

COMMON SYSTEMS
INCOMING TRUNK TEST LINE CIRCUIT
FOR TESTING INCOMING TRUNKS
IN CROSSBAR NO. 1 OFFICES OR
FINAL MULTIPLE TEST LINE CIRCUIT
FOR TESTING INCOMING SELECTORS
IN PANEL OFFICES
USING 114KA RELAYS
FOR AC-DC OR SUPERIMPOSED
RINGING OFFICES

CHANGES

B. CHANGES IN APPARATUS

B.1 Superseded Superseded By
B429 Relay B31 Relay

D. DESCRIPTION OF CIRCUIT CHANGES

D.1 The use of the B429 relay is rated
"Mfr. Disc." to show realistic ratings
for obsolescent apparatus.

All other headings, no change.

BELL TELEPHONE LABORATORIES, INC.

DEPT. 2353-MRG-EWO-PM

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CHANGES

D. DESCRIPTION OF CIRCUIT CHANGES

D.1 Prior to this issue the equipment designation of this circuit was (INC TRK TST L) and (FIN MULT TST L) was not shown.

All other headings, no change.

BELL TELEPHONE LABORATORIES, INC.

DEPT. 3310-MHK-RLL-HJ

COMMON SYSTEMS
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CHANGES

A. CHANGED AND ADDED FUNCTIONS

A.1 The circuit is changed to make the ringing tests over the T & R leads instead of over the R lead only in order to prevent vibration of the bridged impedance incoming supervisory relay when it is connected after the tripping test is satisfied.

A.2 The use of both "S" and "J" options in one test line group has been eliminated.

D. DESCRIPTION OF CIRCUIT CHANGES

D.1 The change for making the ringing tests over the T and R leads consists of superseding "G" option by "H" option.

D.2 In order to eliminate the use of both "S" and "J" options in one test line group, "S" option and note 117 have been rated Mfr. Disc. and note 118 added covering the use of "J" option.

D.3 The title has been changed to "No. 1 Crossbar Offices" in place of "Crossbar Offices".

All other headings under "Changes", no change.

1. PURPOSE OF CIRCUIT

1.1 This circuit is designed to test the tripping and supervisory relays of incoming trunk or incoming selector circuits using 114KA tripping relays, in crossbar or panel offices. It is used in conjunction with Outgoing trunk test frames, portable and automatic incoming test circuits. It may also be used in connection with the test of incoming trunks from manual and toll switchboards.

1.2 This circuit is arranged to make the following tests:

1.21 To make a pretrip test of the tripping relay during the silent battery period following the first ringing period on incoming trunks arranged for individual line or two party line full selective ringing or on trunks arranged for semi-selective ringing if the test lines are in the one ring code group.

1.22 To make a pretrip test of the tripping relay in the second silent period on trunks arranged for semi-selective ringing, where the test lines used are in the two ring code group, and for trunks having immediate ringing.

1.23 To make a trip test of the tripping relay during the silent battery period following the second ringing period on incoming trunks arranged for individual line or two party line full selective ringing or on trunk arranged for semi-selective ringing if the test lines are in the one ring code group.

1.24 To make a trip test of the tripping relay during the silent battery period following the fourth ringing period on trunks arranged for semi-selective ringing if the test lines are in the two ring code group, and for trunks having immediate ringing.

1.25 To test the supervisory relay for operate, release, sticking and chatter.

1.26 To determine whether the battery and ground on the tip and ring of the incoming are in the proper direction.

1.27 To check for ringing current on the ring side of the line and ring ground on the tip.

1.3 This circuit is connected to a terminal on the primary line switch multiple in the line link and

group control circuit of crossbar offices or to terminals on the final multiple in panel offices. When it is desired to test the incoming trunk circuit the incoming circuit is directed to the line terminal to which this line is connected. When this test line is seized under this condition it will be progressed automatically from one test to another, provided the incoming trunk circuit functions satisfactorily. When the test of the incoming circuit is completed, this test line circuit will advance and give a distinctive test complete signal and wait for disconnection at the originating end. In case of failure of the incoming relay circuit to function properly this circuit will block and prevent the incoming test circuit from giving an OK signal under certain test conditions. The circuit will return to normal automatically at any time from any point, when released by the incoming trunk circuit and hold the circuit busy until normal. A make busy jack is provided, which will make the circuit busy but will not interfere with the test in progress.

1.4 This circuit is arranged so that in case the tripping relay fails on the pretrip test, the test line blocks and passes a rapidly interrupted ringing tone signal over the tip of the trunk to the distant test attendant so that he can determine the cause of the failure. Failure to trip is indicated to the attendant by the continued presence of normal ringing induction tone. A tick-tock tone is sent to the distant test attendant as a test complete signal.

2. WORKING LIMITS

2.1 None.

3. FUNCTIONS

3.1 To test for ringing current on the ring, and ring ground on the tip side of the trunk.

3.2 To make a pretrip and trip test of the tripping relay in the incoming trunk circuit during the silent battery period of the machine ringing interrupter.

3.3 To wait for the three second silent battery period for making the pretrip and trip tests on trunks arranged for semi-selective ringing if the test lines are in the two ring code group.

3.4 The circuit is arranged to time approximately four seconds with the (R) relay connected to the ring of the trunk following the trip test to determine if the ringing is tripped

before proceeding with the supervisory tests.

3.5 To test the supervisory relay in the incoming trunk circuit for "operate" and "release".

3.6 To make a test for the continuity and polarity of the talking battery, in the incoming relay circuit.

3.7 A check of the pretrip and release test resistances is made in conjunction with the check of the ring lead supervisory circuit.

3.8 This circuit is arranged to give long and short closures to the incoming trunk circuit so as to synchronize the operation of the automatic incoming testing circuit with the operation of the incoming trunk test line circuit. The incoming supervisory relay test will give a long synchronizing closure with a soak current to the incoming in order to get the incoming test circuit in step. The circuit will then give two separate short closures with a soak current of the supervisory relay. Each of these closures and the synchronizing closure will be followed by the release test of the supervisory relay. The test line circuit is then arranged to give a second long synchronizing closure with the soak current in panel offices and with an operate current in crossbar offices to indicate that the release tests are completed. After the second synchronizing closure, the test line circuit will give two closures for the operate test. The two operate test closures and the second synchronizing closure are followed by open circuit release periods.

3.9 When this circuit is operating with the portable incoming test, or at the outgoing trunk test circuit, the manual or toll switchboard, the synchronizing closure, soak, release and operate test closures will cause the supervisory lamp to flash. The number and the regularity of these flashes should be observed by the test attendant in order to determine whether the supervisory relay is responding correctly to the pulses from the test line.

3.10 A feature is incorporated which provides two "J" relays as ringing relays in the test line to prevent them from operating the circuit falsely on talking battery surges.

3.11 Tone signals are provided so that in case of certain failures or on completed tests the distant test attendant may determine the point where the test stopped.

3.12 Message register (GB) is provided and arranged to operate when all test lines in a group are busy.

3.13 A make busy jack is provided so that the test line may be taken out of service.

3.14 The pretrip and trip test conditions are timed by the closed period of the "B" contact of the (TP) interrupter. (.404 to .677 second).

3.15 This circuit is arranged to return to normal from any point after disconnection by the incoming circuit.

3.16 The 206 type selector (A) is used to steer the circuit from one test to another, to count the test pulses and in conjunction with the (P) interrupter to measure the length of the synchronizing pulses.

3.17 Interrupter (P) is used to give the proper open and closed periods for the test pulses to the incoming supervisory relay, to step selector (A) when the synchronizing closures are made and send interrupted ringing and tick-tock tone signals to the distant test attendant.

3.18 Interrupter (TC) is used to time the period required for the trip relay operate check. (Min. period approx. 5 sec. Max. period approx. 8 sec.)

3.19 This circuit is arranged in crossbar offices so that the (S) relay will operate from the "ANS" lead to the line choice connector or number group connector circuits, and close its operate ground to the "ALS" lead to operate the primary line hold magnet and lock up over the associated "ALS" lead to ground in the incoming trunk.

3.20 The circuit is arranged to function on a short ring by locking the (SR) relay until the (T) relay operates.

4. CONNECTING CIRCUITS

When this circuit is listed on the keysheet the connecting information thereon is to be followed.

4.1 This circuit is arranged to function with the line choice SD-25275-01 or number group connector circuits SD-25276-01 (Fig. 1A).

4.2 This circuit is arranged to connect to the line link and group control circuit SD-25553-01 (Fig. 1A).

4.3 This circuit is arranged to function with incoming trunk circuits of the crossbar type. (Fig. 1A) SD-25298-01 (typical).

4.4 Interrupter frame circuit (Crossbar offices) SD-25062-01.

4.5 Misc. ckts. for misc. interrupter frame (Panel offices) SD-21667-01 and SD-21666-01.

4.6 This circuit is arranged to function with battery cut-off relay final selectors (Fig. 1B) SD-21200-01.

4.7 This circuit is arranged to function with ground cutoff relay final selectors (Fig. 1C) ES-239664.

4.8 This circuit is arranged to test incoming selectors of the panel type (Figs. 1B or 1C) SD-21115-01.

DESCRIPTION OF OPERATION

5. CIRCUIT OPERATION

5.1 Seizure

When this circuit is seized in a crossbar office (Fig. 1A) the (S) relay operates over the "ANS" lead thru the line choice or number group connector circuits. The operation of relay (S), (a) closes the ground on the "ANS" lead over the "ALS" lead to operate the primary line hold magnet and to lock to the incoming sleeve ground in parallel with the hold magnets over the "ALS" lead thru the line choice or number group connectors. In panel offices (Figs. 1B or 1C) the (SL) relay operates from ground or battery in the final selector and in turn operates the (S) relay. Relay (S) operated by-passes the "S" lead around the (SB) relay and (MB) jack to the (SL) relay. Relay (S) also (a) closes the tip of the trunk thru relays (TC) and (T) normal thru the winding of relay (R) thru condenser (R) thru relays (TS2), (TS1) and (TCL) normal to the ring of the trunk, (b) opens the (A) selector return to normal ground and (c) closes in part the all paths busy register circuit. The circuit waits under this condition for the first ring. This delay is to insure time to operate the line and incoming hold magnets before separating the "ANS" and "ALS" leads in crossbar offices. The (R) and (R1) relays operate on the first ring and relay (R1) operates relay (SR) which locks thru relay (T) normal to ground on relay (S) operated with (G) option or ringing ground with (H) option and in turn operates relay (TS). The combination of the (R) and (R1) relays is to prevent false operation

of the (SR) relay on surges. Relay (TS) closes ground to the "ANS" lead to hold it busy should the test attendant disconnect at this time. (crossbar only). Relay (TS) operated also (a) closes ground thru arc 2 (A) selector normal to operate relay (T), (b) closes in part a ground from arc 3 (A) selector normal for moving the (A) selector to terminal one. Relay (T) operated (a) locks thru relays (TC1) and (TC) normal to ground on relay (S) operated, (b) substitutes a local ground for the ground on the tip of the trunk to the (R) relays, (c) completes the path from arc 3 thru relay (TS) operates to step selector (A) off the normal terminal, "W" wiring and to energize the (A) selector magnet on "Z" wiring, (d) supplies ground to the trip and pretrip test resistances. Relay (SB) operates when the brush of arc 4 (A) selector reaches terminal 1 to prepare the circuit for return to normal on an abandoned test. Relay (SB) also holds the circuit busy during return to normal.

5.2 Pretrip Test

The "Z" wiring is used when the test line is in a two ring code group or when immediate ringing is used in the trunk and under this condition the (A) selector remains on normal until the (R), (R1), (SR) and (TS) relays release at the end of the first ring. This operation is necessary to insure making the pretrip test after the second ring of the code during the three second silent battery period. In this case the (TS) relay does not lock until it operates on the next ring. With "W" wiring the (A) selector steps to terminal 1 as soon as relay (T) is operated. Relay (TS) locks to ground on arc 2 (A) selector on terminals 1 and 2 and prepares the operate circuit for relay (TS1) thru arc 6 and (TP) interrupter, and also opens the circuit to advance out of position 3. At the end of the ringing period the (R), (R1) and (SR) relays will release. Relay (SR) is made slow release to hold over the open period of the machine ringing interrupter. The release of relay (SR) will close ground thru arc 1 (a) selector thru relay (TS) operated to the (TP) interrupter. When the "F" contact of interrupter (TP) closes, the (A) selector magnet is energized and when (F) opens the (A) selector steps to terminal 2. When the "B" contact of the (TP) interrupter closes relay (TS1) is operated thru arc 6. Relay (TS1) operated closes ground from relay (S) operated with (G) option or from the T lead with (H) option thru relay (T) operated thru the pretrip test resistances to the ring side of the trunk thru relay (TC1) normal, and

energizes the (A) selector magnet. When the "B" contact opens, relay (TS1) releases, opens the pretrip test resistance, and allows the (A) selector to step to terminal 3. When the (A) selector steps off terminal 2, relay (TS) releases and closes ground thru relay (T) operated to step selector (A) off of terminal 3 from a ground on arc 3. The (TN) relay operates on terminal 4 arc 2 of the (A) selector to connect interrupted audible ringing tone to the tip of the trunk for use in notifying the test attendant as to the nature of the trouble in case the circuit blocks due to a false operation of the incoming tripping relay. This operation is as follows: the (TN) relay closes audible ringing tone thru relay (SKR) normal thru the "B" contact of the (P) interrupter thru arc 6 terminal 4 thru the (T) resistance and (T) condenser to the tip of the trunk.

5.3 Trip Test

Assuming a satisfactory pretrip test the (R) and (R1) relays will operate on the ringing current over the ring of the test line to ground. The operation of relay (R1) operates relay (SR) which operates relay (TS). Relay (TS) operated closes ground from arc 3 terminal 4 thru relay (T) operated to step the (A) selector to terminal 5, "W" wiring or to energize the (A) selector magnet "Z" wiring. In the case of "W" wiring relay (TS) remains operated and locks on terminals 5 and 6 arc 2. However, on "Z" wiring the (A) selector does not step until the end of the ring when relays (R), (R1), (SR) and (TS) release. In this case these relays reoperate when the next ringing period is received and the (TS) relay locks. In either case the (R), (R1) and (SR) relays release at the end of the ring and close ground thru arc 1 thru the (TS) relay operated to the (TP) interrupter. When the "F" contact of (TP) interrupter closes, this ground thru arc 5 energizes the (A) selector magnet. When the "F" contact opens, the (A) selector steps to terminal 6. When the "B" contact of (TP) interrupter is closed, relay (TS2) is operated thru arc 6. Relay (TS2) operated closes ground thru the trip test resistances thru relays (TS1) and (TC1) normal to the ring of the trunk to test the tripping relay and closes ground thru arc 5 to the (A) selector magnet energizing it. When "B" contact opens relay (TS2) releases, opening the trip test resistance circuit and allowing the (A) selector to step to terminal 7.

5.4 Trip Test Check

On terminals 7 and 8 arc 1, ground from the (SR) relay normal is closed to

the armature of the (TC) interrupter and when the "B" contact closes this ground operates relay (TC). Relay (TC) operated (a) locks to ground arc 2 terminals 7 and 8, (b) closes the "F" contact of interrupter (TC) to the brush of arc 6 (A) selector in preparation for operating relay (TN), (c) supplies a locking ground for relays (TCl) and (SR), (d) prepares the circuit for operating relay (TCl) thru terminal 8 arc 6, (e) opens the tip lead to the (TN) relay to prevent passing interrupted tone to the tip of the line when relay (TN) operates under this condition, (f) transfers the (T) relay lock circuit to ground on arc 3, and (g) prepares the circuit for checking the supervisory ground on the tip of the line when the (A) selector switch advances to terminal 8. When the "F" contact closes, relay (TN) operates and energizes the (A) selector magnet thru the (T) relay operated. When "F" contact opens the (A) selector steps to terminal 8 and relay (TN) releases. When the "F" contact is again closed the (TCl) relay operates. Should the tripping relay fail to operate when tested, relays (R), (R1) and (SR) will operate on the next ring. Relay (SR) operated opens the ground to the (TC) interrupter to block the circuit.

5.5 Tip and Ring Lead and Test Resistance Check

In the interval between the time the (A) switch leaves terminal 7 and the operation of relay (TCl), the (T) relay is locked to the tip lead thru the 1600 ohm (U) resistance to test the continuity of the tip lead thru the supervisory ground circuit. Should this circuit be open the (T) relay will release and block the (A) switch in position 8. Relay (TCl) operated (a) locks to relay (TC), (b) transfers the (T) relay locking circuit from the tip of the trunk to ground on arc 2 (Relay (T) is slow enough in releasing to hold over this transfer), (c) operates relay (SKR) which in turn operates relay (TS1). Relays (SKR) and (TS1) are operated to close ground from relay (S) operated thru relay (T) operated thru the trip and pretrip test resistances thru relay (TCl) operated thru the winding of relay (RB) thru relay TN normal with H option thru relay (SKR) operated thru the supervisory relay test operate and release resistances thru (SKR) relay operated to the ring side of the trunk. Under this condition the (RB) relay operates to the talking battery on the ring of the incoming trunk under test. Relay (RB) operated closes ground from terminal 8 arc 3 thru relay (T) operated to step the (A) selector to terminal 9. Relay (TCl) holds to ground on arc 3 terminal 9 to insure that relay (T)

releases as the switch leaves terminal 8. Terminal 9 is a passby awaiting the release of the (T) relay which is somewhat slow release. Relay (TC) releases as the selector leaves terminal 8, and relay (TCl) releases as the selector leaves terminal 9. Terminal 10 is a passby position via the "F" contact of the (P) interrupter and is necessary to insure having a full period on the first synchronizing pulse.

5.6 First Synchronizing Closure

In order to get the automatic incoming trunk test circuit in synchronism with the test line, the test line circuit sends a synchronizing closure of approximately 1.3 seconds duration before starting the supervisory relay test. Relay (SKR) is operated when relay (TCl) operates in position 8 and holds until it leaves terminal 18 in order to prepare the circuit for the first pulses. Relay (SKR) holds the (TS1) relay operated to open the ringing bridge during supervisory pulsing. When the (A) selector reaches terminal 11 a circuit is closed to operate relay (SP) from ground on arc 2 thru "B" contact of the (P) interrupter thru arc 6. Relay (SP) operated, locks to ground on terminal 11, 12 and 13 arc 3 and closes a short circuit across the tip and ring of the trunk to give a soak to the supervisory relay and to start the first synchronizing pulse closure. The operation of relay (SP) also prepares the path for moving the (A) selector under control of contact "B" interrupter (P) thru arc 6 for measuring the time of the synchronizing closure. Under this condition the (A) selector is stepped under control of the (P) interrupter to terminal 14. When the brush of arc 3 leaves terminal 13 the (SP) relay releases and opens the stepping circuit. The release of relay (SP) also opens the soak bridge terminating the first synchronizing pulse. Under this condition the release bridge is left connected across the tip and ring leads thru relay (SKR) operated and relays (T) and (TC) normal and relay (S) operated.

5.7 Supervisory Relay "Soak", "Release" Test

The circuit is arranged to give two soak release pulses at this point to test the supervisory relay in the incoming trunk circuit for release. On the next closure of the (P) interrupter ground from arc 2 thru contact "B" (P) interrupter and terminal 14 arc 6 of (A) selector, operates relay (PC). Relay (PC) operated closes the short circuit across the tip and ring of the trunk and energizes the magnet of the (A) selector thru arc 5. At the end of the closed period of "B" contact

interrupter (P), relay (PC) releases and substitutes the release bridge for the soak bridge across the trunk. The release of relay (PC) also allows the (A) switch to step to terminal 15. The next "B" contact closure of interrupter (P) reoperates the (PC) relay over the same circuit. Relay (PC) operated again closes the soak bridge and energizes the (A) selector switch. When the (P) interrupter opens contact "B", relay (PC) releases allowing the (A) switch to step to terminal 16 and again substituting the release bridge for the soak bridge. When the brush of (A) selector switch arc 3 reaches terminal 16 a circuit is closed ("L" wiring) to operate relay (SPO) which prepares the tip and ring bridge circuit for sending the operate value of current for the second synchronizing pulse. Relay (SPO) operated holds thru terminals 17 and 18 arc 3. This arrangement is necessary in crossbar offices to prevent a surge condition due to the use of bridged impedance incoming trunks which causes the automatic incoming test circuits in panel offices to indicate an extra pulse.

5.8 Second Synchronizing Closure

A second synchronizing closure of approximately 1.3 seconds is provided to indicate to the incoming test circuit that the soak release pulse tests are complete. In position 16 of the (A) switch a circuit is closed from ground on arc 2 thru interrupter (P) on the next "B" contact closure and arc 6 terminal 16 to operate the (SP) relay thru its continuity contacts. Relay (SP) operated locks to ground on arc 3 terminals 16, 17 and 18, ("K" wiring) or to the (SPO) relay operated ("L" wiring), closes the soak ("K" wiring) operate ("L" wiring) bridge across the tip and ring of the trunk to start the second synchronizing closure and closes the same ground from the (P) interrupter to the magnet of the (A) selector switch.

When the contacts of the interrupter open the (A) switch is stepped to terminal 17. Under this condition the (A) switch is stepped successively to terminals 18 and 19 by interrupter (P). When the switch leaves terminal 18 relay (SP) releases opening the bridge and the stepping circuit for the (A) switch. The (SKR) relay also releases when the (A) switch leaves terminal 18 which opens the release bridge used between the soak pulses. Relay (SPO) - ("L" wiring) is released when the brush leaves terminal 18 of arc 3.

5.9 Supervisory Relay "Operate" Current Flow Tests

This circuit is arranged to give an open and two operate current and

open pulses to the tip and ring of the trunk after the second synchronizing closure: The open periods between the operate current pulses will allow the supervisory relays to release on open circuit to allow the worse condition for supervisory relay chatter. In position 19 the (PC) relay is again operated from ground on arc 2 thru interrupter (P) and arc 6 of the (A) switch. Relay (PC) operated closes the tip and ring leads thru the (SKR) relay normal, thru resistances to give an operate test value of current to the incoming trunk supervisory relay. Relay (PC) also by-passes the tip lead around the (SKR) relay normal. When interrupter (P) opens its contacts relay (PC) releases. The release of relay (PC) opens the test operate bridge across the tip and ring of the incoming trunk and allows selector switch (A) to step to terminal 20. On the next closure of "B" contact of interrupter (P), relay (PC) will again operate to close the test operate bridge across the tip and ring leads and to energize the (A) selector magnet. At the end of the (P) interrupter closure, relay (PC) will release, opening the test operate bridge and causing the (A) selector to step to terminal 21.

5.10 Test Complete Signal and Disconnect

In position 21 relay (TN) is operated from ground on arc 2. Relay (SKR) is also operated from ground on relay (SR) normal thru arc 1 of (A) selector to provide battery thru resistance (BA) and interrupted ground thru resistance (T) for supplying the tick-tock tone used as a test complete signal. Relay (TN) operated transfers the tip of the trunk to the tick-tock tone supply. When the test attendant hears the OK signal he will disconnect causing relay (S) to release. Relay (S) released closes a circuit thru relay (SB) operated to advance the (A) selector switch to normal. When the (A) switch leaves terminal 21 relays (SB), (TSL), (TN) and (SKR) release restoring the circuit to normal and removing the busy from the test line. In panel offices relay (SL) is released when the final selector returns to normal. Relay (SL) in turn releases relay (S) which holds a busy condition on the "S" lead and advances the (A) selector to normal as explained above.

5.11 Tone Signals

There are three tone signals, two of which are supplied by the test line circuit and one supplied by the incoming trunk circuit. The first tone signal consists of ringing induction interrupted at .3 second make and .2 second break by the interrupter (P). This tone is connected to the tip of

the trunk in position 4 indicating to the test attendant that the test line circuit has been blocked due to the tripping relay in the incoming trunk operating on the pretrip test. The second tone is regular ringing induction from the incoming trunk and if received for a period longer than should elapse for the tripping test to take place indicates that the ringing was not tripped during the trip test interval. The third tone is a tick-tock tone effect produced by interrupter (P) and is connected to the tip of the trunk in position 21 of the (A) selector switch indicating that the test line has completed all tests and is awaiting disconnection.

5.12 Test Line Guard and Return to Normal on Wipe Out

Relay (SB) is operated from arc 4 terminals 1 to 21. Relay (SB) operated closes a busy condition to the line choice or number group connector, crossbar.

5.13 Make Busy

This circuit is made busy by inserting a make busy plug in the (MB) jack.

5.14 All Circuit Busy Register

When all test line circuits in a group are busy the (GB) register will operate.

BELL TELEPHONE LABORATORIES, INC.

DEPT. 3340-GRM-FAK-WP

E-2629X
F-4