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Revision History

Rev	Date	Description of Change
0	February 12, 2024	For Approval



1. GENERAL

1.1. Scope

This Procedure covers the requirements for fabrication of Pump Testing Plan and accessories for "TORISHIMA PUMP MFG. CO.,LTD".

1.2. Reference

This procedure prepared in accordance with following reference:

- JIS Standards
- ASME Standards
- ASME Section II, Part A
- ASME Section II, Part C
- ASME Section V
- ASME Section VIII, Div. 1
- ASME Section IX
- ASTM Standards
- Fabrication Drawing (AFC)
- 1.3. Equipment of Supply

Scope of Equipment to be supply in accordance with following below :

No.	Item Name	Material Specification	Quantity
1.	Head Cover H Pump	SS 304	1
2.	150/65A Adaptor	SS 304	3
3.	Connection Pipe	SS 304	2
4.	Connection Pipe	SS 304	1
5.	Pressure Port Pipe	SS 304	1
6.	65A Elbow	SS 304	1
7.	150A Elbow	SS 304	1
8.	300/150A Adaptor	SS 304	1
9.	65A Adaptor	SS 304	2
10.	Test Tank	SS 304	1
11.	Column Pipe	SS 304	1
12.	Cover Flange	SS 304	1
13.	Heat Exchanger	SS 304	1





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2. INSPECTION AND TEST (FABRICATION)

Fabrication of the equipment's shall be carried out in accordance with the requirements prescribed in the reference par.1.1. and 1.2. (General).

- 2.1. Receiving Material Inspection
 - 2.1.1. Before receiving the material, the QC Dept must prepare a PO, BOM, as reference the inspection material.
 - 2.1.2. When the material arrives at shop QC inspector will be checked based on packing list.
 - 2.1.3. after unloading the material and put at laydown area, Inspection will done such as dimensional, quantity, visual, heat/lot no. and material specification.
 - 2.1.4. The identification all the material will be done for easy to traceability of material report.
 - 2.1.5. All item material receiving will compare to the purchase order, so that there are no deviations in the material receiving process. Result of Receiving Inspection Checklist Report will be created and distribute to other Department.
 - 2.1.6. If any reject, the material must be separated and marked.
- 2.2. Material Identification
 - 2.2.1. Material shall be checked that they are coincided with the designation. The identification of each material shall be visually and dimensional inspected with the mill test certificate/ certificates.
 - 2.2.2. During shop fabrication, in case that the mill marking is unavoidably cut out or the material is divided into two or more pieces, heat number, shall be properly stamped or marked on each piece of the material before cutting.
 - 2.2.3. PMI (Positive Material Identification) for Anchorage & Dissimilar metal welds shall be conducted before installation in accordance with approved Positive Material Identification Procedure.
- 2.3. Cutting and Edge Preparation
 - 2.3.1. Plates and other parts may be cut to shape and sized by mechanical means such as machining, grinding, or by plasma arc cutting. All slag and detrimental discoloration of material which has been molten shall be removed by grinding prior to further fabrication.
 - 2.3.2. Bevels of the butt weld connection, etc. are finished with plasma arc cutting, machining, grinding by stainless steel disc.
 - 2.3.3. Stainless Steel material, shall be cut by plasma arc cutting, and edge preparation shall use special grinding tool/ brushes used for Stainless Steel, and shall be segregated from Ferritic's inclusion.





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- 2.3.4. The plate shall be cut by thermal means and the contamination such as oxide scale, slag which would be adversely affected to the quality or strength of the weld shall be removed up to 2 mm to remove hard scale and HAZ.
- 2.3.5. Plate edge shall be closely inspected by visual, and shall free from cutting notch and lamination defect.
- 2.3.6. Uneven surface of plate edge shall be treated as follows.



Part	Size of notch	Treatment	Remarks
	(mm)		
Poot food	d <u><</u> 1, w <u><</u> 2	Smooth by grinder	
ROOLIACE	d > 1, w > 2	Weld repair and MT or PT	(*1)
Povol	d <u><</u> 1, w <u><</u> 2	Smooth by grinder	
Devel	d > 1, w > 2	Weld repair and MT or PT	(*1)

Note: (*1) Repair welds shall be performed by a qualified welder and approved Welding Procedure Specification (WPS).

2.4. Fit-Up

- 2.4.1. Prior to assembling / fit up, marking of each part, dimensions shall be checked with shop drawing.
- 2.4.2. The parts to be welded shall be cleaned out and free from scale, rust, oil and other deleterious foreign material for a distance of at least 13 mm from the welding joint preparation.
- 2.4.3. The following dimensional tolerances shall apply.
 - Offset in butt welding (Alignment tolerance: UW-33 of ASME Section VIII, Div. 1)



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Section Thickness	Joint Category			
(mm)	A	B, C & D		
T ≤ 13 mm	1⁄4 T	1⁄4 T		
Over 13 to 19, incl	3 mm	1⁄4 T		
Over 19 to 38, incl	3 mm	5 mm		
Over 38 to 51, incl	3 mm	1/8 T		
Over 51	Lesser of 1/16 T or 10 mm	Lesser of 1/8 T or 19 mm		

Where: T is Thickness

1. Root gap bevelled angle to be within the range specified on the approved WPS or Drawing, unless otherwise specified another Code/ Standard.

2.5. Dimensional

- 2.5.1. Shell Plate
 - The dimension inspection of shell plates shall be performed prior to bending. The dimensional tolerances of shell are as follows :

Measurement items	Tolerance (mm)
Width (AC, BD, EF)	± 3
Length (AB, CD)	± 3
Diagonal (AD-BC)	± 3



- To check the thickness of the plate at the six points on each plate after rolling process as shown below, using the micrometer or ultrasonic thickness meter.



Measuring Point

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- The curvature of shell plate shall be checked by a curvature gauge with the tank radius as shown below.

The deviation (C1, C2, E) of curvature on the inside surface of shell plate shall be 3mm and less.



- The shell of a completed stacks shall be substantially round and shall meet the following requirements:
 - a) The difference between the maximum and minimum inside diameters at any cross section shall not exceed 1% of the nominal diameter at the cross section under consideration.
 - b) When the cross section passes through an opening or within 1 I.D. of the opening measured from the centre of the opening, the permissible difference in inside diameters given above may be increased by 2% of the inside diameter of the opening. When the cross section passes through any other location normal to the axis of the vessel, including head-to-shell junctions, the difference in diameters shall not exceed 1%.



<u>Maximum ID – Minimum ID</u> x 100% ≤ 1% Nominal ID

- c) Straightness of the stacks shall be measured with piano string / wire / theodolite and shall not be greater of ±1.0 mm per 1000 mm of length.
- d) At the time of trial assembly, the stack shall be levelling by X and Y coordinate to within 2 in. (50 mm) in 100 ft (30 m) with using theodolite.
- e) Local dents in plates shall be no deeper than one-half the plate thickness.
- 2.5.2. Nozzle and manhole attached to shell plate.



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The dimensional tolerances of nozzle and manhole attached to shell plate are as follows:

Item	Measurement items	Tolerance (mm)
	Projection (C)	-0, +5
	Inclination of	± 0.5°
Nozzle	flange face to neck (D)	
	Location (H)	± 4
	and (L)	± 2
	Nominal Thickness	-0.125 mm
	Projection (C)	-0, +5
	Inclination of	± 1.0°
	flange face to neck (D)	
Manhole &	O.D of manhole neck (A)	<u>Amax-Amin</u> = 0.01A
Blind Cover	O.D of flange (B)	± 4
	Thickness of plate flange	-0, +3
	Location	± 5
	(H, L)	
	Nominal Thickness	-0.125 mm





2.5.3. Reinforcing pad for nozzle and manhole. The allowable tolerance of reinforcing pad is as follows :

Measurement items	Tolerance (mm)	
d1, d2	± 1.5	
D1, D2	± 3.0	







2.6. General Dimensional Tolerance.

This is General tolerance for Test Tank.









NOTES FOR FIGURE 1:

- 1. The tolerance on dimensions not specified herein or specifically shown on project drawings shall be \pm 1/4 inch.
- 2. Items not covered by Notes 16,17 and 18 which have been located on project drawings by elevation or by a dimension form a tangent or reference line shall be located form the reference plane, within a tolerance of \pm 1/4 inch.
- 3. The tolerance on orientation from the reference center line to the center line of a nozzle or manhole is \pm 1degree, except the circumferential measurement shall have a maximum tolerance of \pm 1 inch.
- 4. The tolerance on the distance from the face of a nozzle to the vessel surface is \pm 1/4 inch.
- 5. The tolerance on the distance from the inside vessel wall to downcomer support bars or weirs is shown on the tray manufacturer's tower attachment drawing.
- 6. The tolerance on the height of downcomer bolting bars above tray support rings is as shown on the tray manufacturer's tower attachment drawing.
- 7. The tolerance on the length of downcomer bolting bars is as shown on the tray manufacturer's tower attachment.
- 8. The tolerance on the alignment of a nozzle flange face with the indicated plane is ± 1degree in any direction
- 9. The tolerance on the distance from the face of a manhole flange to the vessel surface is $\pm \frac{1}{2}$ inch.
- 10. The maximum deviation of the actual circumference (as determined by strapping) from the nominal circumference is as shown in Column C, Table 1
- 11. The tray support rings shall be perpendicular to the longitudinal axis of the vessel within the limits given in Column B, Table 1. Dimensions shown in Table 1 represent total permissible out of level across diameter of vessel.
- 12. The top surface of tray support rings shall be perpendicular to the vessel shell within 1/16 inch in the width of the ring.
- 13. The top of weld-attached weir plates shall be perpendicular to the longitudinal axis of the vessel within the limits given in Column C, Table 1.
- 14. The tolerance on the distance between adjacent tray supports is \pm 1/8 inch.
- 15. The maximum deviation in the elevation between each adjoining clip, bracket, and similar structural attachment located in the same plane is \pm 1/8 inch. The tolerance on location from the tangent or reference line for each individual clip, bracket, or attachment is shown in Note 2.
- 16. The tolerance on the distance from the reference plane to support lug is +1/4 inch & -0.
- 17. The tolerance on the distance from the reference plane to the bottom of baseplate is +0, & -1/4 inch.





- 18. The tolerance on the distance from the reference plane to horizontal vessel support (saddle) is +1/4 inch, & -0.
- 19. The tolerance on the distance from the vessel surface to the bottom of horizontal vessel support saddles is +1/4 inch, & -0.
- 20. The reference plane shall be located 2 inches above the root land (face) in a vertical vessel bottom course and 2 inches from the root land in a horizontal vessel end course at the side from which dimensions are run. The plane shall be punch marked inside and outside at 0, 90, 180, 270 degree points. Punch marks shall be circled with paint.
- 21. The tolerance on the specified dimension between two nozzles, connections, or clip is $\pm 1/8$ inch.
- 22. The maximum deviation from a straight line perpendicular to the reference plane of any cylindrical element of the vessel shell (including cylindrical or similar supports extending beyond the shell of vertical vessels) shall be 1/8 inch for each 10 feet of length.
- 23. The tolerance on the distance from the face of a hillside shell nozzle to the vessel centerline is $\pm 1/4$ inch.
- 24. The tolerance on nozzle bolt hole orientation is $\pm 1/16$ inch measured at the bolt circle diameter.
- 25. The tolerance for external clip orientation and clip face alignment is as shown in Notes 3 and 8.
- 26. Bolt circle diameter and pitch between bolt holes, or distance between the bolt holes of support saddles:
 - a. Nominal I.D. ≤7 ft: ±1/8 inch
 - b. Nominal I.D. > 7 ft: ±1/4 inch

Flange face of bottom draw-off nozzles from the reference plane, $\pm 1/4$ inch.

Column/Tower		Tolerance, Inches	5
Diamter ft.	А	В	С
4 ft. & Less	3/8	1/8	1/8
4 ft. to 8 ft.	1/2	1/4	3/16
8ft. to 15ft.	1	5/16	1/4
Over 15ft.	1 1/2	3/8	5/16



- 2.7. Welding.
 - 2.7.1. Welding Qualification Test.
 - Welding Procedure Specification (WPS).

The welding procedure specification shall be supported by the records of Procedure Qualification Record (PQR) as required by ASME Sec. IX. WPS/ PQR shall be Endorsement and approved by the Purchaser prior to commencement of production welding.

- Welding procedure specification shall be carried out in accordance with WPS/PQR & Welding & NDE Map.
- Welder Performance Qualification Testing (WPQT).
- The welders and welding operators shall be carried out in accordance with Welder List & Certificates.
- a). The welders and welding operators who weld pressure parts and join non pressure parts, such as all permanent and temporary clips and lugs, to pressure parts shall be qualified in accordance with ASME Sec. IX.
- b). If a new qualification test for welders is to be taken, the welder performance qualification test shall be performed in accordance with ASME Sec. IX.
- c). Welders shall be initially qualified by Radiography Test.
- 2.7.2. Welding Process
 - Gas Tungsten Arc Welding (GTAW).
 - Shield Metal Arc Welding (SMAW).
- 2.7.3. Preparation of Welding.

The surfaces of the parts to be welded shall be clean free from scale, rust, oil, grease and deleterious foreign material for a distance of at least 13mm for the welding joint preparation for ferrous materials and at least 51mm for non-ferrous materials.

- The welding shall be done by qualified welders.
- a. The welding shall be carried out in "FLAT" position as far as possible and the welding sequence shall be established in order to minimize residual stresses.
- b. Usually, tack weld is applied to prepare edge for welding using the same welding materials as main welding and the same WPS, and they shall be removed by arc gouging and / or grinding so that they are not merged into the actual weld.

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- c. Detail welding procedure shall be in accordance with WPS & PQR approved by purchaser.
- d. During shop fabrication, identification for welding process shall be properly record or marked on each piece of the material before welding.

2.7.4. During of Welding.

When process welding, the QC Inspection shall check of welder activities, that is as follows :

- The wire welding rod according specification or WPS.
- The welding area is shall be clean and free form mill scale, dust, cutting notch or other foreign material.
- Welding material shall be kept on the hand dryer or portable dryer.
- Travel speed of welding, voltage, ampere and pre-heat temperature must be kept according procedure.
- Making weld identification joint for traceability of welding such as : joint no, ID welder, WPS No., and weld process.
- Making welding record.

2.7.5. After Welding.

This is inspection after all welding activity completed, the Inspector having responsibility among them are as follows :

- Final visual welding inspection will be carry out for each welding joint refer to para 2.7 Visual.
- All surface of welding area shall clean and free from defect welding such as : spatter, crack, undercut, slag, irregular weld, etc.
- Check of deformation after weld.
- The welding data to be record each welding joint.
- Final visual examination report inspection refer to attachment-IV

2.7.6. Connections

- All The inner corners of the nozzle shall be rounded off to remove sharp corners.



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- Openings for connections shall not pass-through main seams as far as possible. When unavoidable, the portion of the welded seam that is covered by reinforcing pad shall be ground smooth with the surface of the shell plate, and liquid penetrant and 10% radiographic examination shall be made prior to installation of the pad.
- 2.7.7. Welding and Removal of Temporary.
 - Temporary attachments such as jigs, bars, clamps, etc. are used to hold the roundness of edges to be welded. These welding shall be done by qualified welders using the same quality rods as main welding and qualified welding procedure.
 - Arc strikes on the pressure components shall be avoided. When they occur, the surface shall be ground smooth and examined by PT and the minimum design thickness shall not be violated
 - Temporary weld, removal jig, and load fillet welding shall be removed by thermal cutting and grinding surface ground shall be subjected to liquid penetrant examination.
- 2.7.8. Repair of Defects.
 - Unacceptable defect such as cracks, porosity's, incomplete fusion and other defects shall be removed by gouging and / or grinding.
 - After Removing the defects, the part shall be examined by liquid penetrant examination (LPT) or MT. The area to be repaired shall be re-welded by qualified welder and using qualified WPS.
 - Repair of Welding shall be carried out in accordance with Weld Repair Procedure.

2.8. Visual.

2.8.1. Full length of welded joint shall be inspected visually, and limitation for imperfection and thickness of reinforcement, shall not exceed the following value:

-	Crack	: Not permitted, remove
-	Overlap	: Not permitted
-	Under cut	: Not Exceed 0.4 mm
-	Bead width non uniformity	: Not Exceed 5 mm
-	Bead height non uniformity	: Not Exceed 1.5 mm
-	Incomplete penetration or Lack of Fusion	: Not permitted



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-	Insufficient toe length of fillet weld	: Add weld
-	Crater	: Remove
-	Spatter	: Remove
-	Slag and porosity	: Non exposed
-	Fitting and welded spots for temp. Asst	: Remove
-	Fitting and welded spots for temp. Assy	: Remove

- Weld reinforcement shall be as following table (UW-35 of ASME Section

VIII, Div. 1).

Material Nominal	Max. Reinforcement	Thickness (mm)
Thickness (mm)	Category B & C Butt	Other Welds
	Joint	
2.4 to 4.8, incl.	3	1.5
Over 4.8 to 13, incl.	4	2.5
Over 13 to 25, incl.	5	2.5
Over 25 to 51, incl.	6	3

- Complete fusion and required penetration exist at the joint between the weld metal and the base metal.
- 2.8.2. Welds that failed to meet the visual inspection criteria given in item para 2.6.1, and will be re-inspection after repairs.
- 2.8.3. Welding on the structural miscellaneous and accessories steel.
 - Platform
 - Vertical Ladder
 - Handrail, etc.
- 2.8.4. Repair for welding shall be done before hydrostatic testing in accordance with the following.

- Any defects shall be removed by mechanical means or thermal gouging process.

- All defects in areas thicker than the minimum shall be feathered to at least a
- 1:4 taper. Minimum thickness shall be confirmed after grinding.





- The repair weld shall be visually examined.

- The gasket contact surface of the flange shall be visually checked to ensure cleanliness and is free from any surface defect.

- 2.9. Non Destructive Examination (NDE).
 - 2.9.1. NDE Sub-contractor.
 - N.D.E shall be done by subcontractor on the request of Vendor's QC Inspector.
 - N.D.E subcontractor shall provide the technical procedures and shall perform accordance with the approved NDE procedure and personnel by ASNT Level III.
 - 2.9.2. NDE Personnel.
 - N.D.E personnel who are performing the inspection shall be qualified by

possessing of actual certificates and those documents shall be produced to customer for approval.

- Residue from magnetic particle examination and penetrant developer from

liquid penetrant shall be removed from working surfaces of the vessel at pickling or prior to painting.

2.9.3. NDE Report.

N.D.T reports shall be prepared by the NDT sub-contractor and shall be reviewed and approved by Vendor's QC Inspector and Customer.

2.9.4. Radiographic Testing.

The extent of radiographic examination shall be in accordance with the approved drawing the method of radiographic examination shall be in accordance with ASME Section VIII Div.1 UW-52

- The radiographic examination shall cover a part of the main butt weld line

(category A & B). However, Intersection of the longitudinal and circumferential weld line shall be certainly radiographed.

- The acceptance criteria of welds examined by radiography shall be in accordance with ASME Section VIII Div.1 UW-52.

- Radiographic Testing 100% for but joint.



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2.9.5. Liquid Penetrant Testing.

Penetrant Testing shall be carried out ASME section V Art 6. Acceptance criteria: ASME Sect VIII Div.1 Appendix 8.

Scope: Penetrant Testing shall be performed as following area

- Back chip
- Welding of loaded parts
- Welding of Stainless steel
- Dissimilar material for stainless and carbon steel parts
- All final welding but joint for material stainless steel PT 100%
- 2.9.6. Magnetic Particle Testing.

Magnetic Particle Testing shall be carried out ASME Section V Art 7 Acceptance criteria: ASME Sect VIII Div.1 Appendix 6

Scope: MT shall be performed as following carbon steel area.

- Back chip
- Welding of loaded parts
- Final welding but joint for Carbon Steel MT 100%
- 2.9.7. Positive Material Identification.

PMI for Anchorage & Dissimilar weld metal shall be conducted before installation in accordance with client's specification requirements.

- 2.10. Pressure Test.
 - 2.9.1. Leaking Test (Soap Bubble Test)

Air Leak Test shall be applied for nozzle reinforcing pad with pressure 1.5 kg/ cm^2 , and than holding time around 10 until 15 minute. Acceptance criteria specified by the Owner.

2.9.2. Hydrostatic Testing

All pressure part shall hydrotest according design pressure of the part, for Test Tank and pipe will be testing with pressure 30,59Kg/Cm².

2.11. Pickling.

Surface of material stainless steel shall clean and shine and free from rust, paint mark and other foreign material. Process pickling shall refer to document procedure.

- 2.12. Bolt Tightening & Bolt Up.
 - 2.12.1. Tighten up using a minimum of 5 passes as follows:



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- Pass 1 Tighten bolts loosely by hand in the first instance, according to the cross-bolting pattern, then hand tighten evenly.
- Pass 2 Using a torque wrench, torque a maximum of 30% of the full torque first time around, according to the cross-bolting pattern. Check that the flanges is bearing uniformly on the gasket.
- Pass 3 Torque to a maximum of 60% of the full torque, according the crossbolting pattern.
- Pass 4 Torque to the full torque, according to the cross-bolting pattern.
- Pass 5 Final pass at full torque, in a clockwise direction on adjacent **fasteners.**
- 2.12.2. Examples of bolt tightening sequences are shown as below :



- 2.12.3. Bolt T tightening & Up shall be carried out in appropriate with client specification requirements of Bolt Tightening and Bolt Up.
- 2.13 Packing & Shipping

Packing & Shipping shall be carried out in accordance with Packing & Shipping Document.

3. INSPECTION AND TEST RECORDS

The results of inspection and test shall be properly recorded just after the inspection and test, the following inspection and test records shall be submitted to the purchaser after final inspection and test, in accordance with requisition and Approval MDR Index.

- 1) Receipt Inspection Checklist Report
- 2) Material Traceability Report
- 3) Dimensional Inspection Report
- 4) Visual Inspection Report
- 5) Welding Traceability & NDE Clearance Report





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- 6) Bubble Test Report
- 7) Packing & Shipping Inspection Report
- 8) Pressure Test Report
- 9) Bolt Tightening Report
- 10) Painting Report



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Attachment -1 Receipt Inspection Checklist Report.

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PUMP TEST PLANT



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Attachment-2 Material Traceability Report

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Attachment-3 Dimensional Inspection Report.

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Signature & Name				
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Attachment-4 Visual Examination Report

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Attachment-5 Welding Traceability & NDE Clearance Report.

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Attachment-6 Certification of Leak Test.



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Attachment-7 Packing Inspection Report.

PT. HANAZONO Engir We are always partner with y	neering Indonesia	PACK	ING INSPECTION REPORT		TORISHIMA PUMP MFG.CO.,LTD
Project :		Item Name		Report No.	
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Remarks : See photograph page 2 of 2					
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