

Approved: R. Woodside NDT III

Dated 9/30/11

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NOTE: THESE CRITERIA ARE TO BE USED IN THE CASE WHERE THE DRAWING OR REFERENCED SPECIFICATION DOES NOT PROVIDE ACCEPTANCE CRITERIA FOR THE PARTS BEING PROCESSED THROUGH MAGNETIC PARTICLE INSPECTION. IF AT ANY TIME THERE IS A QUESTION OR CLARITY IS NEEDED AS TO THE INTERPETATION OF THESE CRITERIA YOU MAY CONTACT THE COGNIZANT LYCOMING NDT LEVEL III

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General:

NOTE: The criteria on this page applies to all parts except where the part specific criteria contradicts this page, then the part specific criteria applies.

1. A transverse indication is a linear indication that is oriented 30 degrees or more off parallel with the grain flow or the axis of the part.
2. Clusters, a group of four or more indications in a one square inch area, are cause for rejection.
3. Any reference to the Distance from a fillet noted in these criteria is defined as the length between the start of the radius and the indication.
4. Any indication less than .010 of an inch shall be deemed non-relevant.
5. An “open” indication is an indication visible on the surface of the part after the residual powder has been removed.
6. Rounded indications are indications having a length less than three times the width. Rounded indications determined to be “open” shall be further evaluated visually with a minimum 7x magnification after removal of the residual particles to see if they are actually linear indications, such as star cracks.
7. Linear indications are indications having a length of more than three times the width.
8. Non-relevant indications are caused by flux leakage, but are not discontinuities. Examples are magnetic writing, change in section due to part design and heat affected zone line in welding.
9. Two rounded indications adjacent each other where the diameter of the larger is greater than the distance between the two shall be measured as one indication.
10. Two indications end to end shall be considered as one indication if the distance between them is less than the length of the shortest indication. If such a condition exists, the length of the indication to be evaluated shall be the sum of the two indications plus the distance separating the indications.
11. Magnification or penetrant inspection may be used to referee in determining open indications. Note: Penetrant may not hold in shallow or broad open indications.
12. When an indication is reviewed by the residual method and any or all of the indication reappears within a five second count it shall be determined to be a surface indication and the residual formation of the indication shall be evaluated for acceptance.
13. Any cracks or scale are cause for rejection.
14. All forging and casting lines or seams that could be stress risers during further processing or during the service life of the part shall be removed.
15. Indications determined to be “grain flow”, due to the forging process, are acceptable provided concurrence from Lycoming Engine’s Materials Lab or cognizant NDT Level III is obtained.

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Piston Pins

Examples: P/N 60403, LW-13445, LW-14078

1. One fine subsurface indication, the length of the pin is acceptable.
2. One fine subsurface indication, the length of the pin together with one fine subsurface indication no longer than 1" is acceptable if indications are separated radially by at least ½ of an inch.
3. Three fine subsurface indications are acceptable providing the total length of indications is not greater than 2-1/2", the length of any one indication is not over 1" and they are separated radially by ½ of an inch.
4. Any crack, open indication or transverse indication, including tool marks or grinding marks, is cause for rejection.
5. Any indication opposite another through a wall is cause for rejection.
6. An indication determined to be surface by the residual method that is not open to the surface, is not longer than ½" in length and does not extend over an edge is acceptable.

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Shafts

Examples: P/N 61174, 65986, 68156, 70384, 72246, 72626, 76121, 76155, 76784, 78530, LW-10298, LW-10299, LW-11179, LW-13790, LW-14021, LW-15022, LW-15032, LW-15345

1. Any crack, open or transverse indication is cause for rejection.
2. Any indication closer than 1/16" of a drilled hole, machined edge or a radius that returns residually is rejectable.
3. One light subsurface indication the length of the shaft is acceptable.
4. Two light subsurface indications totaling no more than the length of the shaft are acceptable provided that they are separated radially by at least 1/8".
5. Three light subsurface indications totaling no more than the length of the shaft are acceptable provided they are separated radially by at least 1/8".
6. One indication determined to be surface by the residual method is acceptable provided it is no more than 1/2 the length of the shaft and it is not open to the surface.
7. Any rounded indication that exceeds (.030) inch or that is open to the surface is rejectable. A maximum of two rounded indications are allowed in a one (1) square inch area.
8. Any indication opposite another through a wall is cause for rejection.

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Counterweights - Finished

Examples: P/N 14U22539, LW-19200, LW-19227, 71904, 73644, 78987

AREA A: - Inside four ground holes, from centerline toward flat edge.

1. No surface or subsurface indications permitted.

AREA B: - Inside four ground holes, from center line toward circular edge.

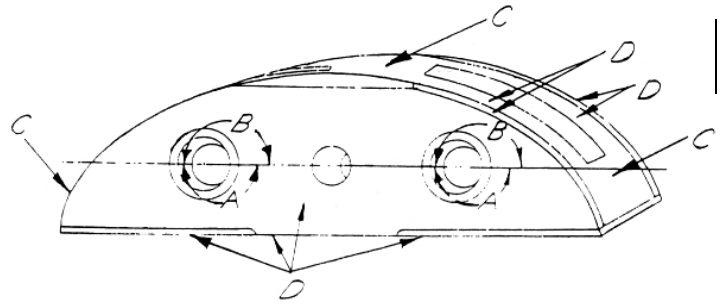
1. No surface indications permitted .050" from edge of hole.
2. Surface indications in remainder of area to the extent of 1/16" long in transverse direction are acceptable providing the indications are 3/16" minimum from the centerline.
3. Surface indications in remainder of area 1/8" long maximum in peripheral direction are acceptable.
4. Indication shall be no closer than 3/16" apart.

AREA C:

1. These areas shall be free of surface indications.
2. Subsurface indications are acceptable provided they do not break over edges.

AREA D:

1. No surface indications are permitted closer than 3/16" to any edge.



Counterweight Rollers

Examples: P/N LW-15558, 77385, 77007, 76042, 76043, 70416, 14W22647, 14W21696, 73648, 75631, 72022,

Acceptance Criteria – No Indications Allowed

Counterweight Washers

Examples: P/N 70004, 71907

Acceptance Criteria – No Indications Allowed

Counterweight Bushings

Examples: P/N 74876, 73810, 71903, 77001

Acceptance Criteria – No Indications Allowed

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Crankshafts

General

1. Any indication more than 30 degrees off parallel with the direction of grain flow is cause for rejection.
2. If there are 15 or more surface indication of which 9 or more are over 1/2" long or in clusters, class the piece as dirty steel and reject.
3. Surface indications (seams or laps) should be ground out of the unmachined portions of the shaft prior to nitriding. These areas should be well blended to prevent propagation during the nitride process.
4. Surface indications on unmachined areas that are broad and not heavy which apparently are from a scale pattern or from forging wrinkle, are acceptable without blending.
5. Subsurface indications are acceptable in the unmachined forged areas providing they are light and not in clusters.
6. Grinding cracks are cause for rejection.
7. Acceptable indications in journals, both main and rod, are restricted as to location and number as herein established.

Main Bearing Journals

1. A surface indication in a fillet is cause for rejection.
2. A light subsurface indication no more than 1/16" long in a fillet, that does not return residually is acceptable.
3. One (1) longitudinal light, subsurface indication 3/4" long is acceptable.
4. Three (3) longitudinal light, subsurface indications totaling 1" are acceptable providing they are separated radially by 1/8".
5. One (1) tight-lipped longitudinal indication open on the surface 1/2" long in the center third of the bearing width or 1/4" long in the remaining width is acceptable after the open section has been lightly blended below the bearing surface.
6. Two (2) tight lipped longitudinal indications, open on the surface having a combined length of 5/8" are acceptable in the center third of the bearing width or 3/8" combined length in the remaining width of the bearing are acceptable. The open sections shall be lightly blended below the bearing surface.

Rod Bearing Journals

1. A surface indication in a fillet is cause for rejection.
2. A light subsurface indication no more than 1/16" long in the radius, that does not return residually is acceptable.
3. One (1) longitudinal light, subsurface indication 1/2" long is acceptable.
4. Three (3) longitudinal light, subsurface indications totaling 3/4" are acceptable providing they are separated radially by 1/8".
5. One (1) tight-lipped longitudinal indication, open on the surface 1/4" long is acceptable after the open section has been lightly blended below the bearing surface.
6. Two (2) tight-lipped longitudinal indications, open on the surface having a combined length of 3/8" are acceptable providing they are 1/8" from each other. These indications shall be lightly blended below the bearing surface.

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Section - Thrust Face, Front Main Bearing To End Of Shaft

1. Standards for the thrust bearing area shall be the same as main journal. See section on main journals. The following standards apply to the remaining area.
2. Surface indications may not run into a radius or closer than 1/8" to a hole or 1/4" to a spline.
3. One (1) tight-lipped surface indication 1/4" long is acceptable.
4. Three (3) tight lipped surface indications each 3/16" or less are acceptable provided that they are 1/2" apart in the same plane or 1/8" around the circumference of the shaft.
5. One light subsurface indication 1-1/2" long is acceptable, providing it does not run into a radius, spline or hole. Indications which do run into these locations are acceptable provided they do not appear when inspected by the residual method.
6. More than one light subsurface indication is acceptable provided that the total lengths do not exceed 1-1/2" and they do not run into a radius, spline or hole. Indications which do run into these locations are acceptable provided they do not appear when inspected by the residual method.
7. No surface indications are acceptable in the spline, or either the major or minor diameters.
8. No surface or subsurface indications in the sides of the spline are acceptable.
9. One light subsurface indication 1" long is acceptable in either the major or minor diameter of the spline provided it is a minimum distance of 1/16" from either a corner or a radius.
10. Three light subsurface indications with a combined length of 1-1/2" are acceptable on the major or minor diameter provided they are not on adjacent splines or adjacent spline roots. In addition they shall be a minimum distance of 1/16" from a radius or a corner.
11. One tight lipped surface indication in the major diameter of the threads 3/4" long, or maximum of four (4) indications that total lengths not exceeding 1-3/4", are acceptable providing they are not deeper than 1/32" from the crest of the thread.
12. A maximum of four (4) light subsurface indications the combined length not exceeding 1-3/4" are acceptable in the root of the thread provided they are a minimum distance of 1/8" apart.
13. A maximum of four (4) interrupted indications in the profile of the threads are acceptable provided they are a minimum of 1/64" from the root or crest of the thread. Minimum separation between parallel indications shall be 1/8".

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Camshafts - Final MPI

General

1. If there are 13 or more indications of which 8 or more are over ½ inch in length or if any one indication is over six inches in length or if the indications are clustered, the part shall be rejected.
2. Any crack, transverse indication or open linear indication that extends into a hole or radius that returns residually is cause for rejection.
3. Subsurface indications parallel to the grain flow and any indications that are determined to be surface by the residual method, but is not open to the surface, are acceptable provided they are stringers and do not exceed the dirty metal requirements.
4. Any open linear indication in the front or rear thrust face or radius of a thrust face is cause for rejection.
5. Seams, laps or flash lines that show as sharp indications shall be removed and blended.

Main Bearing Surfaces

1. An open indication that is not a crack or tool mark that is parallel to the grain flow is acceptable so long as it is 3/8" or shorter in length and does not break the edge of the bearing journal.

Lobes

1. Any indication in the top section (nose) of a cam (¼ inch on either side of top-dead-center) on the camshaft is cause for rejection.
2. An open indication that is not a crack or tool mark that is parallel to the grain flow is acceptable so long as it is 1/8" or shorter and does not break the edge of the lobe.

Gear Teeth

1. Surface indications in the gear tooth area are cause for rejection. Tool marks are to be evaluated visually per the drawing requirements.

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Dated [9/30/11](#)**Nuts - Final MPI**

Examples: P/N 71133, 74646, LW-12186, STD-2090, STD-2106

1. Any crack is cause for rejection.
2. Seams are acceptable provided they are perpendicular to the washer face and do not break over an edge by more than .030 of an inch.
3. Up to 10 small voids or porosity on the bearing surface are acceptable providing none of them exceed .020 of an inch in diameter and none are within .040 of an inch of another.

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Hydraulic Tappet Bodies

Examples: P/N 71105, 72877 & 15B21318 Styles

General

1. Any indication in a radius is cause for rejection.
2. Any crack or transverse indication is cause for rejection.
3. Any indication breaking an edge is cause for rejection.
4. Any indication determined to be an inclusion is cause for rejection.

Tappet Stem Surface (Excluding The Socket Area Of P/N 71105)

1. A total of eight rounded indications up to a maximum size of .020 inch are acceptable provided the indications are no closer than .500 inch of each other and none of the indications are closer than .160 inch from the stem end.

Tappet Face Surface

1. A total of three rounded indications up to a maximum size of .020 inch are acceptable provided the indications are no closer than .250 inch of each other.

Side Of Tappet Head

1. A total of three rounded indications up to a maximum size of .020 inch are acceptable provided the indications are no closer than .250 inch from each other.

Underside Of Head

1. A total of three rounded indications up a maximum size of .032 inch are acceptable provided they are no closer than .063 inch of each other.
2. (For Lycoming inspection only): After the application of the ferox coating in the radius under the head fine indications may not be visible.

Tappet Stem End

1. A total of three rounded indications up to a maximum size of .020 inch are acceptable provided they are no closer than .063 inch of each other.

Push Rod Socket (71105 Only)

1. A total of three rounded indications up to a maximum size of .020 inch on the O D and end are acceptable provided no indication breaks the edge of the push rod contact surface area (inside diameter).

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Hydraulic Lifters

Examples: P/N LW-15861 & LW-16812

General

1. Any indication in a radius is cause for rejection.
2. Any crack or transverse indication is cause for rejection.
3. Any indication breaking an edge is cause for rejection.
4. Any indication determined to be an inclusion or “loose metal” is cause for rejection.

Tappet Face Surface

1. A total of four rounded indications up to a maximum size of .020 inch in diameter are acceptable provided the indications are no closer than .250 inch to each other or closer than .060 inch to the edge.

Tappet O.D. Surface

1. A total of eight rounded indications up to a maximum size of .063 inch in diameter are acceptable provided the indications are no closer than .500 inch of each other and they are no closer than .060 inch to an edge.

Open End- (End and ID & OD Chamfers)

1. A total of two rounded indications up to a maximum size of .032 inch in diameter are acceptable provided they are no closer than .250 inch of each other.

Push Rod Socket

1. A total of three rounded indications up to a maximum size of .020 in diameter are acceptable provided they are no closer than .250 inch of each other and they do not break the edge of the push rod contact area.
2. Any indication in the push rod contact area is cause for rejection.

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Dated [9/30/11](#)**Hydraulic Tappet (Plunger Assembly)**

Example: P/N 78290

1. No cracks or crack-like indications allowed.
2. No indications are allowed in a radius or to break an edge.
3. A total of four rounded indications up to .020-inch maximum diameter are acceptable as long as the indications are no closer than .500 inch of each other.

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Dated [9/30/11](#)

Intake Valves

General

1. Any crack or linear indication is cause for rejection.
2. Any indication up to .010 inch in any area of the valve shall be considered acceptable.

Valve Face

1. A total of four indications up to a maximum size of .040 inch in diameter are acceptable provided each indication is separated by a minimum distance of twice the diameter of the larger indication and no indication is closer than .060 inch to the edge.

Valve Seat

2. No indication allowed.

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Dated [9/30/11](#)**Weldments Not Covered By LPS 356**

1. Any crack in the weld or adjacent base metal is cause for rejection.
2. Crater or star cracks are cause for rejection.
3. Undercutting that exceeds 1/10 of the thickness of the thinnest material is cause for rejection.
4. Incomplete penetration or lack of fusion is cause for rejection.
5. Any rounded indication in excess of ½ the material thickness or (.100) inch in diameter is cause for rejection.
6. Rounded indications are limited to no more than 4 indications in any linear inch of weld area and shall be no closer to another indication than the diameter of the largest indication.
7. Any subsurface linear indication parallel to the length of the weld in excess of 1/8 of an inch in length or 10% of weld length, which ever is less, is cause for rejection.
8. A subsurface linear indication perpendicular to the length of the weld in excess of .090 or 20% of the weld width, which ever is less, is cause for rejection.

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Gears

Examples: P/N 13S19646, 13S10649, 27A22099, 27B22323, 29E22367, 29G21730, 29H22368, 51B23274, 61665, 65979, 67393, 67479, 68087, 68297, 68317, 68639, 68835, 68964, 69176, 69730, 70326, 71665, 71669, 72232, 72350, 72547, 72963, 72970, 72973, 72975, 73309, 74768, 75523, 77873, LW-10268, LW-10289, LW-10304, LW-10326, LW-10441, LW-11182, LW-14039, LW-15140, LW-15659, LW-16447, LW-19273

General

1. Any crack, transverse or open indications are rejectable.
2. Indications that are clustered are cause for rejection.
3. Up to two rounded surface indications in any surface area are acceptable provided they are no more than (.031) inch in size.
4. Any indication closer than 1/16th inch of a drilled hole, machined edge, or a radius that returns residually is rejectable.

Gear Area

1. Up to two rounded sub-surface indications in any surface area are acceptable provided they are no more than (.047) inch in size.
2. Surface indications that are no more than (.125) inch in length, that are separated by at least (.250) inch radially, that do not break an edge and that are not in a radius are acceptable.
3. Sub-surface indications that are no more than (.187) inch in length and are separated by at least (.250) inch radially are acceptable.

Teeth And Splines

1. Any indication extending over an edge that returns residually is rejectable.
2. Any indication that returns residually in the root of the gear or spline is rejectable.
3. A parallel indication opposite the spline or gear root is cause for rejection.
4. An indication on the gear tooth having a length that exceeds 20 % of the gear tooth length shall be cause for rejection.

Shaft Area

1. One subsurface stringer up to 1 inch in length is acceptable. Up to two such indications in any area of the same diameter are acceptable providing they are separated radially by a minimum of 1/8th inch.
2. One surface stringer up to ½ inch in length is acceptable. Up to two such indications in any area of the same diameter are acceptable providing they are separated radially by a minimum of 1/8th inch.

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Dated [9/30/11](#)

Alternator Belt Adjusting Idler Shafts

Example: P/N LW-19237, LW-19238

1. Any crack, hot tear, cold shut, transverse or open linear indication is cause for rejection.
2. Any indication that extends into a drilled hole, machined edge or a machined radius that returns residually is cause for rejection.
3. Any indications over (.030) inch in the root of the threads are cause for rejection.
4. Rounded indications greater than (.090) inch in diameter shall be rejected.

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Dated [9/30/11](#)**Coupling – Magneto – As Cast and Machined**

Example: P/N LW-14910, 73000, 73013

1. Any crack, coldshut, misrun or linear indication is cause for rejection.
2. Any rounded indication that exceeds (.090) is cause of rejection.
3. Any indication in a radius that returns residually is cause for rejection.

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Rocker Forgings And Finished Parts

Example: P/N 17F19357, F17F19303, 17F23342

1. Any crack or transverse indication is cause for rejection.
2. Any forging laps are cause for rejection.
3. Any rounded indication greater than (.015) in a machined area is cause for rejection.
4. Any rounded sub-surface indication greater than (.030) in any as forged surface is cause for rejection.
5. Longitudinally oriented indications in the non-machined areas along the flash line of the forging are acceptable provided they are no more than ½ inch in length and do not break an edge.
6. Surface indications, such as pits caused by scale in the dies, in the non-machined areas, that are broad and fuzzy without sharp edges or corners and that are no more than (.376) inch in size or more than (.032) inch in depth are acceptable.
7. In threaded rockers, any linear indication in the root or between the root and the pitch diameter of the threads is cause for rejection.

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Forged Idler Shafts

Example: P/N LW-13795, 73305, F74235

As Forged:

1. Any crack, burst, or transverse indication, other than a lap as defined herein, is cause for rejection.
2. Any sub-surface rounded indication that exceeds (.030) inch in diameter is cause for rejection.
3. Surface indications, such as pits caused by scale in the dies, that are broad and fuzzy and without sharp edges or corners up to (.376) inch in size and no more than (.032) inch in depth are acceptable.
4. Two subsurface indications no more than one inch in length are acceptable provided they are separated radially by at least 1/8".
5. Up to three sub-surface indications with a combined length of no more than 2" which are separated radially by at least 1/8 inch, are acceptable.
6. Laps that are no more than 1/32" in depth are acceptable.

As Machined:

1. Any crack, burst, or transverse indication, other than a lap as defined herein, is cause for rejection.
2. Any indication, other than a lap, in a radius or closer than 1/16th inch of a machined edge or drilled hole that returns residually is cause for rejection.
3. Any indication opposite another through a wall is cause for rejection.
4. One indication determined to be surface by the residual method is acceptable provided it is no more than 1/2" in length and it is not open to the surface.
5. Any rounded indication that exceeds (.030) inch or that is open to the surface is rejectable. A maximum of two rounded indications are allowed in any one square inch area.
6. Forging laps that break into a machined surface by no more than 1/32" are acceptable.

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Bolts, Studs And Screws

Examples: P/N LW-12596, 75061, 73807, 38-13

General

1. Any indication at an angle more than 10 degrees off parallel to the grain flow or the axis of the part, except those indications allowed on the head and/or end of the stem, shall be considered transverse and be rejected.
2. Any indication closer than 1/16th of an inch to another in a radial direction is cause for rejection.
3. When the distance between two indications end to end is less than 1/8th of an inch the two indications and the distance between them shall be considered one indication.

Sides Of Head

1. Up to six subsurface or surface indications are allowed per head.
2. Indications that run in a direction from top to bottom of the head, within 10 degrees of parallel to grain flow, may be no more than the full height of the head and may only break either edge by a maximum depth of 1/32nd of an inch.
3. Light indications such as metal folds from tooling smears that are more than 10 degrees off parallel with grain flow are acceptable when they do not break the bottom edge of the head and the indication of a representative sample has been sectioned and found not to exceed (.002) inch in depth.

Shank Or Stem

1. Broad open indications are cause for rejection.
2. Up to a maximum of 10 subsurface and/or light surface indications are acceptable providing the length of any indication does not exceed the full length of the surface where it is located and total length of all indications does not exceed twice the length of the surface where it is located. No indications shall break into a fillet or over an edge.

Threads

1. Any indication in the root or between the root and the pitch diameter is cause for rejection.
2. A light indication between the pitch diameter and the tip of the thread is acceptable as long as the bottom of the indication is not toward the root of the thread.
3. Crest craters or laps shall be evaluated by the Lab for acceptance.

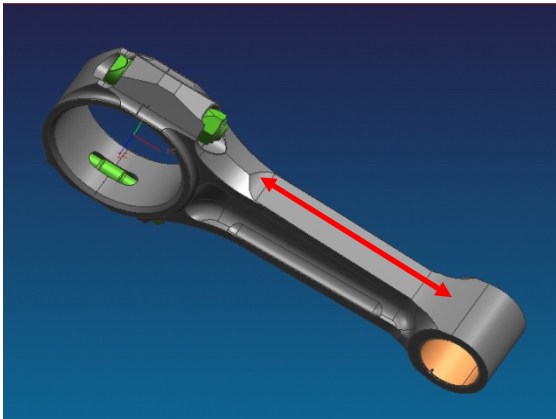
Top Of Head Or End Of Stem

1. Light indications that do not break an edge and are no more than (.010) in depth are acceptable. The depth can be determined by sectioning a representative sample in the Lab.

Connecting Rods – Forged & Machined

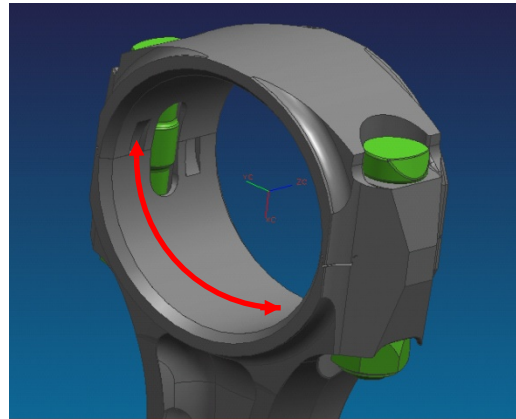
Examples: P/N 77450, 78030, LW-11750, LW-19332, LW-13305

1. Laps, seams, and other forging defects are cause for rejection.
2. Any crack or transverse indication is cause for rejection.
3. An open indication that is not a crack or tool mark that is parallel to the grain flow (Page 22, Figures 1a and 1b) is acceptable so long as it is no longer than 1/8" and it is no closer than 1/8" to an edge or hole.
4. A closed surface indication parallel to the grain flow (Page 22, Figures 1a and 1b) is acceptable so long as it is no longer than 1/4" and it is no closer than 1/8" to an edge or hole.
5. A subsurface indication parallel to the grain flow (Page 22, Figures 1a and 1b) is acceptable so long as it is no longer than 1/2" and it is no closer than 1/8" to an edge or hole.
6. Clusters of indications, defined as a group of four or more indications in a one square inch area, are cause for rejection



Grain Flow Direction (Red Arrow)
Along the Rail and Outside Diameter of
the Piston Pin and Crankpin Bores

Figure 1 (a)



Grain Flow Direction (Red Arrow)
Along the Inside Diameter of the
Crankpin Bore

Figure 1 (b)

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Rebuilt(-85) or Overhauled (-70) Steel Parts

The main objective of magnetic particle inspection of rebuilt (-85) or overhauled (-70) steel parts is to find indications that have developed as a result of the function of the part while in service. Examples of such indications are fatigue cracks or heat checks (cracks).

SCOPE:

These criteria are to be used for all refurbished steel parts requiring Magnetic Particle Inspection other than crankshafts.

General:

- All parts shall be processed using the same technique for longitudinal and circular amperage values as was established for the major detail part of the assembly when it was new, where applicable.
- Any crack is cause for rejection.
- Transverse indications are cause for rejection.
- Linear indications open to the surface, which emanate from holes, radiuses, corners or porosity, are cause for rejection.
- Component or detail parts of assemblies not subject to magnetic particle inspection per drawing, such as bushings, plugs, spacers, or caps, should only be rejected for gross indications such as fatigue cracks. Other inherent discontinuities, such as stringers and porosity are acceptable.

NOTE: If there is a question for processing any parts to the above criteria or if a technique is not available, contact your supervisor or the cognizant Level III.

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Acceptance Criteria for Welds

Per LPS 356

Type Of Defect		WELD JOINT CLASS			
		I	II	III	IV
Crack and Crack Line Indications		U	U	U	U
Incomplete Penetration & Fusion		U	U	U	U
Maximum Size "L" which ever is less		U	T/3 or 0.07"	T/2 or 0.10"	T or 0.13"
Surface Porosity	Max Total Length / Linear Inch	U	2L	4L	6L
	Min. Dist. Between Ind.	U	3L	2L	L
	Maximum Depth	U	T/20	T/10	T/5
Under cutting	Maximum Length	U	10T in 30T	10T in 20T	Unrestricted

Legend:

U - Unacceptable

L - Maximum Dimension Of Defect

T - Thickness Of Thinnest Base Metal