Operating Flight Restrictions -

The maximum permissible limit speed (knot - IAS) for various operations is as follows:

<table>
<thead>
<tr>
<th>Operation</th>
<th>Limit Speed (mph)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Lowering or retracting landing gear</td>
<td>235</td>
</tr>
<tr>
<td>Lower Flaps (both trailing and leading edge)</td>
<td>200</td>
</tr>
<tr>
<td>Opening Canopy</td>
<td>250</td>
</tr>
<tr>
<td>Opening Speed Brakes</td>
<td>540</td>
</tr>
</tbody>
</table>

Aerodynamic Limits:

- Mach Number: None

Structural Limits:

- Air Speed: 640 mph
- Maximum speed for full aileron deflection: 540 mph
- Maximum speed for full rudder deflection: 290 mph
- Rolling pull-out-full aileron deflection:
  - Load Factor: 3.0 g.
  - Air Speed: 540 mph

Symmetrical positive load factors:

<table>
<thead>
<tr>
<th>Configuration</th>
<th>Load Factor</th>
</tr>
</thead>
<tbody>
<tr>
<td>Clean</td>
<td>3.8 g.</td>
</tr>
</tbody>
</table>

Prohibited Maneuvers:

- Spins
- Snap Rolls
- Prolonged Inverted Flight

Access to Cockpit -

Access to the cockpit is obtained by depressing the flush type crank handle, located on the left side of the fuselage above the armament access door. Pulling the handle out, until it is free to turn and crank the canopy open. Use pilot's access ladder to enter the cockpit.

Before Starting J34 Engine -

a. Adjust rudder pedals and seat height.
b. Adjust seat harness, radio and oxygen connections.
c. Control system feel and power control switches to "Both Off"
d. XT-38 control switches and throttle "Off"
e. J-34 throttles "Off"
f. Afterburner switches "Off"
g. Cabin heat control to "Auto"
Before Starting J-34 Engine - (Continued)

h. J-34 engine nozzle control switches in "Normal" and nozzles full open.
i. Battery and generator switches "Off"
j. Inverter switch to "Main"
k. Oxygen selector at "Normal"
l. Emergency heat control "On"

Starting J-34 Engines (External power is required) -

a. Fuel selector to engine being started (Or to "Both" to start second engine).
b. Momentarily hold starter switch to engine being started.
c. At 10% RPM move throttle forward until approximately even with the idle position.
d. After light off control the turbine outlet temperature with the throttle to prevent exceeding 920°F for five seconds and 820°F for remainder of the time to attain idle RPM.
e. After both engines have reached idle RPM (32-40%) turn battery and generator switches "On" and have external power supply disconnected.

Note: If it is desired to discontinue a start, depressing the starter cut-out button will cut out the starter circuit. (The same button is also the air start ignition switch). After two unsuccessful starting attempts allow at least 20 minutes for the starter to cool.

After Engines are Started -

a. Test overheat warning system.
b. Decrease downspring to 0,
c. Elevator power and feel to "Both On," aileron power and feel to "Boos Only" rudder power and feel to "Both On."
d. Using elevator trim over ride switch, run elevator tab to 0 then place switch in "Auto."
e. Rudder trim at 10R.
f. Aileron trim at 0.
g. Wing trailing edge flaps at 20°. (When stopping the flaps at any position between full up and full down there is an 8° coast after the flap switch is placed in neutral).

Note: The wing leading edge flaps will automatically deflect 30° down whenever the trailing edge flaps are deflected and will automatically go full up whenever the trailing edge flaps are full up.
After Engines are Started - (Continued)

h. Speed brake switch in the closed (forward) position.

i. Radio "On."

j. With the voltmeter selector at elevator feel trim position, run the elevator feel trim with the stick grip button to obtain a reading of 10 on the voltmeter.

Fuel Management -

Fuel control is automatic with the exception that to use 50 gal. in each of two wing tanks the wing tank air switch must be placed in the "On" position.

Taxiing -

Turning the airplane requires considerable braking and frequent turning can result in overheating the brakes.

No nose wheel steering!

Take-Off -

When in position for take-off, advance both throttles to 100 - 102% RPM then close nozzles to increase turbine outlet temperature to within about 20° C of R.L. temperature. Do not exceed R.L. temperature except momentarily. (At times both on the ground and in flight it is necessary to retard the throttle to about 80% RPM to get the nozzle to close and then again advance the throttle to obtain the desired temperature). When the desired temperature has been obtained at 100 - 102% RPM turn the afterburner switches on. There will be a momentary drop in RPM then a surge in temperature after which the engines should stabilize at 100 - 102% RPM and close to the R.L. temperature. Nozzle control during afterburning is automatic. At 155 mph lift the nose and allow airplane to become airborne. Retract landing gear as soon as airborne by firmly pressing landing gear switch full up. The up position of the switch is momentary and it will return to neutral when released but the landing gear will continue the retraction cycle. Raise the flaps before exceeding 200 mph IAS. The sooner the afterburners are turned off after reaching a comfortable speed (about 230 mph) the greater will be the range and endurance. The afterburners are normally turned off by placing the afterburner switches in the off position, however, the afterburner will also be turned off if the throttle is retarded to decrease the RPM to 96%. Any time an afterburner is turned off allow at least one minute before attempting to turn it on again.
Climb -

For best climb use 100 - 102% RPM on both engines with the nozzles adjusted to obtain close to but not exceeding R.L. turbine outlet temperature. (If available use maximum permissible power on XT-38 also). Good results have been obtained from 2000 feet to 25,000 feet by climbing with both J-34 engines and the XT-38 at about 300 mph IAS.

General Flying Characteristics -

The stability of the airplane is weak but stable, except for a Mach number range between .92 and .94 where slight longitudinal static instability occurs. This is felt as a mild tuck under from .92 to .94 Mach number, however, it disappears at .95 Mach number and static stability returns, from .95 to .97 Mach number, the maximum obtained to date.

The propeller blade angle for feather changes slightly with speed and at high airspeeds the propeller will rotate even with the brake on. The propeller brake should be released and the propeller selector switch momentarily held to "Increase RPM" if the propeller is rotating in a counter clockwise direction or to "Decrease RPM" if it is rotating in a clockwise direction in order to stop the rotation. This procedure is also necessary after XT-38 shutdown at high speed if it is desired to bring the propeller to a complete stop.

J-34 Engine Shutdown in Flight -

a. Throttle "Off"
b. Fuel selector to engine still operating
c. Generator switch "Off"

J-34 Engine Air Start

a. Fuel selector "On"
b. Advance throttle to idle
c. Hold air start switch until engine lights
d. Generator "On" when engine reaches 40% RPM

Stalls

The XF-88A, either in the clean or gear and flaps down configuration, does not perform a complete stall. That is, a wing or the nose does not drop suddenly. The airplane remains completely stable with increasing aft stick position in which an extremely large angle of attack is indicated. The
Stalls - (Continued)

airplane, however, exhibits such a large sinking speed at high angles of attack that it is impracticable and unsafe to use the corresponding air speeds for landing approach. There is a natural warning to the pilot not to decrease air speed too low. The warnings consist of general airframe shaking and slight rolling oscillation in which the lateral attitude can easily be steadied by normal use of ailerons. This warning begins at approximately the upper limit in sinking speed in which the pilot can safely make a landing approach, and increases to intensity with decrease in air speed. In all cases recovery is positive with forward stick applied.

The air speed at which the warning begins will vary considerably with gross weight, i.e., fuel load; the table below gives the speeds for the following conditions:

<table>
<thead>
<tr>
<th></th>
<th>STALLING SPEEDS</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>FLAPS UP</td>
</tr>
<tr>
<td>Full Internal Fuel 21559 lbs.</td>
<td>133</td>
</tr>
<tr>
<td>G.W.</td>
<td>153</td>
</tr>
<tr>
<td>No Fuel 16231 lbs.</td>
<td>115</td>
</tr>
<tr>
<td>G.W.</td>
<td>132</td>
</tr>
<tr>
<td>Full Internal Fuel and Bombs and Rockets 24819 lbs.</td>
<td>142</td>
</tr>
<tr>
<td>G.W.</td>
<td>163</td>
</tr>
</tbody>
</table>

As stated, the air speed at which warning occurs begins at approximately the upper limits in sinking speed in which the pilot can safely make a landing approach. Therefore, the landing approach speed must be made with reference to air speed only. Note that the air speeds should be given some margin.

Approach and Landing -

With wheels and flaps fully down maintain about 170 to 180 MPH until on final approach then gradually decrease speed to 150 to 160 mph at the end of the runway. 150 mph IAS with about 1000 pounds of fuel remaining is considered the minimum speed which should be reached before crossing the end of the runway. Below this speed flight path control and airspeed control become very difficult and the aircraft has a tendency toward sinking spells from which recovery requires considerable altitude.
If a landing must be made with only one J-34 operating, considerable discretion must be exercised as to the appropriate time for extension of landing gear and flaps. The airplane will not quite maintain altitude on one engine with only the landing gear extended so it is recommended that the gear not be extended until on close base leg and that flaps not be lowered until on final approach when it is definite that the runway can be reached.

After landing roll open J-34 engine nozzles full open.

Stopping J-34 Engines -

a. Flaps up  
b. At signal from ground crewman throttles "Off"  
c. Fuel selector "Off"  
d. Elevator aileron and rudder power control switches "Off"  
e. Battery and generator switches "Off"

Note: If residual burning occurs after stopping engine have external applied and actuate started switch with fuel selector off until burning has ceased then press starter cut-out switch.
XF-88B EMERGENCY OPERATING INSTRUCTIONS

Emergency Retraction of Landing Gear -

a. Normal landing gear switch "UP"
b. 'EMERG.' switch "UP"

Emergency Extension of Landing Gear -

'Pull Out' emergency handle on forward vertical instrument panel and allow gear to free fall. Pulling the emergency release handle operates the main and nose landing gear emergency release mechanism, and an emergency dump valve through a cable and bell crank system.

Fire Detection System -

A fire detector and warning system for the engine compartments is provided. The controls for testing the system consist of three 'PUSH TO TEST' warning lights located on the main instrument panel, and one fire detector test switch located on the left-hand console immediately aft of the salvo switch. The lights, one for each engine, are electrically connected to thermocouples in the corresponding engine compartment. In the event of fire in an engine compartment, the thermocouples in that compartment cause the corresponding warning light to glow. The test switch, when depressed, operates all lights and tests the complete circuit of both engine detector systems. If necessary, hold the switch in for ten seconds while testing.

CAUTION

Do not ignore a fire warning regardless of previous test indications. The test circuit may have been defective while testing, yet the actual operating circuit will function independently in case of fire.

Overheat Warning -

In case of temperatures reaching 300° F in the engine compartment, an overheat flashing indication will be seen on the fire warning lights.

Fire Extinguisher System -

To actuate the fire extinguisher system place the selector switch on the left aft console in the desired engine position then turn the actuating switch (just aft of the selector switch) "ON". It is a one shot system.
which is depleted after one actuation.

Hydraulic System Failure -

Turn elevator, aileron and rudder power control switches to "Both Off." Aileron forces will be slightly high but control of the airplane can be easily maintained.

Flap Emergency Operation -

In the event of hydraulic system power failure, the flaps may be extended by the use of the flap emergency system. Pulling the emergency flap control in the cockpit opens the valve on the emergency air bottle installed in the airplane. Compressed air, acting upon the shuttle valves, closes the normal flaps 'DOWN' lines and directs air pressure to the flap motor. As the shuttle valves open, compressed air, acting simultaneously upon the emergency dump valve, allows flap motor exhaust air and hydraulic fluid to return directly to the reservoir with a minimum of restriction. Once on the ground the flaps will have to be retracted hydraulically and the compressed air bottle recharged or replaced.

Emergency J-34 Engine Nozzle Operation -

During non-afterburner operation, if the exhaust nozzle does not respond to cockpit control, place appropriate emergency nozzle control in the 'EMERGENCY' position. The exhaust nozzle will close to minimum area with switch in this position. If this condition occurs during military power operation, it may be necessary to retard throttle slightly in order to prevent excessive turbine outlet temperature.

During afterburner operation, if sustained excessive turbine outlet temperatures are observed, place appropriate emergency nozzle control in the 'EMERGENCY' position. The exhaust nozzle will open to maximum area. Operation of the afterburner with exhaust nozzle in maximum area will result in turbine outlet temperatures below red line.

NOTE

It is not advisable to prolong afterburner operation at high altitude with exhaust nozzle in 'EMERGENCY' position. Maximum nozzle area will result in excessively low turbine outlet temperatures with accompanying low thrust.

In case of an emergency if the throttle is retarded below 96% rpm, the afterburner fuel control circuit is deenergized; thereby discontinuing afterburner operation.
Emergency J-34 Nozzle Operation - (Continued)

CAUTION

If throttle is again advanced beyond 96% rpm, immediately place afterburner master switch in the 'OFF' position in order to avoid excessive loss of fuel through the afterburner.

Canopy Jettison -

The canopy is pneumatically jettisoned in an emergency by means of the manual jettison handle located on the left side of the pilot's seat. Pulling up the release handle actuates the valve on the air bottle which supplies compressed air to the canopy motor, and also rotates the canopy stop out of the path of the canopy rollers allowing the canopy to fly back freely.

Pilot Ejection -

a. Lock shoulder harness if time permits.
b. Place feet in stirrups.
c. Pull up red handle on left side of seat jettisoning canopy.
d. Pull up red handle on right side of seat firing seat ejection cartridge.
XP-88B NORMAL OPERATING INSTRUCTIONS

Ground Operation

Starting

a. Main inverter and fuel indicator circuit breakers in.

b. All XT-38 circuit breakers in except:
   1. Oil boost breaker out (XT-38 oil unsafe light will be on during ground operation).
   2. Prop feather breaker out if it is desired not to feather on shut down.

c. Inverter switch to "Main."

d. Overspeed control switch in "Start" position.

e. Propeller low pitch stop switch in "Stop Out" position.

f. Motoring switch in "Normal."

g. Engine master "On" (check for duct door unsafe light out indicating duct door has opened).

h. Throttle in start position. (Align white marks on throttle and quadrant).

i. Hold propeller selector switch to increase rpm position until propeller blade angle has run to 0 and stopped. (Do not return switch to "Auto.")

j. Fuel and oil switch "On."

k. Momentarily depress starter button.

l. The engine should light off automatically and accelerate to slightly over 80% RPM. Observe the following limits for starting:
   - Minimum oil temperature before starting: -34°C
   - Maximum turbine inlet temperature: 870°C
   - Maximum power section oil pressure during warm up: 250 psi

Note: If the engine fails to lift off after 3 minutes of cranking, discontinue the start by turning the fuel and oil switch off and retarding
the throttle to the stop. Wait 5 minutes before attempting another start.

m. Overspeed control switch in "Normal" (RPM will increase).

n. If constant speed propeller governing is desired synchronize engine RPM and electronic governor control setting between 90% and 100% RPM then place propeller selector switch in "Auto." (The electronic governor control indicator reads 3% higher than actual RPM).

Operating Limitations -

Avoid rapid throttle advances to prevent overspeeding the engine.

Observe the following normal operating limits:

<table>
<thead>
<tr>
<th>RPM</th>
<th>Power Section Oil Press.</th>
<th>Gear Box Oil Press.</th>
<th>Oil Temp.</th>
</tr>
</thead>
<tbody>
<tr>
<td>Below 90%</td>
<td></td>
<td></td>
<td>100°C Max.</td>
</tr>
<tr>
<td>Above 90%</td>
<td></td>
<td></td>
<td>81°C Max.</td>
</tr>
<tr>
<td>At 100%</td>
<td>170 Psi Min.</td>
<td>150 Psi Min. at</td>
<td>100°C Max. 5 Min.</td>
</tr>
<tr>
<td>At 100%</td>
<td>200 Psi Max.</td>
<td>at</td>
<td>80 - 85°C</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>60 - 85°C</td>
</tr>
</tbody>
</table>

Overhaul engine if RPM exceeds:

105% for over 3 minutes
106% momentarily

Consult XT-38 power limitation chart for maximum allowable turbine inlet temperature for existing atmospheric conditions.

Extensive ground operation will result in excessive oil temperature unless the free air temperature is below freezing or a supply of water is provided at the inlet of the oil cooler duct. A minimum of about 50° propeller blade angle is necessary to provide adequate flow through the duct. Both manual and automatic control of the oil cooler duct shutter are provided.

Normal Shut Down -

a. Retard throttle to stop.

b. Turn fuel and oil switch "Off."

c. "Master" has to go off to put prop brake on. (Below 10%)

To Release Propeller Brake When Engine is Not Running -

a. Turn fuel and oil switch "Off."

b. Turn engine master switch "On."

c. Advance throttle sufficiently to actuate throttle switch.
AIR START PROCEDURE FOR XT-38

1. All T-38 Circuit Breakers In.
2. Overspeed control switch in "START."
3. Prop low pitch stop switch "STOP IN" guar down.
4. Motoring switch in "MOTOR."
5. Prop selector switch out of auto & oil cooler "AUTO."
6. Engine master "ON" (Check for duct door lite out).
7. Throttle in start position (white lines on quadrant).
8. Hold prop selector switch to "INCREASE RPM" to obtain 3500 RPM 25%.
9. Fuel and oil switch "ON."
10. Motoring switch to "NORMAL."
11. At light off hold prop selector switch to increase RPM until blade angle has reached low pitch stop.*
12. Overspeed control switch to "NORMAL."
13. After light off, place "overspeed control switch" to NORMAL at 80% RPM.
14. Set electronic governor control to 97% (true) (100% indicated on dial).
15. Prop selector switch to auto.

*NOTE: If no light after 10 seconds, shut down by retarding throttle
Then, follow Normal Shutdown procedure.

AUTO EMERGENCY SHUT DOWN OF XT-38

If red light is on indicating actuation of feathering by speed switch—the system must be reactivated by pulling out Throttle circuit breaker and resetting.

NORMAL SHUT DOWN FOR XT-38

1. Retard throttle to stop.
2. Turn fuel & oil switch "OFF."

Note: To release propeller brake when engine is not running:
   a. Turn fuel and oil switch "OFF."
   b. Turn engine master switch "ON."
   c. Advance throttle sufficiently to actuate throttle switch.

"Master must be turned "off" to engage prop. brake."
Flight Operation

Air Start -

The following air start procedure has been used successfully from altitudes of 2000 feet to 20,000 feet at 250 mph indicated airspeed. Air starts at altitudes greater than 20,000 feet or indicated airspeeds greater than 250 mph should be investigated with caution, since the RPM attained after light-off and after placing the overspeed control switch in the normal position will increase with altitude and indicated airspeed with the resultant danger of overspeeding the engine.

a. All circuit breakers in.
b. Overspeed control switch in "Start" position.
c. Propeller low pitch stop switch in "Stop In" position.
d. Motoring switch in "Motor" position.
e. Oil cooler switch in "Auto."
f. Propeller selector switch out of "Auto."
g. Engine master switch "ON" (check for duct door unsafe light out indicating duct door has opened).
h. Throttle in start position (Align white marks on throttle and quadrant).
i. Hold propeller selector switch to "Increase RPM" to obtain 25% RPM.
j. Turn fuel and oil switch "on" and place motoring switch in "Normal."
   (Light off will occur almost immediately after placing motoring switch in "Normal."

k. At light off hold propeller selector switch to "Increase RPM" until blade angle has reached low pitch stop.

l. The engine should accelerate rapidly to somewhat above 60% RPM depending on altitude.
   Observe the following limits for starting:

   Minimum oil temperature before starting -34°C
   Maximum turbine inlet temperature 870°C
   Maximum power section oil pressure during warm up 250 psi.

Note: If engine does not light off within 10 seconds discontinue start by turning motoring switch to "Motor" and fuel and oil switch "Off.
   Wait about 1 minute to clear engine of fuel before attempting another start.
m. Overspeed control switch in "Normal" (RPM will increase).

n. Synchronize engine RPM and electronic governor control setting between 90% and 100% RPM then place propeller selector switch in "Auto." (The electronic governor control indicator reads 3% higher than actual RPM.)

Operating Limitations -

Avoid rapid throttle advances to prevent overspeeding the engine at all times. When operating with the propeller in fixed pitch or any time the propeller has reached the low pitch stop the RPM is very sensitive to both airplane speed changes and throttle movements.

<table>
<thead>
<tr>
<th>RPM</th>
<th>Power Section Oil Press.</th>
<th>Gear Box Oil Press.</th>
<th>Oil Temperature</th>
</tr>
</thead>
<tbody>
<tr>
<td>Below 90%</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Above 90%</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>At 100%</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>At 100%</td>
<td>170 Psi Min.</td>
<td>150 Psi Min.</td>
<td>80-85⁰C</td>
</tr>
<tr>
<td>At 100%</td>
<td>200 Psi Max</td>
<td></td>
<td>60-85⁰C</td>
</tr>
</tbody>
</table>

Overhaul engine if RPM exceeds:

- 105% for over 3 minutes
- 106% momentarily

Consult XT-38 power limitation chart for maximum allowable turbine inlet temperature for existing atmospheric conditions.

Do not exceed approximately 87% of maximum allowable turbine inlet temperature if RPM is below 98%.

If XT-38 operation is desired at low airspeeds it will be necessary to place the propeller low pitch stop switch in the "Stop Out" position since propeller blade angles less than the flight low pitch stop are necessary to attain 100% RPM at low airspeed.

Normal Shut Down

- a. Retard throttle to stop.
- b. Turn fuel and oil switch "Off"
- c. Engine master switch "Off" when it is desired to close the duct door.
If Normal Shut Down Procedure Does Not Shut Engine Down -

a. Raise guard and place emergency shut down switch in the down position. (This switch performs the same functions as retarding the throttle to the stop).

b. Turn fuel and oil switch "Off."

c. Engine master switch "Off" when it is desired to close the duct door.

If Normal Shut Down Procedure and Emergency Shut Down Switch Fail to Shut Engine Down -

a. Turn fuel and oil switch "Off."

b. When the turbine inlet temperature indicates that the engine is no longer running, feather the propeller by holding the propeller selector switch to "Decrease RPM" until propeller stops turning.

c. Engine master switch "Off" when it is desired to close the duct door.

To Release Propeller Brake When Engine is Not Running -

a. Turn fuel and oil switch "Off."

b. Turn engine master switch "On."

c. Advance throttle sufficiently to actuate throttle switch.