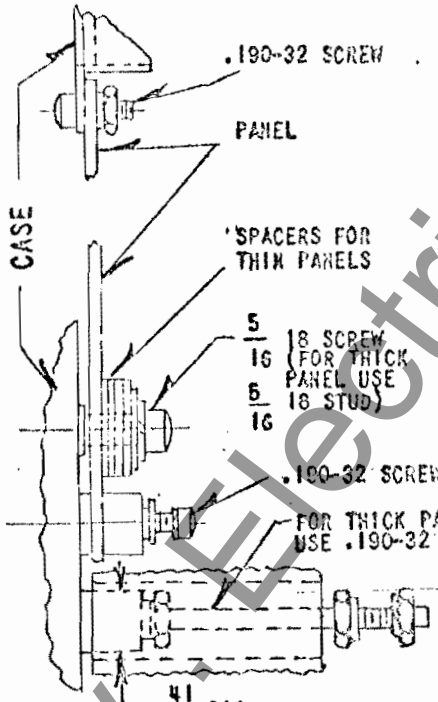
'ESTINGHOUSE ELECTRIC CORPORATION - [illegible] Y - INSTRUMENT DIVISION - NEW[illegible] N.J., U.S.A.

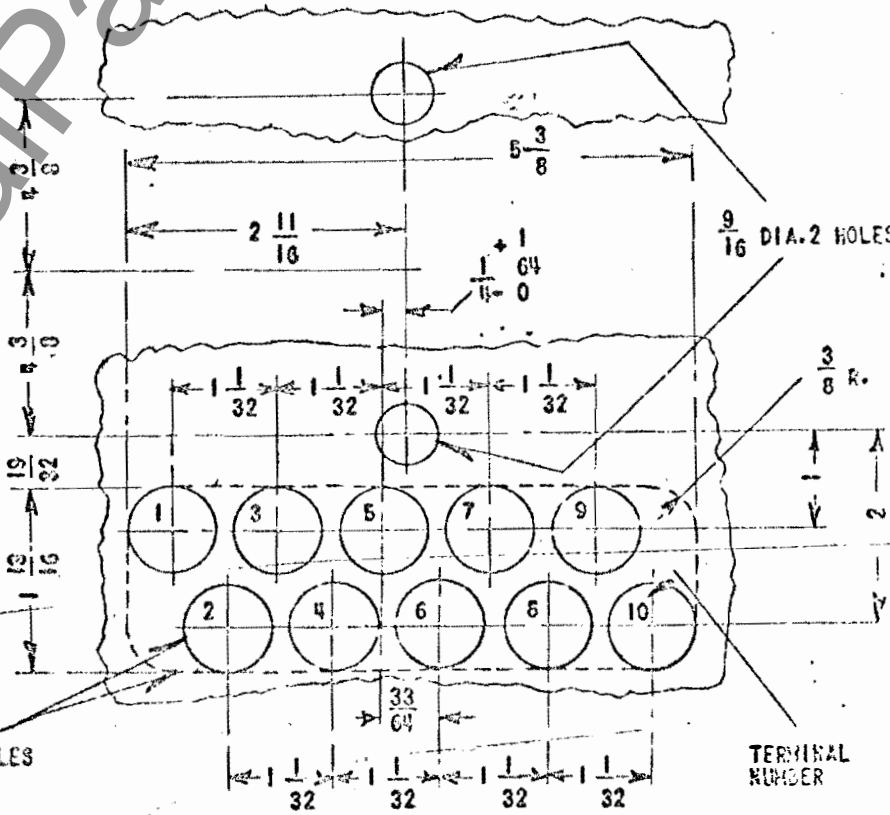
OUTLINE & DRILLING FOR RELAY [illegible] TYPE FT 31

DIMENSIONS IN INCHES









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