BACKGROUND: To provide instructions to check the correlator operation and troubleshoot correlator related issues.

PROCEDURE:

A. Operating principals:

The mechanical correlator installed on the Enstrom Piston Engine helicopters automatically operates the throttle when the pilot moves the collective relieving the pilot of having to manipulate the throttle to maintain blade RPM in the green arc.

The correlator is unlike an electronic governor in that the throttle twist grip must not move during collective operation. This forces the correlator to change the position of the throttle arm on the servo. If the throttle twist grip is allowed to rotate during collective operation, the correlator will not cause the throttle arm on the servo to move in the correct relationship to the collective, and the correlator will not work correctly.

With the helicopter sitting on the ground, the pilot begins the take-off process by opening the throttle to bring the engine and rotor RPM into the green arc, and then raises the collective while rolling OFF the throttle to maintain the RPM in the green arc. As the collective is raised, the correlator will automatically increase the throttle so to maintain the RPM in the green, the pilot must roll off throttle as the collective is raised.

As the helicopter lifts into a hover with the RPM in the green, the throttle is then CORRELATED to the collective and the engine for the helicopter gross weight, density altitude, wind...etc for that particular flight. As the pilot moves the collective up and down, the correlator automatically adjusts the throttle to maintain engine RPM.

The throttle friction must be set firmly enough so that when the collective is moved up and down, the throttle twist grip on the collective does not move.

B. Verifying proper Correlator operation.

1. Remove the collective cover and the firewall access cover in the seat back to gain access to the correlator and to the fuel injector servo and waste gate linkage.
2. Place the collective down and the throttle so the rivet is in the 12 o’clock position.
3. Check that the idle speed adjustment screw is against the stop on the servo.
4. Check that the clearance between the waste gate arm and the open stop is .06 to .09. (Fig 1) (The waste gate should be in the open position. (Fig 2))

![Fig 1](image1.jpg)

![Fig 2](image2.jpg)

5. Completely close the throttle; there should be no change in the position of the throttle-arm position on the servo. The throttle position between the point where the rivet is at 12 o’clock and fully closed is the override position and should have no effect on the position of the throttle arm on the servo. It is there only to make the correlator function properly.
6. Open the throttle to the full throttle position.
7. The throttle arm on the servo should be at least 90% open.
8. Open and close the throttle several times.
9. The operation of the output lever (item 210 figure 3) should be smooth and the output lever should rotate freely (perpendicular to the mounting plate (10) on its shaft (270) without causing the shaft to move laterally. If moving the throttle causes the pivot shaft to lean over (move laterally forward) this is an indication that there is friction in the system, throttle cable, servo, or wastegate.

![Fig 3](image3.jpg)
The throttle cable rod end is connected to the forward end of the output lever (210) which rotates on its shaft (Bolt 270). The shaft (270) is mounted in a uniball type bearing which allows it to lean over sideways if the throttle arm or cable movement is restricted.

The lateral (forward) movement of the pivot shaft (270) is the mechanism that allows the collective to be raised and lowered if the throttle cable or linkage locks up and allows the helicopter to be flown in this condition.

10. Raise the collective about 2 inches. Rotate the throttle from the idle position (closed) to the wide-open position. As before, the actuator arm must rotate freely on the pivot shaft parallel to the seat frame and the pivot shaft should not lean over laterally (forward). There will be no override position at the closed throttle position with the collective up two inches.

11. Open and hold the throttle at 100%, slowly raise the collective. As the collective is raised the shaft supporting the output lever should lean over sideways (forward) and allow the collective to be raised about 2 inches without the throttle turning. At about 2 inches, the throttle will begin to close as the pivot shaft deflection reaches its limit.

12. If the output lever shaft leans over at any time other than when the throttle arm on the servo is at the full open position, it is an indication that there is binding (friction) in the system.

C. Troubleshooting the Correlator: If the throttle cable actuator arm moves laterally (forward) when the throttle is rotated there is an issue with the system binding that must be corrected for the correlator to operate correctly.

1. Throttle cable:
   a. Disconnect the throttle cable from the servo and operate the throttle. If the throttle output lever rotates on the pivot shaft and the pivot shaft does not move out of plane, (laterally forward), the correlator and throttle cable are working correctly and the servo or the waste gate are causing the problems.
   b. If the throttle actuator arm (fig 3, item 210) continues to pivot sideways (forward) on its shaft when the throttle is twisted, disconnect the throttle cable from the throttle actuator arm and test the correlator operation again.
c. If the correlator now works correctly, the throttle cable has internal friction and should be replaced.

2. Correlator:
   a. If the actuator arm pivot shaft is still moving laterally (forward) after the throttle cable has been disconnected, there is a problem with the correlator. Contact Enstrom product support if the cause cannot be determined.

2. Wastegate:
   a. Disconnect the wastegate actuating arm from the throttle arm on the servo and operate the wastegate by hand.
   b. Operate the throttle and observe the throttle actuating arm for lateral movement on the pivot shaft, if the correlator now works correctly the issue is in the the servo.

3. Servo:
   a. If the correlator, throttle cable, and wastegate have been eliminated as causes, the servo is the issue.
   b. Operate the throttle arm on the servo by hand. If the throttle arm is stiff, disconnect the mixture arm control rod and operate the mixture arm and the throttle arms independently to determine if the issue is in the throttle shaft or the mixture side of the servo.

D. Adjusting the correlator after maintenance;

1. Adjustments to the engine such as magneto timing and fuel injection mixture adjustments may affect the correlator operation requiring fine tune adjustments after a test flight.
2. Throttle friction must be set high enough to prevent the throttle from moving when the collective is raised and lowered.
3. Fly the helicopter with the RPM set at 2900, 25 in MAP, and 55 MPH.
4. While holding airspeed at 55 MPH, increase collective to 39 in MAP.
5. Note the RPM change.
6. Hold airspeed and reduce collective to 25 in MAP
7. Note RPM change.
8. The desired operation of the correlator will not allow the RPM to exceed the maximum RPM while increasing collective or the minimum RPM while lowering the collective.
9. Make a small adjustment to the summing lever bolt (Fig 3, item 180)(No more than 1/8 – ¼ turn of the summing lever bolt each adjustment).
10. Fly the operational test again and continue to make adjustments until the best operation of the correlator is obtained.
1. Hold the throttle or set the friction to prevent throttle movement
2. Slowly raise the collective until the manifold pressure reaches 39 inches while maintain airspeed.
3. Record the RPM change.
4. The correlator can be adjusted by turning the summing lever screw (item 180 fig 3-11) in the IPC which will increase or decrease the RPM change.
5. The screw must be turned SMALL amounts, 1/8 to ¼ turn only.
6. My experience is that turning the screw anti clockwise increases the effectiveness of the correlator. (I think, its been a while!)