

भारत सरकार/GOVERNMENT OF INDIA
रेल मंत्रालय/MINISTRY OF RAILWAYS
(रेलवे बोर्ड)/(RAILWAY BOARD)

सं/No. Track/21/2004/0902/7Vol.III

दिनांक/Date: 20.06.2022

PCEs, All Indian Railways;
CAOs, All Indian Railways.

विषय/Sub: Comprehensive instructions of USFD Testing of rails/Welds and its outsourcing.

- संदर्भ/Ref:
1. Board's Letter No. Track/21/2004/0902/7 dated 12.03.2009.
 2. Board's letter No. Track/21/2004/0902/7/Pt.dt.08.02.2012.
 3. Board's letter No. Track/21/2004/0902/7 dated 26.03.2014.
 4. Board's letter No.2017/Track-P/9(2) Vol.III dated 07.03.2019.
 5. Board's letter No. Track/21/2004/0902/7 Vol-II dt18.04.2019.
 6. Board's letter No.2018/Track-I/11/1/ATWeldingVol.-Idated 03.06.2019.
 7. Board's Letter No. Track/21/2004/0902/7 Vol 2 dated 31.12.2019.
 8. Board's Letter No. Track/21/2002/0905/7 Vol III dated 15.01.2020.
 9. Board's Letter No. Track/21/2002/0905/7 Vol III dated 15.03.2020.

Vide above referred letters, various instructions were issued from time to time. Therefore in order to simplify comprehensive instructions are issued hereunder. The instructions issued by this letter will supersede all the earlier instructions issued on the subject.

I. Departmental USFD Testing :

1. USFD Testing with 'B'-Scan has been started on 'A'-route on IR and it has to gradually proliferate on all routes till existing SRT/DRT completes their codal life. Procurement of SRT/DRT with B-Scan is only to be done for rail testing. However for testing of Welds A-Scan machines can be procured till the time B scan machines are made available.
2. Selection of the sections for departmental testing is to be done on the basis of work load vis-a-vis manpower availability.
3. Railway should make all out efforts to strengthen the in-house capabilities of USFD testing so that minimum quantity of USFD testing is outsourced.
4. Training of all USFD Operators JEs/SSEs and Sectional JEs with B-Scan machines should be got done as early as possible.
5. All supervisors of USFD should be proficient to use TMS.

6. Data of B-Scan should be kept preserved as permanent records for 3 years period and in case of fracture the same should be analysed and action taken accordingly.
7. Divisional Testing program must be prepared annually and compliance ensured, so that no overdue testing on rails and welds remain as per frequency laid down in USFD manual and instructions issued from time to time.
8. In case exigencies USFD testing can be done departmentally in the section under outsourcing and cost of testing to be recovered from the contractor from the contractor.
9. Only departmental testing is permitted in all construction projects.

II. USFD Testing by Outsourcing:

1. Based on the importance of section Zonal Railway should identify the sections for outsourced USFD testing which will be approved by PCE/CTE. However no departmental testing will be carried out in the identified section for outsourced USFD testing.
2. Need for outsourcing should be assessed on the basis of workload (including construction) of USFD testing (Rails + welds) & availability of departmental infrastructure.
3. Tender for USFD Testing of rails by outsourcing should be called only with B-Scan Machines equipped with 9 Channels SRT/DRT and two extra 37 degree probes. However for Weld Testing A-Scan machines can be permitted for the time being.
4. RDSO certified USFD operator and machines for the testing is to be made mandatory. To ensure it the contractor has to propose the name of RDSO approved USFD operator after award of LOA, which will further be verified and approved by ADEN. However, contractor has to propose the RDSO approved USFD machines to be utilised for testing, in the tender itself.
5. Zonal Railways should ensure that a contract provision for scrutiny of B-scan record and its continuity as part of test check at ADEN level is kept in the tender conditions. Data of B-Scan should be part of payment records and preserved for three years for further analysis and necessary action in case of fracture.
6. Software to view the B Scan data to be obtained as part of contract by the railways.
7. In case of vehicular USFD testing the software should be equipped with play, forward and rewind option and with defect to defect pause features.
8. Provision of geo tagging and date stamping in the B Scan should be kept in the contracts.
9. Test check of 10% at SSE level on fortnightly basis and 5% at ADEN level on monthly basis should be carried out within one month.



10. In case of detection of any undetected flaw during test check by the railways, the length of track tested in that particular week will be required to be retested by the contractor without any extra payment. Also, record of USFD operator will be kept who missed the flaw and the USFD operator who missed ten flaws in a year will be removed by Railways and its approval will be withdrawn by RDSO.
11. CTE shall act as third party to investigate whether the defect was detectable at the time of USFD testing or not. The decision of CTE shall be final and binding on both the parties and this decision is not arbitrable.
12. USFD tender should only be called from the Headquarters and not from the Divisions so that in case of requirement it can be deployed all over Zonal Railway.
13. For outsourcing of USFD testing, tenders for longer period should be invited keeping in view local site and working conditions.
14. Maximum delay permitted in testing of a section after it has become due for USFD testing is 15 days. For further delay, penalty of Rs.5000/- per km per day will be levied on the contractor.
15. For contracts for works tender related to "USFD Testing of Rails/Welds by SRT/DRT/Handheld Testers" whose technical capabilities have already been established by RDSO, Board (ME & FC) have decided to dispense with the Minimum Technical Eligibility Criteria mentioned in Indian Railways Standard General Conditions of Contract. However, Financial Eligibility Criteria as given in Standard General Conditions of Contract will remain unchanged.
16. Zonal railway should have a contract provision of Maximum length of Track as 6 km per day per machine with two operators and 30 No of welds testing per operator per day per machine in non vehicular testing contracts.
17. Following eligibility condition should also be incorporated in the tender:

The Contractor must provide documentary evidence of

- a) Owning [XX] of RDSO approved machines


OR

- b) Proof of entering into MOU with manufacture/ supplier of RDSO approved vender for required no of machines as specified in (a) above.

(No of machines will be decided by zonal railways depending upon workload and duration of the contract.).



- III. For guidance of field officials, the classification of Rail/Weld fractures into 'Avoidable' on account of certain non performance or violation of laid down instructions of USFD/IRPWM/ATW/FBW manuals is attached as **Annexure-I**.
- IV. Concise booklet on USFD Inspection for guidance is also attached as **Annexure-II**.


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Avoidable Rail/Weld failures			
S.No.	Item	Cause for avoidable fracture	References
1	Rail failures		
	(a) IMR defect	<ul style="list-style-type: none"> Speed restriction of 30 KMPH or stricter not imposed by SSE/USFD immediately. Joggle plate not provided within 24 hrs. Not replaced within 3 days if detection. 	USFD manual-Para 6.4 – Action to be taken after detection of defects.
	(b) Any fracture in fish plated zone	<ul style="list-style-type: none"> Lubrication not done as per schedule. Chamfering of bolt holes not done. Oblong bolt holes due to loose bolting. Flame cut bolt hole. 	IRPVM (Jun-2020) – Para 619 – Lubrication of rail joints & 620 – Maintenance of rail joints. 620(7) – Chamfering of bolt holes in rails. (Compliance of PCE circular No.69 dated 28.01.2020)
	(c) Gauge corner fatigue	<ul style="list-style-type: none"> Fatigue formation in rail head not detected during USFD testing having favourable orientation for detection. 	USFD manual – Para 1.2.1(h) – Nature of defects in rails.
	(d) Any fracture on turnout & SEJs (because these are inspected in detail once every quarter)	<ul style="list-style-type: none"> Shortfall/Overdue in inspection schedule. (Improper inspection) 	IRPVM (Jun-2020) – Para 345(6) – Maintenance of SEJs & table 1-B, 1-C – Inspection schedule of SSE (In charge)/SSE/JE/P. Way.
	(e) IMR SEJ Tongue Rail/Stock Rail	<ul style="list-style-type: none"> 20 KMPH or stricter caution not imposed by SSE/USFD immediately. Not advised to sectional SE/JE (P. Way) by SSE/USFD immediately. Not deputing a permanent watchman by SSE/JE (P. Way) for protection of defective SEJ till it is replaced. Not replaced within 3 days if detection. 	Draft USFD test procedure for stock and Tongue rail of SEJ/Improved SEJ – Para 11.10.
2	Weld fractures		
	FB Weld		

(a) lack of fusion (It forms kidney defect)	<ul style="list-style-type: none"> • Improper Preheating cycles & time, flashing & butting strokes. • Perfect end squareness not done before welding. 	FB weld manual- Annexure V (Para 10)-(2)
(b) Arcing effect (Copper entrapment)	<ul style="list-style-type: none"> • Improper cleaning & wearing of copper electrodes, causing arcing during FB welding process. 	FB weld manual- Annexure V (Para 10)-(5) & Para 4.3,5(5.1)
(c) Improper stripping of upset metal at web area and bottom surface.	<ul style="list-style-type: none"> • Bad stripping of upset metal after FB welding process at web area or improper profile grinding finish at the rail bottom surface & web causing formation of sharp edges. 	FB weld manual- Annexure V(Para 10)-(4) & Para 5.3,5
(e) Fracture during transportation	<ul style="list-style-type: none"> • If any defective FB weld received in rail panel fractures. 	FB weld manual- Annexure VII-(Para 11)-Handling Instructions for 90UTS rails.

3	AT Weld	
(a) Defective weld	<ul style="list-style-type: none"> • Lack of fusion • Blow holes • Porosity • Slag inclusion • Half moon defect • Inverted half moon shaped fatigue zone at web-flange junction. • Eccentric mould • Sand inclusion • Risers not trimmed off properly. • Low joint(Train passed within 30minutes of welding/ Insufficient time for cooling) 	<p>AT weld manual- Annexure-9- Preventive steps to be taken to avoid weld defects.</p>
(b) Improper placement of weld	<ul style="list-style-type: none"> • Weld placed on the sleeper or at the edge of sleeper. 	AT weld manual- Para-4.10.6-welding AT weld manual- Para-5.3-Passing of traffic. IRPWM(Jun-2020)-Para 623(1)-Laying of plain track sleepers
(c) If the weld was Untested	<ul style="list-style-type: none"> • Not joggle fish plated with two tight clamps and supported on wooden block immediately after welding. 	USFD manual-Para 8.10 - Initial USFD testing of AT welds.

(d) If the weld was found defective during USFD and stipulated instructions violated.	<p>IMRW</p> <ul style="list-style-type: none"> • Speed restriction of 30 Kmph or stricter not imposed by SSE/USFD immediately. • Clamped jogged plate not provided within 24 hrs. • Not replaced within 3 days of detection. <p>DFWR</p> <ul style="list-style-type: none"> • Speed restriction of 30 Kmph or stricter not imposed by SSE/USFD immediately. • Jogged fish plate not provided with 2 far end tight bolts before relaxing the caution to normal. • In case of non-removal of DFWR weld within 3 months speed restriction of 75 Kmph for Goods train and 100 Kmph for passenger train not imposed. <p>DFWR</p> <ul style="list-style-type: none"> (On major bridges & bridge approaches (100m either sides) and in tunnel & tunnel approaches (100m on either sides)) • Speed restriction of 30 Kmph or stricter not imposed by SSE/USFD immediately. • Speed restriction of 30 Kmph or stricter is relaxed before the defective weld is replaced. 	<p>USFD manual-Para 6.4 & 8.14- Action to be taken after detection of defects.</p>
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Rail/Weld fractures		
(a) Fractures due to overlook	<ul style="list-style-type: none"> • Overdue rail/weld. • USFD testing frequency is not followed. • Winter precautions to prevent rail/weld fractures not followed. 	IRPWM(Jun-2020)-Para 702-1(d) - Factors Governing Permanent Way Renewal, USFD manual- Para 6.6 & 8.15 and IRPWM(Jun-2020)-Para 116-7(d)-Important duties of Keyman.
(b) At locations which was USFD tested and flaw missed in USFD testing.	<ul style="list-style-type: none"> • If detectable flaw found in fractured rail piece. 	USFD manual- para 8.15.2 & Annexure-II- A & B.

NOTE : Other than above mentioned criteria, any type of Rail/Weld fracture in service found to be due to violation of stipulated guidelines will be considered as 'Avoidable' fractures.

USFD INSPECTION BOOKLET

Frequency of Testing

Need based Rails testing as per USFD Manual 2012

A. Through Rail Testing/Tongue Rail and Stock Rail (Gap avoiding rail) Testing of SEJ/Turnout Testing as demarcated Zone-I and Zone-II/Head Testing of FB Weld (Ref para6.6.1.1)

Reduced frequency testing period for rail testing: -

1. For the rails rolled before April-99: 15% of stipulated service life in terms of GMT.
2. For the rails rolled in April-99 and later: 25% of stipulated service life in terms of GMT.

Route	Routes having GMT	USFD testing frequency during the "Reduced Frequency testing Period"	Normal Testing frequency once in	USFD Testing Frequency only for CC+8+2 Routes with 52 kg (90 UTS) In Zone IV & III
All BG Routes (rail head centre and gauge face corner/ no gauge face corner testing)	≤ 5	4years	2 years	18 months
	$>5 \leq 8$	30 months	12 months	09 months
	$>8 \leq 12$	20 months	9 months	6½ months
	$>12 \leq 16$	15 months	6 months	4½ months
	$>16 \leq 24$	10 months	4 months	03 months
	$>24 \leq 40$	6 months	3 months	2½

			month s
>40 ≤60	4 months	2 months	1½ month s
>60 ≤80	3 moths	1.5 moths	1 month s
>80	2 months	1 month	20 Days

B. Conventional AT welding

Type of testing	Testing schedule
Periodic test	Every 20 GMT or 5 years whichever is earlier

C. SKV AT welding

Acceptance test	Main Lines	Immediately after welding	
	Loop Lines		
Fist periodic test	Main Lines	20 GMT or 1 year whichever is earlier	
	Loop Lines	After 1 year	
Further tests	Based on Route GMT in	Routes having GMT	Frequency
		>80	1 year
		>60 ≤80	1.5 years
		>45 ≤60	2 years

	Main Lines	>30 ≤45	3 years
		>15 ≤30	4 years
		0-15	5 years
	Loop Lines	Once in 5 Years for Passenger Running Loop Lines.	
		Not to be carried out for Non-Passenger Running Loop Lines.	

- i. In case of welds on major bridges and bridge approaches (100m on either side) and in tunnels and on tunnel approaches (100m on either side), the minimum **frequency of testing shall be once in a year.**
- ii. Due to unusually high weld failures or other abnormal development in some sections, **Principal Chief Engineer may order testing of welds early, as per need.**
- iii. Testing interval of USFD testing of defective welds should be **reduced by 50% of normal testing interval** of AT welds as provided in the table above to avoid fracture of defective welds.

Para 4.3 of USFD Manual stipulates that the Sectional AEN should spent at least few hours (min. two hours) each month during his routine trolley inspection with USFD team and cross check the working including accuracy/sitting/calibration of USFD machines.

General Points to be checked by Inspecting Officials

1. Whether USFD Machine is from RDSO approved vendors e.g., PARAS/ MODSONIC/EEC?
2. Whether adequate staff are available for handling/lifting of machines?
3. Whether audio alarm is working or not?
4. Whether display screen is clearly visible?
5. Whether Battery is Fully Charged?
6. Check functioning of control Buttons.
7. Check functioning of trolley-
8. Probe Assembly, Wear of Wheel flange, Watering arrangement, Condition of Connecting Cables, Oiling and greasing, smooth movement of Trolley.
9. Check condition of Probes- Wear, Alignment and Wear in Probe Shoe.
10. Check Functioning of junction box.
11. Check gap between Probe and Rail top with 0.2 mm feeler gauge.
12. Check availability of Couplant under the Probe.
13. Check proper functioning of 37°, 70° and 45° (Test Rig) probes by touching the probe bottom.
14. Check whether back wall echo from 0° probe is full.
15. Whether test is being done as per procedure.
16. Whether Standard Test Piece for RAIL/ AT WELD/ FB WELD/ SEJ STOCK RAIL are available.
17. Whether defect marking is as per classification.
18. Whether necessary action was taken.

19. Whether details of testing, observations, echo pattern and echo amplitude of defects are entered in the TMS.
20. Whether the details are supplemented with A-scan and B-scan.

General Inspection Details				
Date of Inspection:				
DIVISION	SECTION	LINE	KM/TP	_____
Machine used for testing: Single Rail Tester / Double Rail Tester _____				
Type: A-SCAN/B-SCAN _____				
Name of Operator(s): _____				
				Competency Certificate of Operator and its Validity & Details _____
Points to be checked by Inspecting Officials on Work Site				
1. Date of testing of work being inspected.				
2. Stipulated frequency of section				
3. Whether testing is done as per Schedule				
4. In case of 'D' Marked Rails whether it has been checked as per the revised frequencies as fixed by CTE?				
5. Whether Extra gain of 10dB has been provided and saved for 'D' Marked Rails and Single Line Sections?				
6. Whether Calibration done as per schedule?				
7. Whether Sensitivity Setting done as per schedule?				
8. Location of testing (From Km to Km) of work being inspected.				
9. Type of Testing (Rail / AT Weld / FB Weld / SEJ / Turnout)				
10. Rail Section				
11. Whether all the inspected IMR defects are confirmed?				
12. If not, revised classification of such defect(s)				
13. Whether all the inspected OBS defects are confirmed?				
14. If not, revised classification of such defect(s)				
15. Percentage of Over and/or Under Reported defects				
16. Whether action taken at all the inspected defect(s)?				
17. The A-Scans of all defects and relevant data being preserved.				

**Classification of Defects detected during
Trough Rail Testing Using SRT/DRT and Test Rig**

Vulnerable location: The locations On Tunnels and Major Bridges and up to 100 m of its approaches, Fish plated area, In the Vicinity of the Hole near the weld (50mm for old AT weld and 75 mm for new AT weld from the center of weld on either side of weld) shall be classified as Vulnerable Locations.

Additional Conditions for classification of IMR Defects

- i) Any defect or defects at any location which is detected by two or more probes and are considered to be classified as OBS/OBSW based on peak pattern of individual probe, should be classified as IMR/IMRW and action shall be taken accordingly as per para 6.4.
- ii) In case two or more OBS/OBSW defects are located within a distance of 4.0 meter from each other, such OBS/OBSW defect shall be classified as IMR/IMRW and action shall be taken accordingly as per Para 6.4.

Note: (i) Check whether sensitivity setting is done as per S1 to S17 listed below.

A. Rail Defects

Note: USFD testing of rails and welds by B-Scan (SRT/DRT) having 7 probe/channel each rail, shall be decided by Principal Chief Engineer of the Zonal Railway depending on availability of B-Scan (SRT/DRT) having 9 probe/channel each rail.

Probe (Frequency)	Location of Defects	Location of Track	Oscillogram pattern	Classification
0° (4MHz)	Within Fish plated area	All Location	No back echo or drop in back echo before or after appearance of bolt hole echo	IMR
	Outside Fish plated area	Vulnerable	No back echo	IMR
		Non Vulnerable	No back echo with flaw echo for $H \geq 20$ mm	IMR
			No back echo with flaw echo for $H < 20$ mm	OBS

	Side probing on rail head	All Location	In case of loss of back echo from rail top, any flaw echo	IMR
70° Central (2 MHz)	Rail Head In case of 'Non- D' Marked Rails on double line	Vulnerable	$H \geq 30\% \text{ \& } V \geq 20\%$	IMR
		Non Vulnerable	$H \geq 50\% \text{ \& } V \geq 60\%$	IMR
			$30\% \leq H < 50\% \text{ \& } V \geq 20\%$	OBS
70° Central (2 MHz)	Rail Head In case of 'D' Marked Rails on double line	Vulnerable	$H > 0 \text{ \& } V \geq 20\%$	IMR
		Non Vulnerable	$H \geq 50\% \text{ \& } V \geq 20\%$	IMR
			$0\% > H < 50\% \text{ \& } V \geq 20\%$	OBS
70° GF & NGF Side (2MHz)	Rail Head	Vulnerable Locations	$H \geq 15\% \text{ \& } V \geq 20\%$	IMR
		Non-Vulnerable	$H \geq 30\% \text{ \& } V \geq 60\%$	IMR
			$15\% \leq H < 30\% \text{ \& } V \geq 20\%$	OBS
			$H \geq 15\% \text{ \& } 20\% \leq V < 60\%$	OBS
		All Locations	Any sweeping signal on horizontal baseline that does not extend beyond 25% from the left edge of the screen or vice versa	GCC

37° Single Crystal (2MHz)	Rail Web	All Locations	Any moving signal observed beyond 2.3 div in horizontal scale other than standard peak from bolthole, bond wire hole etc.	IMR
45° one Pair of probes Mounted in Test RIG (2MHz)	Rail head with scabs, wheel burn on top surface	Vulnerable Locations	Loss of signal height equal to or more than 20% Of full screen height	IMR
	Rail head with scabs, wheel burn on top surface in	Non- Vulnerable Locations	Loss of signal height equal to or more than 80%	IMR
	Rail head with scabs, wheel burn on top surface in	Non- Vulnerable Locations	Loss of signal height equal to or more than 20% but less than 80%	OBS
B.Weld (AT/FB) Defects (During Rail testing)				
0° (4MHz)	Weld Top to	Vulnerable Locations	No back echo with flaw echo, shifting or without shifting	IMRW

	Bottom	Non Vulnerable Locations	No back echo with flaw echo, shifting or without shifting	OBSW
70° Centre (2MHz)	Weld head	Vulnerable Locations	$H \geq 30\% \text{ \& } V \geq 20\%$	IMRW
		Non Vulnerable Locations	$H \geq 50\% \text{ \& } V \geq 60\%$	IMRW
			$30\% \leq H < 50\% \text{ \& } V \geq 20\%$	OBSW
			$H \geq 50\% \text{ \& } 20\% \leq V < 60\%$	
70° GF & NGF side (2MHz)		Vulnerable Locations	$H \geq 15\% \text{ \& } V \geq 20\%$	IMRW
		Non Vulnerable Locations	$H \geq 30\% \text{ \& } V \geq 60\%$	IMRW
			$15\% \leq H < 30\% \text{ \& } V \geq 20\%$	OBSW
			$H \geq 15\% \text{ \& } 20\% < V < 60\%$	OBSW

Classification of Defects detected during Hand Probing			
Note: (i) Check whether sensitivity setting is done as per S1 to S17 listed below.			
A. Tongue Rail and Stock Rail (Gap avoiding rail) Testing of SEJ			
Probe & Ref. of Sensitivity & Calibration Para	Location of Track	Oscillogram pattern	Classification
0° (4MHz)	Head, Web, web-foot junction and Bottom of the Stock rail / Tongue rail.	$V > 20\%$	IMR

45° Hand probe (2MHz)			Bottom of Stock Rail / Tongue Rail of SEJ			
70° Hand probe (2MHz)			Nose of Stock rail /Tongue rail of SEJ			
B.AT Weld Testing (Hand Probing)						
Probe & Ref. of Sensitivity & Calibration Para	Location of Defects	Initial Periodic Testing	Oscillogram pattern	Classification	Probe & Ref. of Sensitivity & CalibrationPara	
0° Hand probe (2MHz)	Weld head & In Web up to Neutral axis	Initial Testing	30% ≤ V from weld head region.		DFWN	
			20% ≤ V from web or foot location.			
		Periodic Testing	40% ≤ V ≤ 60% from weld head region.		DFWO	
			20% ≤ V ≤ 40% from the web or foot location.			
			V > 60% from weld head region		DFWR	
	Weld head	Initial Testing	V > 30% (Moving signal)		DFWN	
			V > 10% (A bunch of Moving signal)			
		Periodic Testing	40% ≤ V ≤ 60% (Moving signal)		DFWO	
			V > 60% (Moving signal)			
			A bunch of moving signal- V > 10%		DFWR	
70° Hand Probe (2 MHz)	Weld flange	Initial Testing	V > 30% (Moving signal)		DFWN	
		Periodic Testing	40% ≤ V ≤ 60% (Moving signal)		DFWO	
			V > 60% (Moving signal)		DFWR	

Pair of 70° side Looking (2 MHz)	Bottom of the weld foot	Initial Testing	V ≥ 20% from bottom of the weld foot	DFWN
		Periodic Testing	V ≥ 20% from bottom of the weld foot	DFWR
	Bottom of the weld foot	Initial Testing	V ≥ 20% from bottom of the weld foot	DFWN
45° Hand probe (2 MHz) 4		Periodic Testing	V ≥ 20% from bottom of the weld foot	DFWR
Pair of 45° (Tandem Rig) (2 MHz)	From Head Web junction to Web foot junction	Initial Testing	V ≥ 30% from weld head, web & foot region below web	DFWN
		Periodic Testing	V ≥ 40% from weld head, web & foot region below web	DFWR
C.FBW Testing (Hand Probing)				
Pair of 45° (T/R method) 2 MHz	Head of FBW	On vertical scale: Any flaw signal		Defective weld
70° Hand probe 2 MHz	Web and foot of FBW			

General Points to be checked by Inspecting Officials at Depot/Headquarter	
<ol style="list-style-type: none"> 1. Due Date of Check for above 2. Actual Date of Check for above 3. Whether various Characteristics of all the probes and machine are conforming to A1 to A6 as defined below 4. Whether Calibration of all the probes is conforming to C1 to C11 as defined below 5. Whether Sensitivity setting of all the probes is conforming to S1 to S17 as defined below 6. Whether Temperature Variation setting for all the probes is done as per schedule 7. Whether sufficient spares are available as per USFD manual/OEM. 	

Characteristic Checking (Assessment), Calibration, Sensitivity Setting			
Details of Characteristics Checking of Machine (Once in a Month)			
Sr No	Characteristic	Probe for testing (Freq.)	Permissible Limit (Digital M/C)
A1	Linearity of Time base	0° S/C (2 to 2.5 MHz)	± 1.25 %
A2	Linearity of Amplification		± 3 %
A3	Penetrative Power		5 Full & 6 th Echo should Appear on screen
A4	Resolution Power		On Set point should below 5 Div. (Half Screen)
A5	Probe Index		± 1 mm
A6	Beam Angle	70°, 45° and 37° S/C (2 MHz) Probe	± 1°

Details of Calibration (Once in a Week)				
Sr No	Type of Probe	Calibration Range	Calibration Done using	Verification Done using
A. Rail testing				
C1	0° (4MHz) D/C Probe	200/300 mm	100 mm height Calibration Block (100x60x50 mm)	Any Known Height Object
C2	70° F/B Probe (Central/GF/NGF)	165 mm	100 mm Radius Arc of IIW Block	25 mm Radius Arc of IIW Block
C3	37° 2 MHz F/B Probe	275 mm		
C4	45° S/C Probe Test Rig	165 mm		
B. AT Weld testing				
C5	0° D/C (2MHz) Probe	200 mm	100 mm height Calibration Block (100x60x50 mm)	Any Known Height Object

C6	70° S/C Probe	165 mm	IIW Block 100 mm Radius Arc	25 mm Radius Arc of IIW Block
C7	45° S/C Probe	275 mm		
C8	45° S/C Probe Tandem RIG	275 mm		
C9	70° Side Looking S/C Probe	165 mm		
C. FB Weld testing				
C10	45° S/C Probe	165 mm	IIW Block 100 mm Radius Arc	25 mm Radius Arc of IIW Block
C11	70° S/C Probe	165 mm		

Details of Sensitivity Setting (Once in a Three Days)					
SN	Type of Probe	Calibration Range	Sensitivity Setting		
			Done using	Done at	Sensitivity Set at (%)
A. Rail testing					
S1	0° D/C (4MHz) Probe	200/300 mm	Good Rail Bottom having no flaw	Peak reflected from bottom of rail	100 %
S2	70° F/B Probe (Central)	165 mm	Standard Test Piece of Rail	12 mm Ø Through Hole	60 %
S3	70° F/B Probe (GF/ NGF)	165 mm		05 mm Ø Flat Bottom Hole	60 %
S4	37° 2 MHz F/B Probe	275 mm	Standard Test Piece of Rail	5 mm Saw Cut in Bolt Hole at 53° Angle	60 %
S5	45° S/C Probe Test RIG	165 mm	Good Rail Head having no any flaw	Peak reflected from opposite face of Rail Head	100 %
B. Tongue Rail and Stock Rail (Gap avoiding rail) Testing of SEJ					

S6	0° D/C (4MHz) Probe	200 mm	Good Rail Bottom having no any flaw	Peak reflected from bottom of rail	60 %
S7	70° S/C Probe	165 mm	Standard Test Piece of SEJ S/R	05 mm Ø Through Hole in Head	60 %
S8	45° S/C Probe	275 mm		3mmx5mm Saw Cut in Flange Bottom	40 %
C. AT Weld testing					
S9	0° D/C (2MHz) Probe	200 mm	Standard Test Piece of AT Weld	03 mm Ø ThroughHole in WeldHead	60 %
S10	70° S/C Probe (Head Testing)	165 mm	Standard Test Piece of AT Weld	03 mm Ø Through Hole in Weld Head	60 %
S11	70° S/C Probe (Flange Testing)			03 mm Ø Through Hole in Weld Flange	
S12	70° Side Looking S/C Probe			Halfmoon Saw Cut (10 x 5 x 2 mm)	
S13	45° S/C Probe (Halfmoon Testing)	275 mm	Standard Test Piece of AT Weld	Halfmoon Saw Cut (10 x 5 x 2 mm)	60 %
S14	45° S/C Probe (Tandem RIG)		Good Rail having no any flaw	Peakreflected from bottom of rail	100 % + Extra 10 dB

D. FB Weld testing					
S16	45° S/C Probe	165 mm	Standard Test Piece of FB Weld	05 mm Ø Through Hole in Weld Head	60 %
S17	70° S/C Probe	165 mm		05 mm Ø Through Hole in the Web of Weld	60 %

Action to be taken after detection of defects			
Sr. No.	Classification	Painting on both faces of Rail	Interim action by SSE/JE (P.way)/USFD
1	IMR/IMRW	Three Cross with red paint (in web)	I) SSE/JE (P.way)/USFD shall impose speed restriction of 30 Kmph or stricter immediately and to be continued till flawed rail/weld is replaced.
2	OBS/OBSW	One Cross with red paint in web	I) SSE/JE (P.way)/USFD to advise sectional SSE/JE (P.way) within 24 Hrs about the flaw location. II) Keyman to watch during daily patrolling till it is joggled fish plated and joggle fish plate with clamped within three days.
3	DFWO	One Circle with red paint in head	I) SSE/JE (P.way)/USFD shall impose speed restriction of 30 Kmph or stricter immediately. II) Communicate to sectional SSE/JE about the flaw location, who shall ensure the following: - a. Protection of defective weld by joggled fish plates using minimum two tight clamps immediately with a speed restriction of 30Kmph. b. 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. c. The joint is to be kept under observation.

4	DFWR	Two Cross with red paint (in head)	<p>I) 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 will ensure the following: -</p> <ol style="list-style-type: none"> Protection of DFWR weld by joggled fish plates using minimum two tight clamps immediately. Speed Restriction 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, within 3 days. The DFWR weld shall be replaced within three months of detection. 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 100Kmph for passenger train should be imposed. <p>II) In case of defective weld (DFWO/DFWR) on major bridges & bridge approaches (100m either side) and in tunnel & on tunnel approaches (100m either side) and other Vulnerable locations following action will be taken: -</p> <ol style="list-style-type: none"> SSE/JE (P.way)/USFD shall impose speed restriction of Kmph or stricter immediately and to be continued till defective weld is replaced. He should communicate to sectional SSE/JE (P.way) about the flaw location who shall ensure the following: <ol style="list-style-type: none"> Protection of defective weld using clamped joggled fish plate within 24Hrs. The defective weld shall be replaced within 3days of detection.
5	DFWN		<p>The defective joints (DFWN) shall not be allowed to remain in service. It shall be cropped, re-welded and tested again. The re-welded joints shall be scanned ultrasonically again with the same set of acceptance criteria to ensure freedom from any harmful defects.</p>

Note: A Thermit welding done Insitu shall be joggled fish plate with two clamps and supported on wooden block of 300 to 50 mm length until tested as good by USFD.

Disclaimer: This Booklet at a glance easy to read and for ready information of USFD testing based on USFD Manual Revised-2012 (Upto ACS-06) and Rly. For complete and detailed information please refer USFD manual along with latest correction slips.