

TURBODYNE CORPORATION - GAS TURBINE DIVISION
PROJECTS AND SERVICES DEPARTMENT
MAINTENANCE SCHEDULES AND REQUIREMENTS
GAS TURBINE MODEL MEGA-PAK GT

Periodic inspection, repair and replacement of parts will be necessary in order to maintain the gas turbine at maximum efficiency and dependability. An original pattern of inspections is set up by the manufacturer:

1. Service Inspection
2. Combustion Inspection
3. Hot Gas Path Inspection
4. Major Inspection

While above formal inspections are scheduled on a periodic basis, the owner is asked to maintain accurate operating logs and data records to permit evaluation of possible deviations in performance. These help the manufacturer to determine whether adjustments in the inspection schedules are warranted.

Inspection intervals and schedules of work to be performed are intended to assure that the turbine will operate successfully and without forced outages to the next scheduled inspection. In setting initial inspection intervals, Turbodyne assumes reasonably favorable conditions in the operation of the turbine. These intervals will be subject to adjustments based on utilization, type of operation, fuel quality, environmental factors and inspection findings.

TURBODYNE CORPORATION - GAS TURBINE DIVISION

PROJECTS & SERVICES DEPARTMENT

RECOMMENDED INSPECTION SCHEDULES

GAS TURBINE MODEL MEGA-PAK GT

	DOWN TIME	LABOR	NATURAL GAS			DISTILLATE #2 (OIL)			RESIDUAL OIL	
	DAYS	MAN HOURS	BASE	PEAK	PEAK RESERVE	BASE	PEAK	PEAK RESERVE	BASE	PEAK
MAINTENANCE INSPECTIONS		--	- MONTHLY -			-MONTHLY-			-MONTHLY-	
COMBUSTION INSPECTION										
Initial	2	32	250	132	25	250	138	25	250	100
2nd Inspection	3	72	1000	550	100	1000	550	100	1000	250
Subsequent	5	240	4000	2250	400	4000	2250	400	2000	500
			OR ANNUALLY			OR ANNUALLY			OR ANNUALLY	
HOT GAS PATH INSPECTION	18	1640	16000	5300	1000	12000	4000	750	8000	2650
			OR EVERY FIVE YEARS			OR EVERY FIVE YEARS			OR FIVE YEARS	
MAJOR INSPECTION	30	2550	32000	10600	2000	32000	10600	2000	24000	8000
			OR EVERY TEN YEARS			OR EVERY TEN YEARS			OR TEN YEARS	

NOTES: (1) Inspection intervals are subject to adjustments based on utilization, type of operation, fuel quality, environmental factors and inspection findings. NOTE: Operation on residual fuel will cause performance deterioration in time due to ash deposits. Opening of turbine for mechanical cleaning may be required prior to scheduled inspections.

(2) Down time and labor hours are based on standard productivity level, scheduled inspection extend and expected parts repairs and replacements.

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Maintenance and Inspection Procedures

1. Service Inspection

The purpose of this inspection is to determine if the gas turbine and associated equipment and control are in proper operating condition.

If the turbine is in operation it can be left in operation and all checks performed. If it is idle it should be started through the automatic starting, synchronizing and loading sequence and required data recorded in Condition Monitoring sheets 1 to 4 attached herewith.

In particular pressure and temperature levels should be compared with data taken during commissioning to detect any deterioration e.g. lube oil and fuel filter pressure drop, base load versus ambient temperature, compressor discharge pressure, control oil pressure and set point oil pressure,

Lube oil tank level and jacking pump oil reservoir level should be checked. An operation and maintenance log sheet should be filled out and mailed to Turbodyne Corporation, St. Cloud each month.

2. Boroscope Inspection

Remove insulation blankets on compressor and turbine casings in areas O and P on attached diagram. O allows a view of the last stage compressor blades through the diffuser, and P which is the position used for rotor contering, or 'S' readings allows a view of compressor 13th stage and 14th stage rotor blades.

If at the time of inspection the top works is not removed, then position N can be used to inspect turbine nozzle guide vanes, Position L (the flame relay sight-window) and the sight window in the combustor mixing zone can be used to inspect the combustion chamber.

Caution should be used when inserting a boroscope into the hot section, to make sure that inside temperature are low (preferably below 200° F.) to avoid melting glue and spoiling the boroscope optics.

Position H can be inspected by entering duct through rectangular door in duct.

Positon M can be inspected by entering exhaust by inspection door near exhaust stack.

3. Combustion Inspection

Disconnect piping and wiring from the combustor top works and remove the top works assembly. The top works should be set on a cradle in the lay down area.

Use the combustor inspection basket to descend through the combustor liner, and set up a ladder in the socket provided in the U-duct to allow inspection of the inner mantle and turbine nozzle guide vanes.

- Condition of perforated "roof" of primary zone, tiles, and mixing zone below the tiled section should be noted, with special reference to edges of holes, welds, and corners to make sure no cracks have started. Look for signs of chafing where surfaces have rubbed over each other due to expansion.

Examine U duct and inner mantle for signs of distortion, overheating (color) and cracks at welds and corners.

Examine Turbine nozzle guide vanes and all visible rotor blades for damage, peeling or bubbling of coating, burrs on blade tips indicating rubbing, or cracks. Check rounded end wall of blade carrier for distortion of color indicating overheating.

4. Hot Gas Path Inspection

The upper half turbine casing is removed without disturbing the compressor cover, then the top halves of inner mantle and blade carrier are removed to allow inspection of half of the turbine stationary blades and all rotary blades by turning the rotor.

In addition to the above, a combustion inspection is performed.

Preventive maintenance on auxiliary equipment is performed and instrument calibrations are checked.

- The electric generator end bells are removed to allow standard inspections and check on this equipment.

After reassembly a post inspection checkout and standard performance test are done to establish a new performance base line.

5. Major Inspection

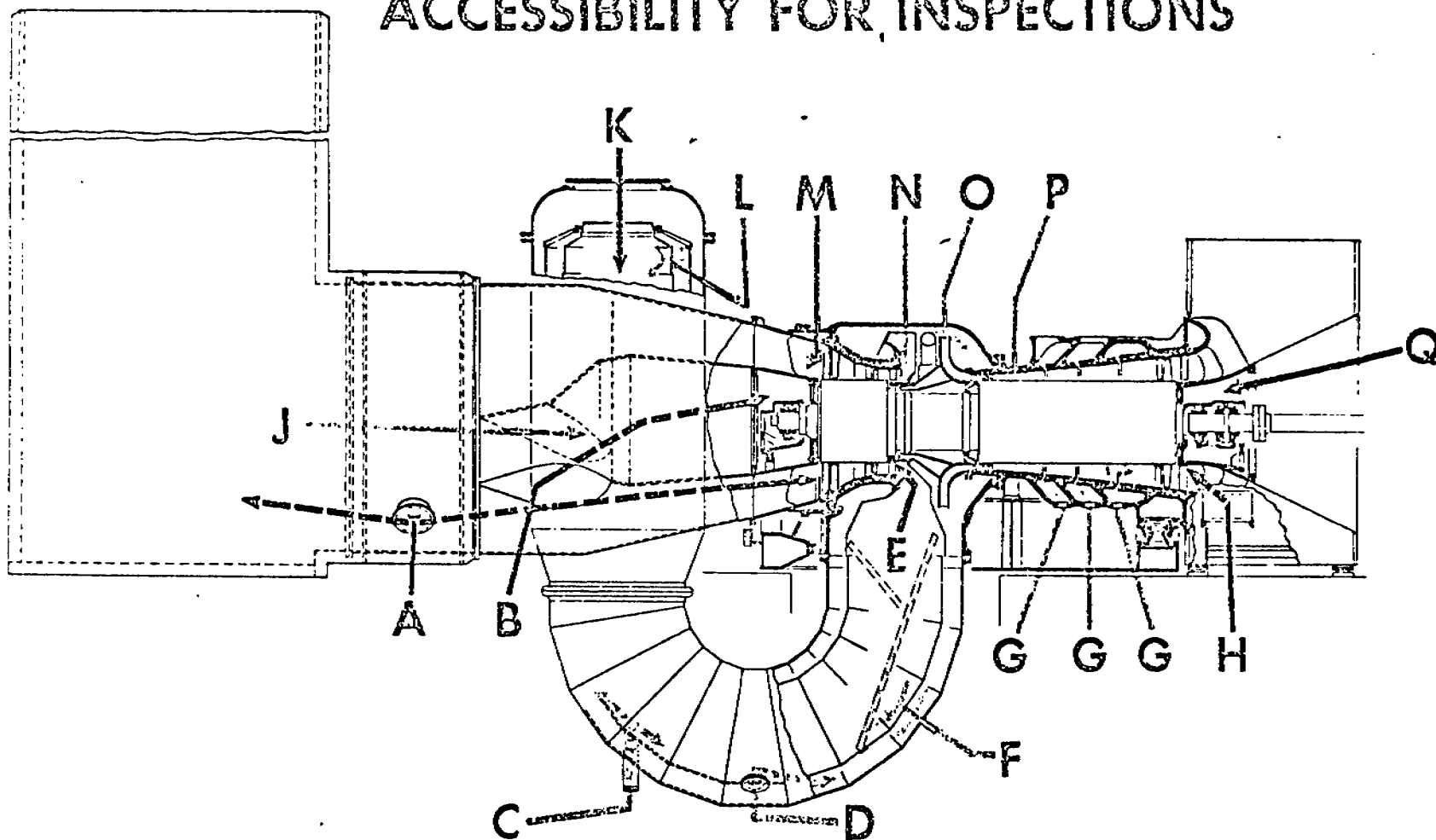
The air intake and blow off valve casings are removed, and the main top half casing (compressor and turbine together) to allow removal of the complete rotor and complete bearing inspection.

Necessary repairs and blade replacements are made to assure successful operation until the next scheduled major inspection.

Everything included in the hot gas path inspection is done and a performance test is run afterward to establish a new performance base line.

MEGAPAK 55GT ACCESSIBILITY FOR INSPECTIONS

FIGURE 1



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MEGAPAK 55GT

ACCESSIBILITY FOR INSPECTIONS

I DURING QUARTERLY SERVICE INSPECTION (no dismantling required – unit idle)

Location

- A. Climb in through manhole. Inspection of diversion grid in the stack, exhaust gas line, and exhaust diffuser, as well as of last gas turbine rotary stage (Last stage of stators with boroscope).
- B. Inspection of bearing area. Climb in through tunnel.
- C. Inspection of the inner mantle of the gas duct using the boroscope.
- D. Inspection hatch. Inspection of the inner mantle guide, of the inner and outer mantles on the air end.
- F. Inspection by boroscope of the inner mantle of the gas duct on the gas and air end.
- G. Inspection with the boroscope of the compressor blades and the exhaust channels.
- H. Climb in through manhole in the intake support. Inspection of the compressor inlet portion and the advance stator stage (1st rotary stage with the boroscope).
- J. Inspection with the boroscope of the lower combustion chamber inner mantle, gas and air ends.
- L. With the boroscope, inspection of the upper combustion chamber inner mantle and combustion chamber tiles, air and gas ends.
- M. At one point on the circumference, inspection with the boroscope of the last rotary stage and of the exhaust channel.
- N. At three points on the circumference, inspection with the boroscope of the 1st stage stator and of the inner housing on the air and gas ends.
- O. At 4 points on the circumference, inspection with the boroscope of the compressor after stator stage and of the inside parts located in the area of the inspection support.
- P. At 3 points on the circumference, inspection with the boroscope of the compressor blades.

II DURING COMBUSTION INSPECTION (after removal of the burner)

Location

- E. With the basket for inspection climb into the combustion chamber to the gas line. Using a ladder, it is possible to climb up to the gas turbine entry portion. Inspection of the 1st stage stators. (1st stage rotors with boroscope).
- K. After removal of the burner, climb into the combustion chamber with the inspection basket. Inspect the inner parts air and gas ends. Possible replacement of tiles.

FIGURE 4A

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