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12/01/15



भारत सरकार - रेल मंत्रालय  
अनुसंधान, अभिकल्प और मानक संगठन  
लखनऊ - 226 011  
EPBX (0522) 2451200  
Fax (0522) 2458500

Government of India - Ministry of Railways  
Research Designs & Standards Organisation  
Lucknow - 226 011  
DID (0522) 2450115  
DID (0522) 2465310

|                                    |                |
|------------------------------------|----------------|
| कार्यालय अधिसूचना<br>Office Supdt. | दिनांक<br>Date |
| निदेशक<br>Director                 |                |
| DA 19/3/11                         | LS/11          |
| SRB-1                              |                |
| PB                                 |                |
| LT-1                               | Dt: 18.12.2014 |
| 517-1                              |                |

No. CT/USFD

I. The General Manager (Engg./Works)

1. Central Railway, CST, Mumbai – 400 001.
2. Eastern Railway, Fairlie Place, Calcutta – 700 001.
3. East Central Railway, Hajipur – 844 101.
4. East Coast Railway, Chandrasekharapur, Bhubaneshwar – 751 016.
5. Northern Railway, Baroda House, New Delhi -- 110 001.
6. North Central Railway, Allahabad - 211 001.
7. N.E.Railway, Gorakhpur - 273 001.
8. N.F.Railway, Maligaon, Guwahati – 781 011.
9. North Western Railway, Jaipur – 302 001.
10. Southern Railway, Park Town, Chennai – 600 003.
11. S.C.Railway, Rail Nilayam, Secunderabad – 500 371.
12. S.E.Railway, Garden Reach, Calcutta – 700 043.
13. South East Central Railway, Bilaspur 495 004
14. South Western Railway, Hubli– 580 023.
15. Western Railway, Churchgate, Mumbai – 400 020
16. West Central Railway, Jabalpur – 482 001

Sub: Manual for Ultrasonic testing of Rails and Welds (Revised, 2012)-  
A&C Slip No. 02 of December, 2014

- Ref:(i) This office letter of even no.dt: 27.06.12/ 06.07.2012.  
(ii) Railway Board's letter no. Track/21/2007/0903/7 dt: 03.12.2014.

1. The 'Manual for Ultrasonic testing of Rails and Welds, (Revised-2012)' was circulated to all Zonal Railways vide this office letter at reference (i) above. Please find enclosed herewith Correction Slip No. 02 of December, 2014 to the above Manual for information and further necessary action.

2. This Correction Slip to USFD Manual is being issued in view of inclusion of 'tunnel approaches (100m either side)' as sensitive locations and Railway Board's instructions issued separately regarding action to be taken on defective welds existing on major bridge approaches circulated vide letter no. Track I/ 21/ 99/0910/7 Pt. dt. 29.10.2002 & Track I/ 21/ 99/0910/7 Vol. II dt. 09.05.2003.

3. Please acknowledge receipt.

संलग्न- उपरोक्त ।

18/12/14  
(एस.के.पाण्डेय)  
कार्यकारी निदेशक/रेलपथ- I  
कृते महानिदेशक/रेलपथ

|           |   |   |  |
|-----------|---|---|--|
| <p>3.</p> | <p>70° probes<br/>Gauge Face &amp;<br/>Non-gauge Face<br/>side Probe<br/>(Sensitivity set<br/>on 5mm FBH)</p> | <p>A) Any transverse defect in the rail head on gauge face/ Non-gauge Face side at the following locations in the track</p> <ul style="list-style-type: none"> <li>i) In tunnel &amp; on tunnel approaches (100m either side)</li> <li>ii) On major bridges &amp; bridge approaches (100m either side)</li> <li>iii) In the vicinity of holes near the weld (50 mm for old AT weld and 75mm for new AT weld from the centre of weld on either side of weld)</li> </ul> <p>B) Any transverse defect in the rail head on gauge face/ Non-gauge Face side at track locations other than A) above</p> | <p>The figure consists of two graphs. The top graph is for 70 degree probes and the bottom graph is for 45 degree probes. Both graphs plot Flaw Peak Height (V) in % on the y-axis (0 to 100) against the Extent of movement of flaw echo on the horizontal scale (H) in % on the x-axis (0 to 100). The graphs are divided into several regions based on H and V values:</p> <ul style="list-style-type: none"> <li><b>IMRW (H ≥ 15; V ≥ 20):</b> A region in the upper right quadrant, shaded with a cross-hatch pattern.</li> <li><b>Non Reportable (H &lt; 15; V ≥ 20):</b> A vertical strip on the left side of the graph.</li> <li><b>Non Reportable* # (H ≥ 15; V &lt; 20):</b> A region in the lower right quadrant.</li> <li><b>Non Reportable (H &lt; 15; V &lt; 20):</b> A vertical strip on the left side of the lower graph.</li> <li><b>OBSW (15 ≤ H &lt; 30; V ≥ 20):</b> A vertical strip in the middle of the lower graph.</li> <li><b>OBSW* (H ≥ 30; 20 ≤ V &lt; 60):</b> A region in the middle right of the lower graph.</li> <li><b>IMRW (H ≥ 30; V ≥ 60):</b> A region in the upper right of the lower graph.</li> </ul> <p>* Details to be forwarded to RDSO quarterly in format at para 5.1.3<br/># To be marked as 'O' on web of rail</p> |
|-----------|---|---|--|


(2)

II Copy along with a copy of the correction slip No. 02 of December, 2014 for information and record to:

1. The General Manager(Cons.), N.F. Railway, Maligaon, Guwahati-781 011.
2. The Chief Commissioner of Railway Safety, Ministry of Tourism & Civil Aviation, NE Rly Compound, 16-A, Ashok Marg, Lucknow-260 001.
3. The CMD, Manging Director, KRCL, Belapur Bhawan, Plot No.6, CBD, Belapur, New Bombay-400 614.
4. The Director General, Railway Staff College, Vadodara-390 004.
5. The Director, IRICEN, Pune- 411 001.
6. The Executive Director, IRCAMTECH, Maharajpur Gwalior-474 020

III Copy along with a copy of correction slip to Executive Director/Track (Procurement), Railway Board, Rail Bhavan, New Delhi 110 001 for kind information in reference to Railway Board's letter no Track/21/2007/0903/7 dt: 03.12.2014.

संलग्न- उपरोक्त ।

  
(एस.के. पाण्डेय)  
18/12/14  
कार्यकारी निदेशक/रेलपथ-।  
कृते महानिदेशक/रेलपथ

IV Copy along with a copy of the correction slip No. 02 of December, 2014 for information and record to:

**The Chief Safety Officer:**

1. Central Railway, CST, Mumbai – 400 001.
2. Eastern Railway, Fairlie Place, Calcutta – 700 001.
3. East Central Railway, Hajipur – 844 101.
4. East Coast Railway, Chandrasekharpur, Bhubaneshwar – 751 016.
5. Northern Railway, Baroda House, New Delhi – 110 001.
6. North Central Railway, Allahabad - 211 001.
7. N.E. Railway, Gorakhpur - 273 001.
8. N.F. Railway, Maligaon, Guwahati – 781 011.
9. North Western Railway, Jaipur – 302 001.
10. Southern Railway, Park Town, Chennai – 600 003.
11. S.C. Railway, Rail Nilayam, Secunderabad – 500 371.
12. S.E. Railway, Garden Reach, Calcutta – 700 043.
13. South East Central Railway, Bilaspur 495 004
14. South Western Railway, Hubli- 580 023.
15. Western Railway, Churchgate, Mumbai – 400 020
16. West Central Railway, Jabalpur – 482 001.

| S.No. | Probe used   | Nature of defect  | Oscillogram pattern | Classification |
|-------|--|---|---------------------|----------------|
| 2.    | 70° 2MHz<br>Centre probe<br>(Sensitivity set with 12mm dia. Standard hole at rail head 25mm from rail top) | <p>A) Any transverse defect in the rail head at the following locations in the track</p> <p>i) In tunnel &amp; on tunnel approaches (100m either side)</p> <p>ii) On major bridges &amp; bridge approaches (100m either side)</p> <p>iii) In the vicinity of holes near the weld (50 mm for old AT weld and 75mm for new AT weld from the centre of weld on either side of weld)</p> <p>B) Any transverse defect in the rail at track locations other than A) above</p> |                     |                |
|       |  |   |                     |                |

\* Details to be forwarded to RDSO quarterly in format at para 5.1.3  
# To be marked as 'O' on web of rail

## Manual for Ultrasonic testing of rails &amp; welds, (Revised-2012)

A&amp;C Slip No. 02 of December, 2014

1. Para 8.14 is modified as follows:

**“8.14 Action to be taken after detection of defects in AT welds:** Action to be taken for defects in AT welds shall be same as at **Para 6.4** and in addition following shall also be applicable for welds classified as defective (DFWO/DFWR) in periodic testing of AT welds with 0° 2MHz , 70° 2 MHz , 45° 2 MHz , 70° 2 MHz SL probes, 45°/ 2 MHz Tandem Rig:

| Classification   | Painting on both faces of weld<br>(In Head)   | Action to be taken  |
|--|---|---|
| Defective weld 'DFWO/DFWR' with 0°/2MHz, 70°/2MHz, 45°/2 MHz or 70° 2MHz SL probe, 45°/ 2 MHz Tandem Rig | In case of DFWO, one circle with red paint.<br>In case of DFWR, two cross with red paint. | <p>(i) In case of DFWO weld, following action will be taken:</p> <p>a) SSE/JE (P.Way)/USFD shall impose speed restriction of 30 kmph or stricter immediately and communicate to sectional SSE/JE about the flaw location, who shall ensure the following :</p> <p>b) Protection of defective weld by joggled fish plates using minimum two tight clamps immediately with a speed restriction of 30 kmph. Speed restriction can be relaxed to normal after protection of DFWO weld by joggled fish plates with 2 far end tight bolts (one on each side) with champhering of holes, within 3 days. The joint is to be kept under observation.</p> <p>ii) In case of DFWR weld, following action will be taken :</p> <p>a) SSE/JE (P.Way)/USFD shall impose speed restriction of 30kmph or stricter immediately and communicate to sectional SSE/JE about the flaw location who shall ensure the following:-</p> <p>b) Protection of DFWR weld by joggled fish plates using minimum two tight clamps immediately. SR of 30 Kmph can be relaxed to normal after providing joggled fish plates with two far end tight bolts one on each side with champhering of holes. The DFWR weld shall be replaced within three months of detection.<br/>Adequate traffic block should be granted for removal of DFWR welds. In case of non removal within three months, a speed restriction of 75 kmph for loaded goods train and 100 kmph for passenger train should be imposed.</p> <p>iii) In case of defective weld (DFWO/DFWR) on major bridges &amp; bridge approaches (100m either side) and In tunnels &amp; on tunnel approaches (100m either side), following action will be taken :</p> <p>a) SE/JE(P.Way)/USFD shall impose speed restriction of 30 Kmph or stricter immediately and to be continued till defective weld is replaced. He should communicate to sectional SE/JE (P.Way) about the flaw location who shall ensure the following :</p> <p>i) Protection of defective weld using clamped joggled fish plate within 24 hrs.</p> <p>ii) The defective weld shall be replaced within 3 days of detection.</p> |

Annexure II B  
(Para 6.5.1)

**Weld defects(AT+FBW)**

| S.No. | Probe used   | Nature of defect  | Oscillogram pattern  | Classification |
|-------|--|---|--|----------------|
| 1.    | Normal probe<br>4MHz<br>(sensitivity set<br>with respect to<br>100% back wall<br>signal height<br>from rail<br>bottom) | A) Any horizontal defect<br>progressing at an angle in<br>vertical plane in the rail<br>at the following locations<br>in the track :<br>i). In tunnel & on tunnel<br>approaches (100m either<br>side)<br>ii). On major bridges &<br>bridge approaches (100m<br>either side)<br>iii) In the vicinity of<br>holes near the weld (50<br>mm for old AT weld and<br>75mm for new AT weld<br>from the centre of weld<br>on either side of weld) | No back echo with<br>flaw echo (shifting or<br>without shifting) | IMRW           |
|       |  | B) Any horizontal defect<br>progressing transversely<br>in the rail at track<br>locations other than A)<br>above  | No back echo with<br>flaw echo (shifting or<br>without shifting) | OBSW           |

2. Para 8.15.1 is modified as follows:

**“8.15.1** Testing of AT welded joints shall comprise of testing by probes with sensitivity setting and calibration as per references indicated against them in the table below:

| S. No | Probes                         | Calibration as per  | Sensitivity Setting as per     | Scanned area   | Acceptance Criteria       |
|-------|--------------------------------|---------------------|--------------------------------|--|---------------------------|
| 1.    | 0° 2 MHz                       | Para 8.5.1          | Para 8.5.2, Fig 20(a)          | Head, web  | As per Para 8.5.4         |
| 2.    | 70° 2MHz                       | Para 8.6.1, 8.9.1   | Para 8.6.2, 8.9.2, Fig 20(a)   | Head, weld foot  | As per Para 8.6.4 & 8.9.4 |
| 3.    | 70° 2MHz SL                    | Para 8.8.1          | Para 8.8.2, Fig 22 (a)         | Weld foot (Half Moon Defect)                                   | As per Para 8.8.4         |
| 4.    | 45° 2 MHz                      | Para 8.7.1          | Para 8.7.1.2 , Fig 22 (a) & 23 | Weld foot (Half Moon Defect/clustered defect & micro porosity) | As per Para 8.7.1.4       |
| 5.    | 45° 2 MHz single crystal probe | As per Para 8.7.2.1 | As per Para 8.7.2.2            | Lack of fusion in the web and foot region below web            | As per Para 8.7.2.4       |

The frequency of testing of AT welds with above listed probes shall be as under:

| S No | Type of Welds        | Type of Testing                  | Testing Schedule                             |                   |           |
|------|----------------------|----------------------------------|--|-------------------|-----------|
| 1    | Conventional AT Weld | Periodic Tests                   | Every 40 GMT or 5 year, whichever is earlier |                   |           |
| 2    | SKV Weld             | Acceptance Test                  | Immediately after welding                    |                   |           |
| 3    |                      | First Periodic Test              | 1 year                                       |                   |           |
| 4    |                      | Further tests based on route GMT | > 45   | Routes having GMT | Frequency |
| 5    |                      |                                  | >30 ≤ 45                                     |                   | 2 years   |
| 6    |                      |                                  | > 15 ≤ 30                                    |                   | 3 years   |
| 7    |                      |                                  | 0-15   |                   | 4 years   |
|      |                      |                                  |  |                   | 5 years   |

In case of welds on major bridges & bridge approaches (100m either side) and In tunnels & on tunnel approaches (100m either side), the minimum frequency of testing shall be once in a year.

Due to unusually high weld failure or other abnormal development in some sections, Chief Engineer may order testing of welds early, as per need.

The testing interval of USFD testing of defective AT welds should be reduced by 50% of normal testing interval of AT welds as provided in Para 8.15.1 to avoid fractures of defective welds.



| SNo | Probe Used  | Nature of Defect   | Oscillogram Pattern  | Classification |
|-----|---|--|--|----------------|
| 5.  | 45° probes mounted in test rig (sensitivity set to 100% with respect to reflection signal received from opposite face of rail head) | A) Any transverse defect in the rail head, with scabs/wheel burn on top surface, at the following locations in the track<br>i) In tunnel & on tunnel approaches (100m either side)<br>ii) On major bridges & bridge approaches (100m either side)<br>iii) In the vicinity of holes near the weld (50 mm for old AT weld and 75mm for new AT weld from the centre of weld on either side of weld) | Loss of signal height equal to or more than 20% of full scale height.                  | IMR            |
|     |   | B) Any transverse defect in the rail head with scabs/wheel burn on top surface at track locations other than A) above.   | Loss of signal height equal to or more than 80% of full scale height.                  | IMR            |
|     |   |  | Loss of signal height equal to or more than 20% but less than 80% of full scale height | OBS            |



3. Annexure IIA and IIB are modified as follows:

Annexure-IIA  
(Para 6.3)

**CLASSIFICATION OF RAIL/WELD DEFECTS FOR  
NEED BASED CONCEPT OF USFD**

**Note :** “Any sweeping signal on horizontal baseline that does not extend beyond 2.5 divisions from the left edge of the screen or vice versa shall be recorded as Gauge Corner Cracking (GCC) and not as OBS”.

**For Rail Defects**

| S. No | Probe used  | Nature of defect  | Oscillogram pattern  | Classification |
|-------|---|---|--|----------------|
| I.    | Normal probe 4MHz (sensitivity set with respect to 100% back wall signal height from rail bottom) | <b>A) Within fishplated area -</b>  |  |                |
|       |   | (i) Any horizontal defect in head web or foot of length equal to distance between rail end and first bolt hole and connected with the rail head.  | No back echo before or after appearance of bolt hole echo with<br>Flaw echo with or without multiples<br><b>OR</b><br>Drop in back echo before or after appearance of bolt hole echo with flaw echo with or without multiple | IMR            |
|       |   | (ii) Any horizontal defect connecting both bolt holes   | No back echo between bolt hole echo. Flaw echo with or without multiples.  | IMR            |
|       |   | (iii) Any defect originating from bolt holes and progressing at an angle towards head-web junction or web-foot junction.  | No back echo before or after appearance of bolt hole echo with or without flaw echo  | IMR            |
|       |   | <b>B) Outside fish plated area -</b>  |  |                |
|       |   | a) Any horizontal defect progressing at an angle in vertical plane in the rail at the following locations in the track:<br>i) In tunnel & on tunnel approaches (100m either side)<br>ii) On major bridges & bridge approaches (100m either side)<br>iii) In the vicinity of holes near the weld (50 mm for old AT weld and 75mm for new AT weld from the centre of weld on either side of weld) | No back echo with flaw echo (shifting/without shifting) for any horizontal length<br><b>OR</b><br>No back echo and no flaw echo  | IMR            |
|       |   | b) Any horizontal defect progressing at an angle in vertical plane in the rail at track locations other than (a) above.   | No back echo with flaw echo (shifting/without shifting) for horizontal length $\geq 20\text{mm}$<br>No back echo with or without shifting flaw echo for horizontal length $< 20\text{ mm}$                                   | IMR<br>OBS     |

|    |   |  |   |
|----|---|--|---|
| 4. | <p>70° probes Gauge Face &amp; Non-gauge Face side (Sensitivity set on 5mm FBH)</p> | <p>A) Any transverse defect in the rail head on gauge face side/ Non-gauge Face at the following locations in the track</p> <p>i) In tunnel &amp; on tunnel approaches (100m either side)</p> <p>ii) On major bridges &amp; bridge approaches (100m either side)</p> <p>iii) In the vicinity of holes near the weld (50 mm for old AT weld and 75mm for new AT weld from the centre of weld on either side of weld)</p> <p>B) Any transverse defect in the rail head on gauge face/ Non-gauge Face side at track locations other than A) above</p> | <p>The figure contains two graphs. The top graph is for tunnel and bridge approaches, and the bottom graph is for other track locations. Both graphs plot Flaw Peak Height (V) in % on the y-axis (0 to 80) against the EXTENT of movement of flaw echo on horiz. scale (H) in % on the x-axis (0 to 100). The top graph shows a shaded region for IMR (H ≥ 15, V ≥ 20), a vertical strip for Non Reportable (H &lt; 15, V ≥ 20), and a bottom region for Non Reportable* # (H ≥ 15, V &lt; 20). The bottom graph shows a shaded region for IMR (H ≥ 30, V ≥ 60), a vertical strip for OBS (15 ≤ H &lt; 30, V ≥ 20), a vertical strip for Non Reportable (H &lt; 15, V ≥ 20), a region for OBS* (H ≥ 30, 20 ≤ V &lt; 60), and a bottom region for Non Reportable* # (H ≥ 15, V &lt; 20).</p> <p>* Details to be forwarded to RDSO quarterly in format at para 5.1.3<br/> # To be marked as 'O' on web of rail</p> |
|----|---|--|---|

| S. No | Probe used  | Nature of defect   | Oscillogram pattern  | Classification |
|-------|---|--|--|----------------|
|       |   | <b>C) Vertical longitudinal split (piping)</b>   | In case of partial/complete loss of back echo, side probing shall be carried out with 0° probe, if any flaw echo with/ without multiples is observed (in any length)   | IMR            |
| 2.    | 70° 2MHz Centre Probe<br>(Sensitivity set with 12mm dia. Standard hole in rail head 25mm from rail top)<br><u>For non 'D' marked rails on double/multiple line sections</u> | <p>A) Any transverse defect in the rail head at the following locations in the track</p> <p>i) In tunnel &amp; on tunnel approaches (100m either side)</p> <p>ii) On major bridges &amp; bridge approaches (100m either side)</p> <p>iii) In the vicinity of holes near the weld (50 mm for old AT weld and 75mm for new AT weld from the centre of weld on either side of weld)</p> <p>B) Any transverse defect in the rail head at track locations other than A) above</p> | <p>The top diagram shows classification regions for rail head defects in tunnels and on major bridges. The y-axis is 'Flaw Peak Height (V) in %' (0 to 100) and the x-axis is 'EXTENT of movement of flaw echo on horiz. scale (H) in %' (0 to 100). Regions include: 'Non Reportable (H&lt;30;0&lt;V&lt;100)', 'IMR (H ≥ 30; V ≥ 20)', and 'Non Reportable* # (30 ≤ H ≤ 100; V &lt; 20)'. The bottom diagram shows classification regions for rail head defects at other track locations. It has the same axes. Regions include: 'Non Reportable (H&lt;30;0&lt;V&lt;100)', 'OBS (50&gt;H ≥ 30; V ≥ 20)', 'IMR (H ≥ 50; V ≥ 60)', 'OBS* (H ≥ 50; 60&gt;V ≥ 20)', and 'Non Reportable* # (30 ≤ H ≤ 100; V &lt; 20)'. A note at the bottom states: '* Details to be forwarded to RDSO quarterly in format at para 5.1.3 # To be marked as 'O' on web of rail'.</p> |                |

| S. No | Probe used   | Nature of defect   | Oscillogram pattern | Classification |
|-------|--|--|---------------------|----------------|
| 3.    | <p>70° 2MHz (Centre) Probe (sensitivity set with 12mm dia. Standard hole at rail head 25mm from rail top and with additional gain of 10dB thereon).<br/> <u>For all single line sections and 'D' marked rails on double/multiple line sections</u></p> | <p>A) Any transverse defect in the rail head at the following locations in the track<br/>           i) In tunnel &amp; on tunnel approaches (100m either side)<br/>           ii) On major bridges &amp; bridge approaches (100m either side)<br/>           iii) In the vicinity of holes near the weld (50 mm for old AT weld and 75mm for new AT weid from the centre of weld on either side of weld)</p> <p>B) Any transverse defect in the rail head at track locations other than A) above</p> |                     |                |