Power Turbine Blade Inspection and Repair Limits and Overhaul Criteria

Engine Application(s):	3013102E, E3013102:	PT6A - 11, 11AG, 15AG, 20, 20A, 20B, 21, 25, 25A, 25C, 27, 28, 34, 34AG, 34B, 36, 110
	3030102E, E3030102:	PT6B - 36, 36A, 36B; PT6T - 3, 3B, 3BE, 3BF, 3BG, 3D, 3DE, 3DF, 6, 6B
Subject:		Inspection, Repair and Overhaul Limits
Compliance:		On Condition
Revisions:	N/C	5/20/03: Initial Release
	A	7/28/05: Add "overhaul criteria" to reason and description
	B	4/12/07: Added E3013102 and E3030102
	C	8/04/09: Updated from EXTEX to TIMKEN.
	D	2/12/16: Updated TIMKEN to EXTEX Engineered Products.

REASON:

To provide Inspection limits, repair procedures and overhaul criteria.

DESCRIPTION:

This document contains the information necessary to inspect and repair/overhaul the subject parts following service. Parts meeting the criteria before or after repair are eligible for return to service. Parts failing to meet the criteria following repair are not eligible for return to service.

APPROVAL:

Technical aspects are FAA Approved.

WEIGHT AND BALANCE:

Not Affected.

PREREQUISITES:

None.

ACCOMPLISHMENT INSTRUCTIONS:

Power Turbine Blades

NOTE: A magnifying glass with three-to-four power magnification may be used as an aid to evaluate and confirm an observed condition in detail.

(1) Fluorescent-penetrant inspect; reject blade if cracked.
(2) All blades: inspect fir-tree roots for wear using two 0.050 in. diameter pins (Figure 4). Check five blades in a set; if any one blade is suspect, check remainder. Any blades with dimension 'c' less than 0.2404 in. must be rejected.

(3) Coated Blades:
- Includes 3030102E and E3030102, all lots, and 3013102E and E3013102, lot # 5646

(a) Carry out visual inspection of coated surfaces of PT blade airfoil for loss of coating as follows:
NOTE: Refer to Figure 2 for depiction of typical slight, moderate and severe PT blade corrosion and pitting.

1. Heat tint blades by heating in air furnace at 1000 ℉ ±25 ℉ for one hour.
2. Examine coated surface A (Figure 3) for color indications:
   - a gold color indicates the presence of coating.
   - a blue or a purple color indicates the loss of coating.
3. Loss of coating is acceptable provided:
   - the total affected area is not more than 25% of Area A.
   - the coating loss is not associated with severe corrosion. Corrosion more than 0.005 inch deep is not acceptable.

   NOTE: Severe corrosion appears as significant roughening of the surface caused by obvious growth and breakdown of the oxide layer of the protective coating.
4. Examine blade airfoil surfaces for signs of corrosion and pitting as follows:
   a. Slight corrosion and/or closely grouped pits on the airfoil coated surface A up to 0.002 inch deep maximum is acceptable provided:
      - the total affected area is not more than 25% of Area A.
      - the corrosion appears as minor roughening of the surface caused by some growth and localized breakdown of the oxide layer of the protective coating.
   b. Mild corrosion and/or closely grouped pits up to 0.005 inch deep maximum is acceptable provided:
      - the total affected area is not more than 10% of Area A.
      - the corrosion appears as moderate roughening of the surface caused by more growth and localized breakdown of the oxide layer of the protective coating.
   c. Severe corrosion more than 0.005 inch deep is not acceptable:
      - severe corrosion appears as significant roughening of the surface caused by obvious growth and breakdown of the oxide layer of the protective coating.
   d. Isolated pitting up to 0.008 inch deep maximum is acceptable provided:
      - the total pitted area is not more than 30% of Area A.
      - the cumulative amount of pitting found on directly opposite sides of the airfoil must not exceed the maximum acceptable total pitting depth of 0.008 inch.

(4) Uncoated blades:

(a) Examine the airfoil surfaces for signs of corrosion and pitting:

1. Slight corrosion and/or closely grouped pits on the airfoil surface up to 0.003 inch deep maximum is acceptable provided:
   - the total affected area of each surface is not more than 50% of the surface,
   - the corrosion appears as minor roughening of the surface.
2. Mild corrosion and/or closely grouped pits up to 0.005 inch deep maximum is acceptable provided:
   - the total affected area of each surface is not more than 25% of the surface,

- the corrosion appears as minor roughening of the surface.

3. Severe corrosion more than 0.005 inch deep is not acceptable.
- severe corrosion appears as significant roughening of the surface.

4. Isolated pitting up to 0.008 inch deep maximum is acceptable provided:
- the total pitted area of each surface is not more than 30 % of the surface,
- the cumulative pitting occurring directly opposite to each other on both sides of the airfoil surfaces must not exceed the maximum acceptable total depth of the pitting.

(5) Coated and Uncoated blades:

(a) Examine PT blade airfoil surfaces for local surface damage (Figures 4, 5 & 6):
NOTE: 1. Surface damage includes local dents and nicks.
NOTE: 2. The cumulative amount of damage found on directly opposite sides of the airfoil must not exceed the maximum acceptable total pitting depth limit.

1. Inspect PT blade airfoil middle surfaces Area b (Figure 5). Local surface damage is acceptable provided:
a - the maximum depth of each damaged area is 0.015 inch and,
b - there are no more than six damaged areas per in^2 and,
c - damaged areas are spaced 0.100 inch apart minimum.
d - Remove raised material and sharp edges with a stone.

2. Inspect airfoil top and bottom fillet radii surfaces 'a' (Figure 5). Local surface damage is acceptable provided:
a - the maximum depth of each damaged area is 0.010 inch and,
b - there are no more than three damaged areas and,
c - damaged areas are spaced 0.100 inch apart minimum.
NOTE: Dimension 'a' is 0.125 inch.
d - Remove raised material and sharp edges with a stone.

3. Inspect PT blade airfoil leading edge surface 'e' (Figure 5). Local surface damage is acceptable provided:
a - the maximum depth of each damaged area is 0.020 inch and,
b - there are no more than four damaged areas and,
c - damaged areas are spaced 0.100 inch apart minimum.
NOTE: Dimension 'e' is 0.125 inch.
d - Remove raised material and sharp edges with a stone and restore original leading edge radius.

4 Inspect PT blade airfoil trailing edge surface 'f' (Figure 5). Local surface damage is acceptable provided:
a - the maximum depth of each damaged area is 0.010 inch and,
b - there are no more than four damaged areas and,
c - damaged areas are spaced 0.100 inch apart minimum.
NOTE: Dimension 'f' is 0.125 inch.
d - Remove raised material and sharp edges with a stone and restore original trailing edge radius.

(b) Examine PT blade top shroud for isolated pitting, local surface damage and surface crack indications as follows (Figure 6):

1. Inspect PT blade shroud Area J:
a - Isolated pitting up to 0.008 inch deep maximum is acceptable provided the total pitted area is not more than 30% of total surface area.
b - Local surface damage up to a maximum depth of 0.010 inch is acceptable provided damaged areas are spaced 0.100 inch apart minimum. Remove any raised material and sharp edges with a stone.

c - Wear and grooves at the top shroud surface up to a maximum depth of 0.005 inch are acceptable. Remove any raised material and sharp edges with a stone.

d - Wear and local surface damage at the shroud knife-edges up to a maximum of depth of 0.005 inch are acceptable. Remove any raised material and sharp edges with a stone.

2. Detail J: Step wear at the shroud notch contact face up to a maximum depth of 0.005 inch is acceptable.

3. View G: Hairline surface crack indications on the shroud fillet radius on convex side of blade are acceptable provided crack indications are not opened and non-concentric wear on the knife-edge is not more than 0.005 inch.

4. View H:

a - Hairline surface crack indications on the upper surface of the shroud are acceptable.

b - Hairline surface crack indications on the shroud notch face are acceptable provided the cracks do not extend into the upper or lower surface of the shroud.

(c) Examine PT blade firtree surfaces for isolated pitting and local surface damage (Figure 7):

1. Inspect PT blade firtree root serrations radii and the adjacent faces (Area 'k').

a - Isolated pitting up to 0.005 inch deep maximum is acceptable provided:
- the total pitted area is not more than 10% of the surface and, the pitting does not form a continuous line on each serration by more than 50 % of the length of the serration.

b - Fretting wear up to 0.003 inch maximum is acceptable. Remove any raised material and sharp edges with a stone and restore the edge radii.

c - Local surface damage up to a maximum depth of 0.005 inch is acceptable provided the total damaged area of each surface is not more than 10% of the surface. Remove any raised material and sharp edges with a stone.

2. Inspect PT blade firtree serrations (Area 'f'):
NOTE: Area 'f' excludes Area 'k'.

a - Isolated pitting up to 0.005 inch deep maximum is acceptable provided:
- the total pitted area of each surface is not more than 30% of the surface and,
- the pitting does not form a continuous line on each serration by more than 50 % of the length of the serration.

b - Fretting wear up to 0.005 inch maximum on the serration retention surfaces is acceptable. Remove any raised material and sharp edges with a stone and restore the edge radii.

c - Local surface damage up to a maximum depth of 0.005 inch is acceptable provided the total damaged area of each surface is not more than 20% of the surface. Remove any raised material and sharp edges with a stone and restore the edge radii.

3 Inspect PT blade firtree faces Area 'm':
NOTE: Area 'm' does not include Area 'k' or chamfer Area 'o'.

a - Isolated pitting up to 0.008 inch deep maximum is acceptable provided the total pitted area of each surface is not more than 30% of the surface.

b - Fretting wear up to 0.005 inch maximum is acceptable. Remove any raised material and sharp edges with a stone and restore the edge radii.

c - Local surface damage up to a maximum depth of 0.008 inch is acceptable provided the total damaged area of each surface is not more than 20% of

the surface. Remove any raised material and sharp edges with a stone and restore the edge radii.

4. Inspect PT blade firtree rivet slot Area 'n':
   a - Isolated pitting up to 0.005 inch deep maximum is acceptable provided:
   - the total pitted area is not more than 20% of the total surface area and,
   - the pitting does not form a continuous line on slot by more than 50 % of the length of the slot.
   CAUTION: DO NOT ROUND THE EDGES OF COUNTERSUNK CHAMFERS.
   b - Deposits of foreign material up to 0.005 inch maximum are acceptable. Remove any raised material and sharp edges with a stone.
   CAUTION: DO NOT ROUND THE EDGES OF COUNTERSUNK CHAMFERS.
   c - Local surface damage up to a maximum depth of 0.005 inch is acceptable provided the total damaged area of each surface is not more than 20% of the surface. Remove any raised material and sharp edges with a stone.
5. Inspect PT blade rivet slot chamfers Area 'o':
   CAUTION: DO NOT ROUND THE EDGES OF COUNTERSUNK CHAMFERS.
   a - Isolated pitting up to 0.005 inch deep maximum is acceptable. Local surface damage up to 0.005 inch deep maximum is acceptable provided:
   - any raised material and sharp edges are removed with a stone, and
   - ensure the initial contour has not changed.
6. Inspect PT blade platform Area 'p':
   a - Isolated pitting up to 0.008 inch deep maximum is acceptable provided the total pitted area is no more than 30% of the surface.
   b - Wear on the blade platform faces of up to 0.005 inch deep maximum is acceptable. Remove any raised material and sharp edges with a stone and restore the edge radii.
   c - Local surface damage up to a maximum depth of 0.015 inch is acceptable provided:
   - the total damaged area of each surface is no more than 20% of the total surface and,
   - the damage does not extend into the airfoil fillet radii. Remove any raised material and sharp edges with a stone and restore the edge radii.

(6) Shroud area: Reject blade if shroud notch is worn more than 0.005 inch, or if wear has reduced shroud thickness to less than 0.005 inch at any point, or if grooving exceeds 0.015 inch (Figure 1).

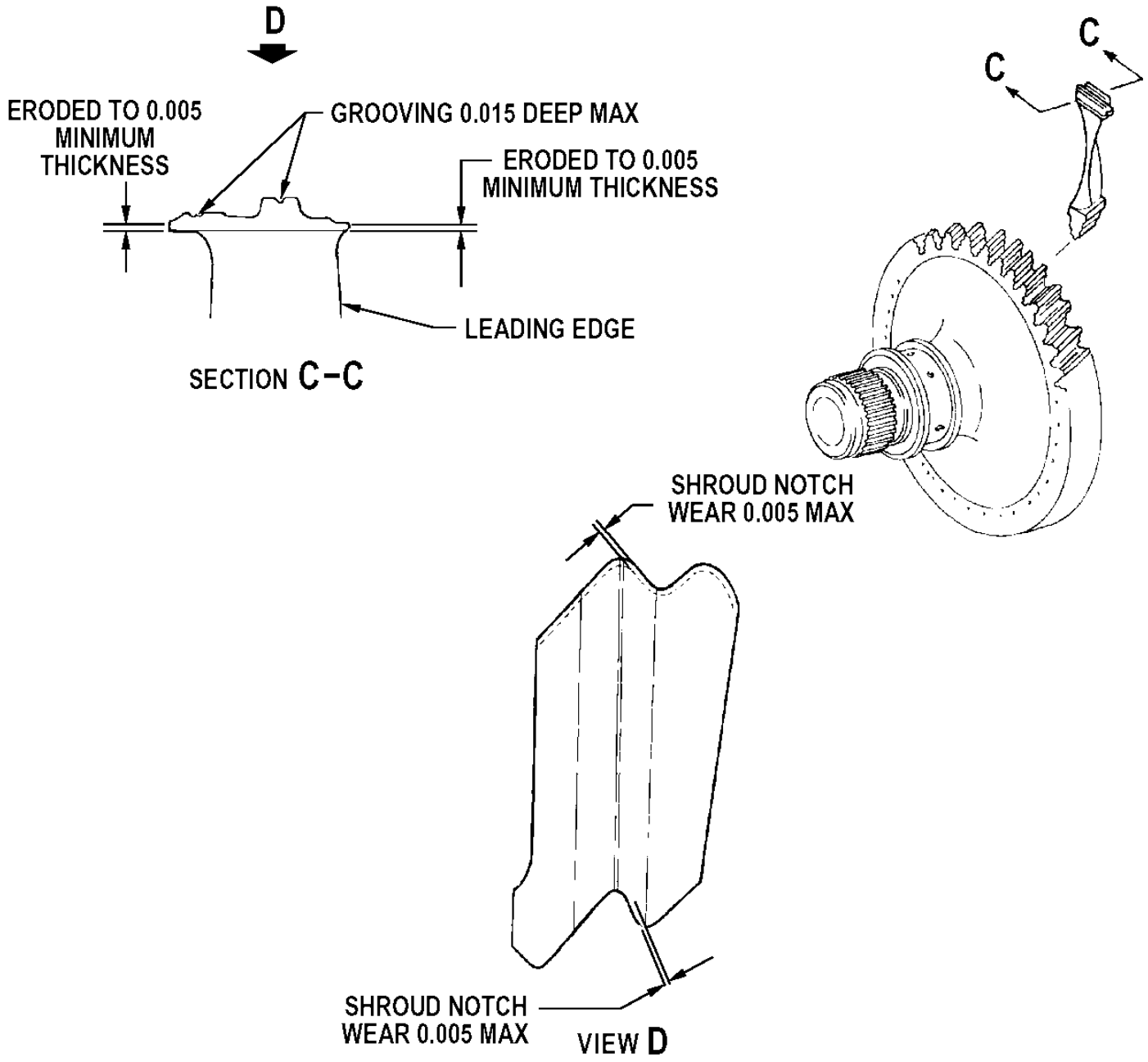
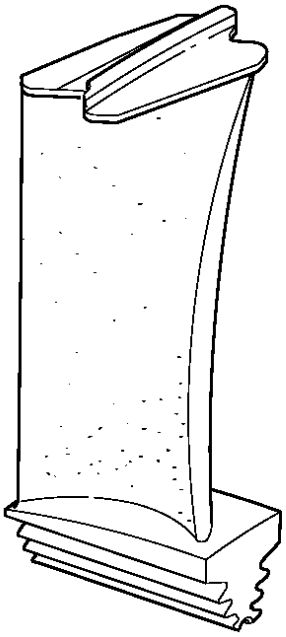
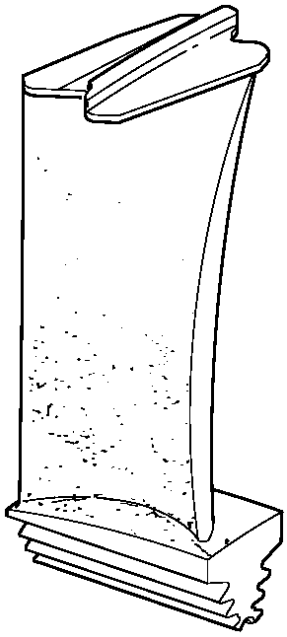


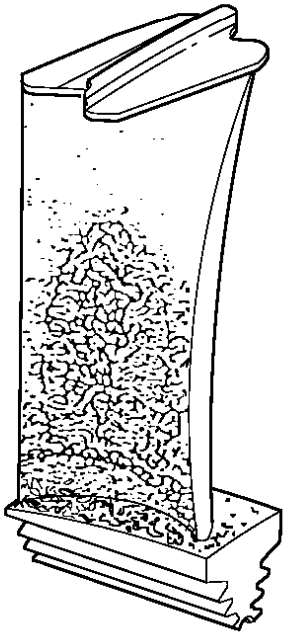
Figure 1



SLIGHT
CORROSION



MODERATE
CORROSION



SEVERE
CORROSION

Figure 2

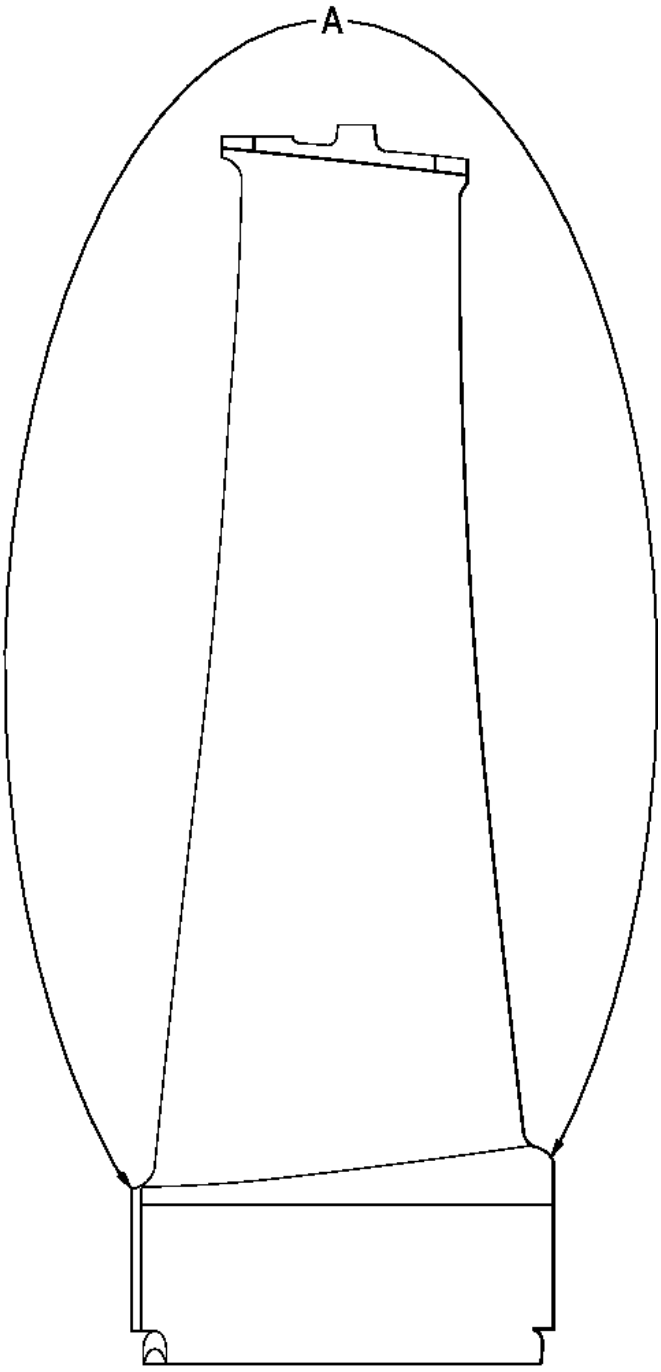


Figure 3

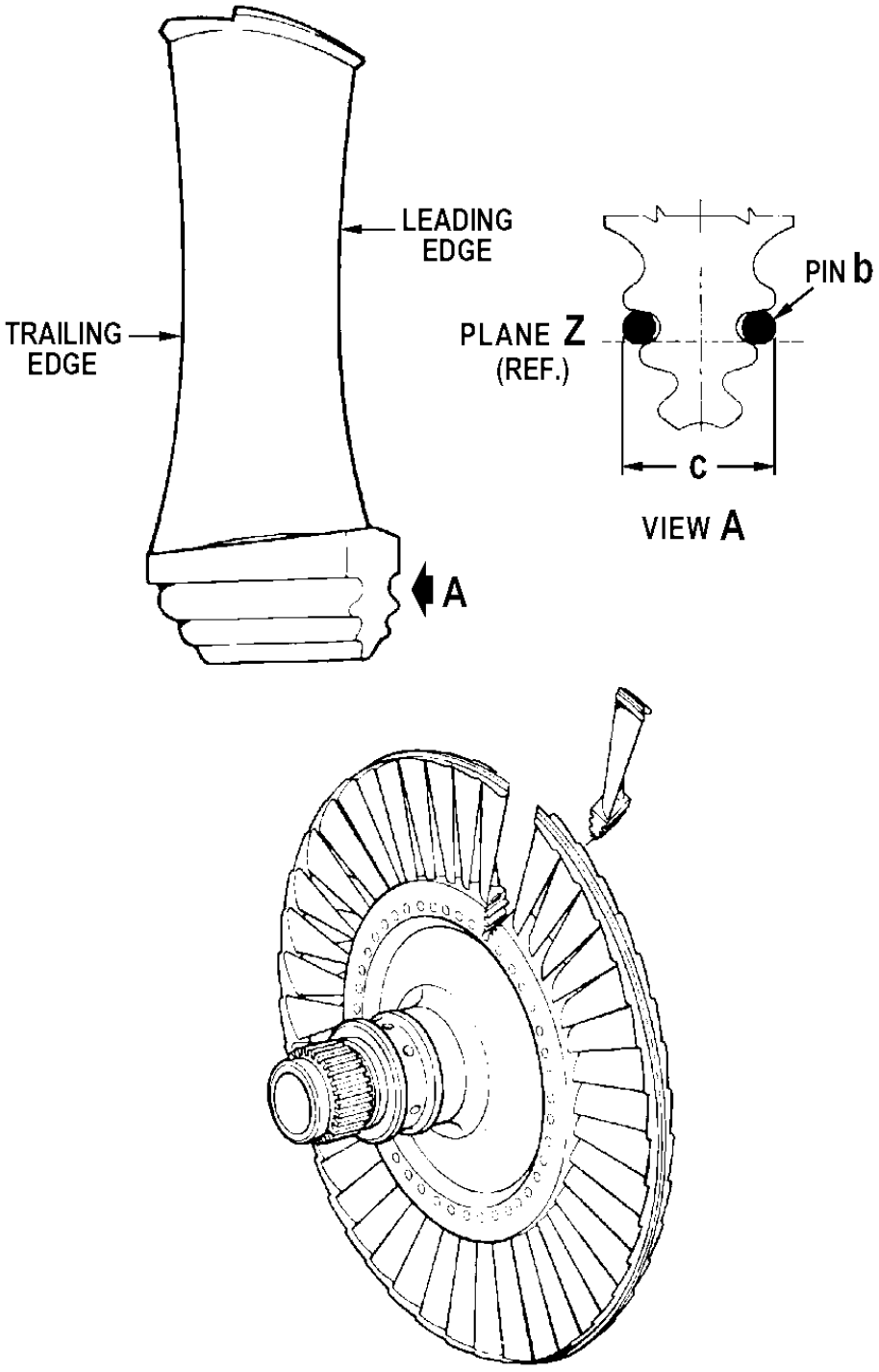


Figure 4

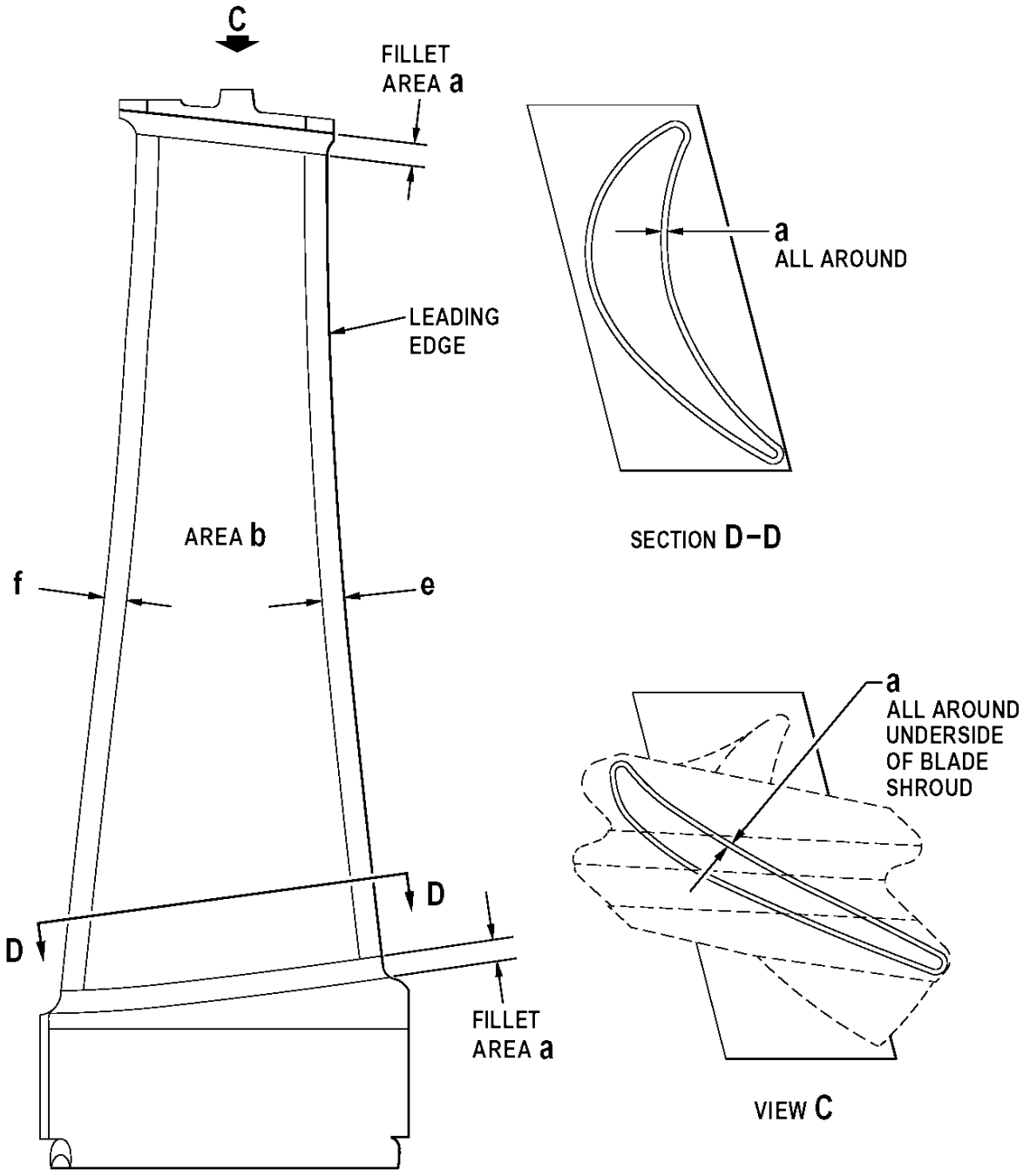


Figure 5

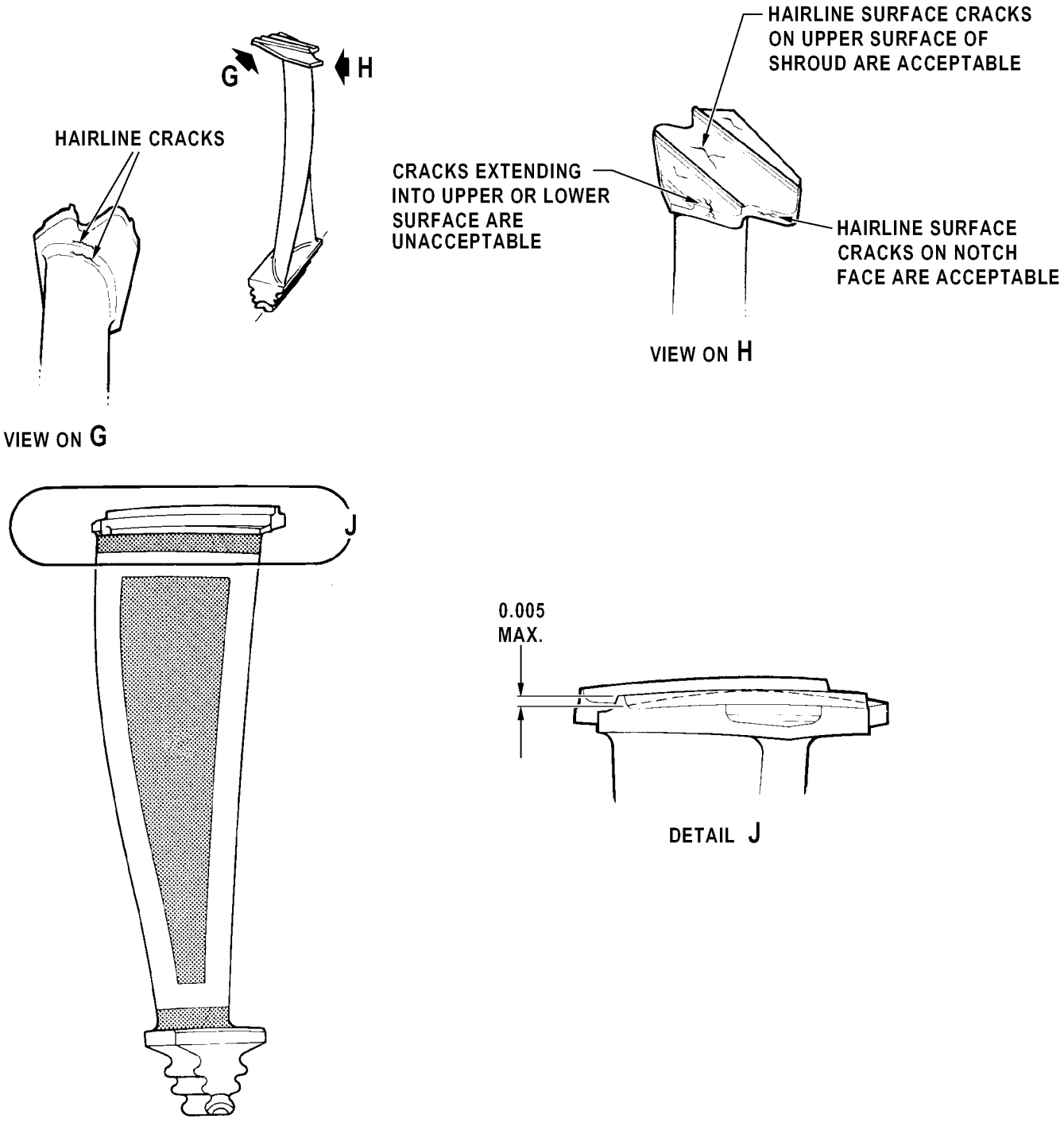


Figure 6

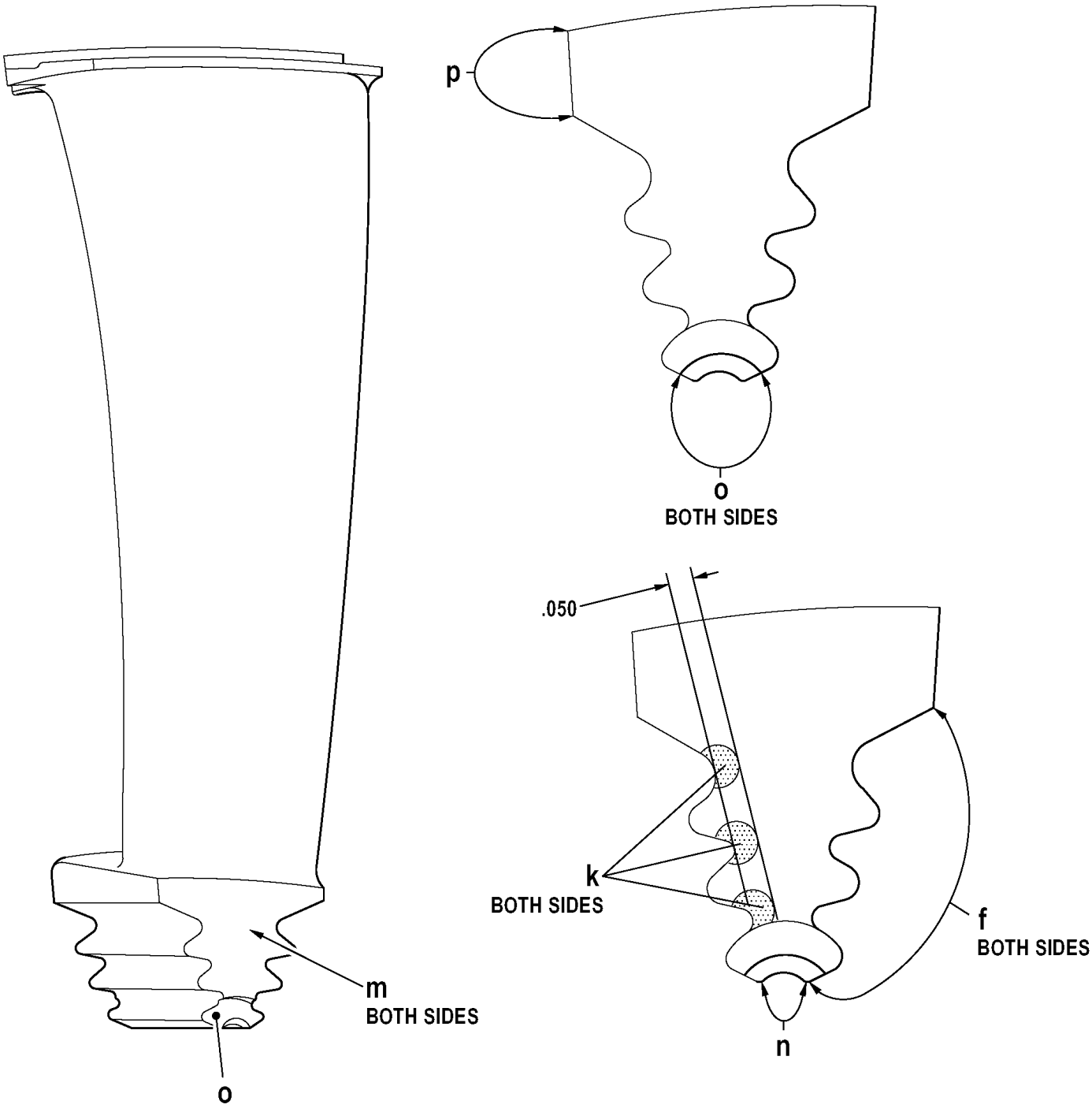


Figure 7

MATERIAL INFORMATION:

Not Applicable