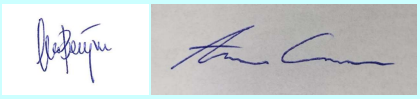
VOLVO

REVIEW OF TECHNICAL SPECIFICATIONS (RTS)

RFQ or DCN No :		RTS INITIATION DATE :	
Part Name(s)		Retarder VR3600	
Part Number(s). & Version(s)			B20 Status
Drawing Numbers(s). & Issue(s)			
Project(s)		P4680	

Supplier Name	Voith	
Supplier Parma Code		
Supplier Part Number(s)		
Supplier Representative (name)		**Phone:**
Supplier RTS Team (names)		
Volvo Design Engineer (name)	Anders Carmestedt / Jesper Bengtström	**Phone:**
Volvo Buyer (name)		**Phone:**
Volvo SQE Engineer (name)		**Phone:**

Required Signatures

Signature: Volvo Design Engineer (virtual signatures allowed) 	**Date** **2023-08-15**
Signature: Volvo Supplier Quality Engineer (virtual signatures allowed)	**Date**
Signature: Volvo Buyer/Purchasing (virtual signatures allowed)	**Date**
Signature: Supplier Representative (virtual signatures allowed)	**Date**

Note : By signing, we affirm that we have completed a thorough review of the Technical Specifications for this product, revision levels listed above, and have the ability to produce and deliver this product in accordance with the specifications, except as documented in the compliance matrix.

Additional Signatures

Name:	Title:	Date:
Kibler, Juergen Digital unterschrieben von Kibler, Juergen Datum: 2023.08.15 11:05:46 +02'00'	Lutz, Christoph Digital signiert von Lutz, Christoph Datum: 2023.08.16 08:17:14 +02'00'	

☐ RTS Signed — Signature Date : _____

☐ RTS Closed (all actions closed) — Closure Date : _____

VOLVO

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EXPLANATIONS ON HOW TO USE THIS RTS EXCEL FILE

The RTS process is described in detail in the GDI 966-04

PRELIMINARY NOTES :

1/ This RTS excel sheet should be used for :
- new components developed or modified within new projects,
- running changes made on components already in serial production (for quality changes, cost rationalisation changes, re-sourcing etc)
- for components from development suppliers and non-development suppliers

This is required for all components for Powertrain, only for criticality [1] components, key components and components from development suppliers for Volvo 3P.

2/ Multiple components from the same supplier can be covered in the same RTS file if the design and processes are very similar. In that case all the part numbers considered need to be mentioned both in the "Compliance Matrix" excel sheet and in the "Revisions Log" excel sheet.

3/ For some questions there is a difference made between development suppliers and non-development suppliers.
For development suppliers the drawings are developed by the supplier and specificed as such in Volvo documentation.
For non-development suppliers the drawings are developed by Volvo.

PURPOSE OF THE RTS :

The purpose of this document is to make sure the supplier understands early enough all the technical specifications of the component(s) supplied to Volvo and agrees on the feasibility of these specifications.
This document also targets to collect, document and react early enough to the suppliers recommendations, inputs and advices on these technical specifications.

The ultimate goals of the RTS process are to avoid :
- the need for late design changes especially after the tooling order and the PPAP order
- late cost increases or quality problems

caused by not understanding and / or meeting the component(s) technical specifications.
Volvo encourages the supplier to put effort into this task. We count on that a cross functional team from the supplier gives the input. Questioning and challenging of the specification will be disposed gratefully. The comments (which are listed in this document) will be handled and evaluated by Volvo Product Design.
If something in this document is not understood please ask the Volvo SQE or Buyer or Engineer (depending the question).

SUPPLIER RESPONSIBILITY :
1/ In respects to ISO9001:2008 and ISO /TS 16949§7.2.2 "Review of Requirements related to the Product",
the SUPPLIER is responsible for :
- organizing internal appropriate Design Reviews to analyse VOLVO Technical Specifications
- recording the results of the reviews in the RTS compliance matrix
- bringing it to the knowledge of VOLVO

When VOLVO Technical Specifications are changed, it is the SUPPLIER's Responsibility to conduct new Design Reviews and amend accordingly the RTS compliance matrix.

2/ By signing the RTS the supplier commits on :
- the manufacturing feasibility of the component(s) with the specificed conditions, tolerances, materials etc
- the feasibility of all the requirements included in the technical specifications (functionalities, testing requirements etc)

This feasibility commitment could be an assessment based on experience on similar products, the evidences of the achievement (capability assessment for tolerances, or durability for example) are not requested for the RTS signature.

HOW TO PRACTICALLY USE THIS FILE :

UNLESS OTHERWISE SPECIFIED IN THE FILE, THIS DOCUMENT SHOULD BE USED THE SAME WAY FOR ALL CASES (NEW COMPONENTS DEVELOPED WITHIN PROJECTS, FOR BOTH VOLVO AND SUPPLIER DEVELOPED DESIGNS, FOR RUNNING CHANGES ON COMPONENTS AFTER SOP, RESOURCING ETC)

I/ FOR NEW PARTS BEING DEVELOPED WITHIN PROJECTS :

1/ when receiving the RFQ documentation package, the supplier is expected to :
- list in the "Compliance Matrix" sheet all the documents of the technical specifications, mentioning the references and the issues of the documents to make sure the latest versions are considered. More help is provided in the "Compliance Matrix" sheet.
- analyze the different requirements of these documents, and the feasibility of these requirements
- for non development suppliers, study the component(s) design manufacturing feasibility
- fill in the excel sheet "Compliance Matrix" with the requirements answers.

If some requirements / questions are not understood this should be highlighted in the compliance matrix (column C & D), with a "GYR" (Green, Yellow, Red) status:
In Column C :
Put "G" if requirement / question is reviewed and fully understood
Put "Y" if requirement / question is reviewed but unclear and need further explanations.
Put "R" if the suppliers considers that some part of the technical specification is not existing, is very late or is of so poor quality that it cannot be used for a proper work.
In column D : describe what items need to be clarified and add any needed question or comment

If some requirements within the technical specifications are considered as not achievable this should be highlighted in the compliance matrix (column E to H) with a "GYR" status :
In Column E :
Put "G" if the requirement / question is reviewed and agreed, and considered achievable
"Y" if the requirement / question is reviewed but raises minor concern, it can be achieved but needs actions
"R" if requirement / question is reviewed but raises major concern, it cannot be met
In Column F explain what is the concern for the requirements that are not achievable

In Column G propose some actions to resolve the concern and in column H a responsible person for the action.

At this stage the supplier may also make some recommendations for improvements to Volvo ("compliance matrix" sheet section 12), and propose some actions. This should be done from the earliest design to avoid late changes.
The updated RTS excel file must then be sent back to the Volvo Buyer with the proposed quotation for the component(s). Internally in Volvo **the Buyer is responsible to collect the suppliers' answers and to communicate them internally to the Volvo SQE and the Volvo Design Engineer.**
The Volvo internal RTS status is then "RTS initiated"

VOLVO

REVIEW OF TECHNICAL SPECIFICATIONS (RTS)

EXPLANATIONS ON HOW TO USE THIS RTS EXCEL FILE

2/ After the supplier's selection, each time a significant change is made in the technical specification, the supplier has to :
- update the "Compliance Matrix" excel sheet
- update the "Revisions Log" excel sheet to keep track of the changes
- make sure the Volvo Buyer, SQE and Design Engineer receive the updated RTS excel file

If some concerns are raised, the supplier has to request a formal RTS review with Volvo (physically or via a phone conference) to share the concerns and agree on an action plan with Volvo.
The progress on the action plan should be reported in the columns I, J and K

3/ RTS FORMAL SIGNATURE

3-A/ FOR RTS FOR NEW PROJECTS DESIGNS :
Based on the C level design definition, and PRIOR TO THE TOOLING ORDER the RTS excel file has to be updated and signed.
The "Revisions log" sheet must be updated.
The "Compliance Matrix" sheet must be updated and must clearly show which documents issues are discussed (drawings, PVR etc).
The status for all the needed actions need to be updated and reported in the "compliance matrix sheet"
The needed conditions for the signature are :
- all requirements are fully understood by the supplier, only green status remaining ("G" in column C) in the "Compliance Matrix" sheet
- no more major concerns without action plan, all requirements have a green or a yellow status ("G" or "Y" in column E) in the "Compliance Matrix" sheet.
- all items have an action plan agreed between Volvo and the supplier and all actions are planned to be closed before the P release planned date, in the "Compliance Matrix" sheet.

Under these conditions the VOLVO SQE, Design engineer and Buyer can sign the RTS (sheet "Revisions Log"). The Buyer sends it back to the supplier for signature.
The supplier sends the RTS and returns it to the buyer.
As hilighted previously, by signing the RTS the supplier commits on :
- the manufacturing feasibility of the component(s) with the specified conditions, tolerances, materials etc
- the feasibility of all the requirements included in the technical specifications (functionalities, testing requirements etc)

This feasibility commitment could be an assessment based on experience on similar products, the evidences of the achievement (capability assessment for tolerances, or durability results for example) are not requested for the RTS signature.

The Volvo internal RTS status is then **"RTS signed".** This has to be achieved **prior to ANY tooling order.**

4/ When the P level design is ready, and PRIOR TO THE P RELEASE the RTS file must be closed.
The needed conditions for the closure are:
- the "Revisions Log" sheet must be updated.
- the "Compliance Matrix" sheet must be updated showing which documents issues are discussed (drawings, PVR etc). No more minor concern should remain
- the actions progress must be updated and reported in the "Compliance Matrix" sheet. At this stage all the actions should have a closed status.

The Volvo internal RTS status is then "RTS closed"

II / FOR RTS DONE FOR MODIFICATIONS ON EXISTING PARTS :

The supplier will be sent a new blank RTS excel file and (except for supplier re-sourcing) a copy of the previously completed RTS file. To complete the new RTS, the supplier should analyse the new technical specifications and fill in the whole document as described above

RTS Signature :
The RTS file has to be signed before the tooling order (if any tooling required for the modification) and before the PPAP.
The needed conditions for the signature are :
- no more major or minor concerns
- all the actions are closed

Storage of the completed RTS files :
Within Volvo the Design Engineer has to store a copy of the final RTS excel file, under Phoenix. The required storage duration is the lifetime of the part plus one year.
The supplier also has to keep a copy with his APQP documentation package. The supplier is required to include a copy of the RTS final document as part of the PPAP documentation to be submitted to Volvo.

VOLVO

REVIEW OF TECHNICAL SPECIFICATIONS, HW TR (RTS)

Compliance Matrix

Part Number(s):

		Requirements understanding		Requirements feasibility				Action plan tracking		
	Requirement / Topic	Are the requirements clear and understood ? **"Green / Yellow / Red " "GYR" status**	Enter here any needed comment If the requirement is not understood, describe what needs to be clarified	Are the requirements achievable ? **"Green / Yellow / Red " "GYR" status**	If the requirements are not achievable, describe what the concern is	Needed Action	Responsible	Comments and updates on the action plan	Due date	Status Open / Closed
	tips to fill in the form	- Put "G" if question reviewed and the requirements are understood - Put "Y" if question reviewed and the requirements are unclear and need further explanations - Put "R" is this part of the technical specification is not existing yet (late), or of so poor quality that it cannot be used for a proper work - Put "NA" for Not applicable if the requirement is not applicable		- Put "G" for "Green" if question reviewed and agreed, requirement achievable - Put "Y" for "Yellow" if question reviewed and raises minor concern, requirement can be achieved but needs actions - Put "R" for "Red" if question reviewed and raises major concern, requirement cannot me met						
A	**B**	**C**	**D**	**E**	**F**	**G**	**H**	**I**	**J**	**K**
0	**Function description**									
	Have you received : description how it is meant to be used, what it should be used for, if confidentiality needed etc..: where is that stated among the documents sent to supplier									
1	**PVR**									
	List below the PVR(s) - part numbers - for the component(s) considered in this RTS (includes TR)	G	2022-01-11, Jacobasch: information, no requirement. TR is provided by Volvo, checking the TR is sep. issue (here no actions from Voith side)	G			Martin (Voith)	2022-01-11, Jacobasch: information, no requirement. TR is provided by Volvo, checking the TR is sep. issue (here no actions from Voith side)		CLOSED
	TR 23006456	G	2022-01-11, Jacobasch: information, no requirement. TR is provided by Volvo, checking the TR is sep. issue (here no actions from Voith side)	G			Martin (Voith)	2022-01-11, Jacobasch: information, no requirement. TR is provided by Volvo, checking the TR is sep. issue (here no actions from Voith side)		CLOSED
2	**Drawings**									
	List below the component(s) drawings and the assembly drawings (references and issues). For each drawing, answer if the full content is : understood (column C & D) and achievable (column E to H) - that can include drawings, describing interface geometry (referential & specification to manage interface, eg assembly/ layout / installation drawings) - Purchasing contract must be a base for responsability split. development suppliers could receive assembly drawings from Volvo that need to be listed below too	G	2022-01-11, Jacobasch: to avoid missunderstanding, you need one drawing for the complete retarder, incl. MRCU --> no component drawing will be shared	G		2022-01-25: Anders: OK for Volvo to have a top level layout drawing with all necessary information and a spare part drawing.	Martin (Voith)	2022-01-11, Jacobasch: to avoid missunderstanding, you need one drawing for the complete retarder, incl. MRCU --> no component drawing will be shared 2022-01-25: Sascha Jacobasch: With feedback from Volvo, this is accepted.		
	Checklist of items to be reviewed on the drawings content. For each item answer if it's understood (column C & D) and achievable (column E to H)	G	2022-01-11, Jacobasch: no requirement, only information how to answer the RTS	G			Martin (Voith)	2022-01-11, Jacobasch: no requirement, only information how to answer the RTS		
	For development suppliers interfaces in the full environment (First Space Envelope, Packaging Module) provided by Volvo	G	2022-01-12, Jacobasch: has to be defined and aligned between Volvo/Voith during project	G		2022-01-25: Anders: All interfaces are not defined, to be done during the development. Comment is accepted from Volvo,	Martin (Voith)	2022-01-12, Jacobasch: has to be defined and aligned between Volvo/Voith during project 2022-01-25: Sascha Jacobasch: With feedback from Volvo, this is accepted.		

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Part Number(s):

		Requirements understanding		Requirements feasibility				Action plan tracking		
	Requirement / Topic	Are the requirements clear and understood ? **"Green / Yellow / Red " "GYR" status**	Enter here any needed comment If the requirement is not understood, describe what needs to be clarified	Are the requirements achievable ? **"Green / Yellow / Red " "GYR" status**	If the requirements are not achievable, describe what the concern is	Needed Action	Responsible	Comments and updates on the action plan	Due date	Status Open / Closed
	tips to fill in the form	- Put "G" if question reviewed and the requirements are understood - Put "Y" if question reviewed and the requirements are unclear and need further explanations - Put "R" is this part of the technical specification is not existing yet (late), or of so poor quality that it cannot be used for a proper work - Put "NA" for Not applicable if the requirement is not applicable		- Put "G" for "Green" if question reviewed and agreed, requirement achievable - Put "Y" for "Yellow" if question reviewed and raises minor concern, requirement can be achieved but needs actions - Put "R" for "Red" if question reviewed and raises major concern, requirement cannot me met						
A	**B**	**C**	**D**	**E**	**F**	**G**	**H**	**I**	**J**	**K**
	Datum systems that allow a robust measurement of the parts dimensions	G	2022-01-11, Jacobasch: context for drawing not clear --> if Volvo expect clear tracebility (PN etc.) on drawing okay, otherwise explain in detail what Volvo expect	G		2022-01-25: Anders: Ok to not have complete datum system. To be added on Volvo side after delivery.	Martin (Voith)	2022-01-11, Jacobasch: context for drawing not clear --> if Volvo expect clear tracebility (PN etc.) on drawing okay, otherwise explain in detail what Volvo expect 2022-01-25: Sascha Jacobasch: With feedback from Volvo, this is accepted.		
	General and geometric dimensions, tolerances, and notes on the drawings. Manufacturing feasibility commitment.	G		G			Martin (Voith)			
	Part marking requirements and location (for part number, branding, production traceability etc)	G	2022-01-12: only for Retarder (system) --> label has PN, SN and prodcution date (further information has to be defined and alligned togehter)	G		2022-01-25: Anders: E-marking and CO2-marking is required. Reference as for VR3250 marking plate. Branding required?	Martin (Voith)	2022-01-12: only for Retarder (system) --> label has PN, SN and prodcution date (further information has to be defined and alligned togehter) 2022-01-31: Sascha: Voith accept the req.		
3	**DSM (Digital Shape Model)**									
	List here the digital models describing the geometrical constraints on component(s). For each Digital Model, answer if the content is : understood (column C & D) and achievable (column E to H). If there are no Digital Models enter NA (non applicable) in column C	G	2022-01-11: please explain in detaild --> do you want outline dimensions of retarder (CAD)?	G		2022-01-25: Anders: This is the early space claim models we sent. Just as a confirmation that the boundaries are known.	Martin (Voith)	2022-01-11: please explain in detaild --> do you want outline dimensions of retarder (CAD)? 2022-01-25: Sascha Jacobasch: With the Volvo comment, this is accepted/clear.		
	Retarder	G	2022-01-11: please explain in detaild --> do you want outline dimensions of retarder (CAD)?	G		2022-01-25: Anders: CAD delivery and general technical meetings. CAD is according to Volvo definition.	Martin (Voith)	2022-01-11: please explain in detaild --> do you want outline dimensions of retarder (CAD)? 2022-01-25: Sascha Jacobasch: With the Volvo comment, this is accepted/clear.		
	Complete Retarder	G	2022-01-11: please explain in detaild --> do you want outline dimensions of retarder (CAD)?	G		2022-01-25: Anders: CAD delivery and general technical meetings. CAD is according to Volvo definition.	Martin (Voith)	2022-01-11: please explain in detaild --> do you want outline dimensions of retarder (CAD)? 2022-01-25: Sascha Jacobasch: With the Volvo comment, this is accepted/clear.		
4	**Standards**									

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A	**B**	**C**	**D**	**E**	**F**	**G**	**H**	**I**	**J**	**K**
	List here all standards and sub-standard (Volvo or international standards) that are applicable for the component. **For each standard, answer if the content is : available at supplier location and understood** (column C & D) and achievable (column E to H). - if no standard is applicable for the component, enter NA in column C	G	2022-01-11, Jacobasch: no requirement, only information	G			Martin (Voith)	2022-01-11, Jacobasch: no requirement, only information		CLOSED
	ISO 4039-2 Road vehicles – Pneumatic braking systems – Part 2: Pipes, male fittings and tapped holes with conical sealing surface:	G		G			Martin (Voith)			
	ISO 16750-3 Road vehicles – Environmental conditions and testing for electrical and electronic equipment. Part 3, Valid 2012	G		G			Martin (Voith)			
	STD 107-0002 Cleanliness of components and systems: Test methods: Contamination control: Issue 15, Valid 2019-10-28	G		G		2022-01-31: Anders: Can this be on part level only? Check internally how we do on similar systems. 2022-02-04: Anders: Check if Appendix B in the standard is applicable.	Martin (Voith)	2022-01-20, Martin: still checking 2022-01-31: Martin: How can this be verified? Parts will be cleaned, but full assembly and logistic add on risk of contamination.		
	Transmission oil according to: STD 1273,05 Issue 9, Valid 2016-3-01 STD 1273,07 Issue 8, Valid 2019-06-28 STD 1273,15 Issue 5, Valid 2019-06-28 STD 1273,18 Issue 4, Valid 2019-06-28	G		G		2022-01-31: Check if an oil list can be sent.	Martin (Voith)	2022-01-20, Martin: still checking 2022-01-31: Martin: List of approved/used oils in the transmission is required. These standards are not so relevant for the retarder. 2022-03-02: Anders: Transmission and Retarder production fill: Shell Spirax S6 GXME Ultra 75W-80 (Volvo std 97307) Transmission oil for hot markets: Shell Spirax S6 GXME Ultra 75W-90 (Volvo std 97315)		
	Test liquids according to: STD 420-0004 Issue 3, Valid 2020-01-09	G		G		2022-01-26: Anders: Shall be considered as spill, not completely drain or soaked in the liquids.	Martin (Voith)	2022-01-20, Martin: still checking 2022-01-31: Martin: Chemical reaction has to be checked during the project.		

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A	**B**	**C**	**D**	**E**	**F**	**G**	**H**	**I**	**J**	**K**
	Solvent according to: STD 1283,1 Issue 7, Valid 2005-07-11	G		G		2022-01-26: Anders: Shall be considered as spill, not completely drain or soaked in the liquids.	Martin (Voith)	2022-01-20, Martin: still checking 2022-01-31: Martin: Chemical reaction has to be checked during the project.		
	Diesel fuel according to: STD 420-0004 Issue 3, Valid 2020-01-09	G		G		2022-01-26: Anders: Shall be considered as spill, not completely drain or soaked in the liquids.	Martin (Voith)	2022-01-20, Martin: still checking 2022-01-31: Martin: Chemical reaction has to be checked during the project.		
	Engine oil according to: STD 420-0004 Issue 3, Valid 2020-01-09	G		G		2022-01-26: Anders: Shall be considered as spill, not completely drain or soaked in the liquids.	Martin (Voith)	2022-01-20, Martin: still checking 2022-01-31: Martin: Chemical reaction has to be checked during the project.		
	Text marking on parts: STD 5051,16 Issue 16, Valid 2016-10-01	G		G		2022-01-31: Anders: Is all this relevant to our product? AM impacts, commercial topic.	Martin (Voith)	2022-01-20, Martin: still checking 2022-01-20, Martin: Voith marking is not a requirement/show stopper.		
	Rubber, vulcanized: Determination of the effect of liquids ISO 1817 Issue 6, Valid 2015	G		G		2022-01-31: Anders: Can this be written as for new materials? All materials are already used in current retarder.	Martin (Voith)	2022-01-20, Martin: still checking 2022-01-31: Martin: Need to verify that the same process was used. No new materials will be used, all well tested.	2022-02-03: Anders: Mark that this is only applicable for new materials, not yet used in truck applications.	
	Chemical substances which must not be used within the Volvo Group. (Volvo´s black list) STD 100-0002 Issue 13, Valid 2019-03-15	G		G			Martin (Voith)	2022-01-20, Martin: still checking 2022-01-31: Accept		
	Pipe Bulge, Coolant Pipes TR 21576670 Issue 5, Valid 2021-09-20	G		G			Martin (Voith)	2022-01-20, Martin: still checking 2022-01-31: Accept		
	Quality of water to be used with coolant in diesel engines. STD 1285,1 Issue 3, Valid 2019-03-05	G		G		2022-01-31: Anders: Only for information.	Martin (Voith)	2022-01-20, Martin: still checking 2022-01-31: Accept		
	Chemical substances which must not be present in products within the Volvo Group. (Volvo´s red list) STD 100-0005 Issue 8, Valid 2019-10-03	G		G			Martin (Voith)	2022-01-20, Martin: still checking 2022-01-31: Accept		

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A	**B**	**C**	**D**	**E**	**F**	**G**	**H**	**I**	**J**	**K**
	General product requirements Reporting of substances and material composition to IMDS. STD 100-0006 Issue 6, Valid 2020-01-27	G		G			Martin (Voith)	2022-01-20, Martin: still checking 2022-01-31: Accept		
	Chemical substances which should not be present in processes or products within the Volvo Group. (Volvo's grey list) STD 100-0003 Issue 16, Valid 2019-03-14	G		G			Martin (Voith)	2022-01-20, Martin: still checking 2022-01-31: Accept		
	Environmental testing – Part 2-2: Tests – Test B: Dry heat. IEC 60068-2-2 Issue 5, Valid 2007-07	G		G	2022-03-01, Jacobasch: will be aligned in the testing overview MRCU (already provided to Volvo)		Martin (Voith)	2022-01-20, Martin: still checking 2022-01-31: Martin: Check with Wassermann 2022-02-08: must be aligned with MRCU tests 2022-03-07: Wssermann:Standard is OK, details to be agreed.		
	Environmental testing - Part 2: Tests. Test Db and guidance: Damp heat, cyclic (12 + 12-hour cycle). IEC 60068-2-30 Issue 3, Valid 2005-08	G		G	2022-03-01, Jacobasch: will be aligned in the testing overview MRCU (already provided to Volvo)		Martin (Voith)	2022-01-20, Martin: still checking 2022-01-31: Martin: Check with Wassermann 2022-02-08: must be aligned with MRCU tests 2022-03-07: Wssermann:Standard is OK, details to be agreed.		
	Environmental testing - Part 2: Tests. Tests A: Cold. IEC 60068-2-1 Issue 6, Valid 2007-03	G		G	2022-03-01, Jacobasch: will be aligned in the testing overview MRCU (already provided to Volvo)		Martin (Voith)	2022-01-20, Martin: still checking 2022-01-31: Martin: Check with Wassermann 2022-02-08: must be aligned with MRCU tests 2022-03-07: Wssermann:Standard is OK, details to be agreed.		
	Environmental testing - Part 2-14: Tests. Test N: Change of temperature. IEC 60068-2-14 Issue 6, Valid 2009-01	G		G	2022-03-01, Jacobasch: will be aligned in the testing overview MRCU (already provided to Volvo)		Martin (Voith)	2022-01-20, Martin: still checking 2022-01-31: Martin: Check with Wassermann 2022-02-08: must be aligned with MRCU tests 2022-03-07: Wssermann:Standard is OK, details to be agreed.		
	Corrosion test in artificial atmospheres - salt spray tests. STD 423-0010 Issue 1, Valid 2004-04-05	G		G			Martin (Voith)	2022-01-20, Martin: still checking 2022-01-31: Martin: Accept		

VOLVO

REVIEW OF TECHNICAL SPECIFICATIONS, HW TR (RTS)

Compliance Matrix

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	Road vehicles – Degrees of protection (IP-Code) – Protection of electrical equipment against foreign objects, water and access. ISO 20653 Issue 2, Valid 2013	G		G			Martin (Voith)	2022-01-20, Martin: still checking 2022-01-31: Martin: Check with Wassermann 2022-02-08: Wassermann: accepted for MRCU		
	Failure Mode and Effect Analysis, FMEA STD 105-0005 Issue 1, Valid 2009-05-18	G		G			Martin (Voith)	2022-01-20, Martin: still checking 2022-01-31: Martin: Accept		
	Geometrical product specifications (GPS) – Geometrical tolerancing – Tolerances of form, orientation and run-out ISO 1101 Issue 3, Valid 2017	G		G			Martin (Voith)	2022-01-20, Martin: still checking 2022-01-31. Martin. Accepted but more interesting at component level instead of assembly level		
	Geometrical product specifications (GPS) – Geometrical tolerancing – Datums and datum systems ISO 5459 Issue 1, Valid 2011-09-28	G		G			Martin (Voith)	2022-01-20, Martin: still checking 2022-01-31. Martin. Accepted but more interesting at component level instead of assembly level		
	Geometrical product specifications (GPS) – Geometrical tolerancing – Maximum material requirement (MMR), least material requirement (LMR) and reciprocity requirement (RPR) ISO 2692 Issue 3, Valid 2012	G		G			Martin (Voith)	2022-01-20, Martin: still checking 2022-01-31. Martin. Accepted but more interesting at component level instead of assembly level		
	Road vehicles – Functional safety ISO 26262 Issue 1, Valid 2011-11-15	G		G		2022-02-09: Anders: The new standard shall be applied.	Martin (Voith)	2022-01-20, Martin: still checking 2022-01-31. More related to electric compoments. Wassermann 2022-02-08, Wassermann: MRCU ASIL B, consider new standrad version (> 2018)? 2022-02-09: Sascha: New standard will be applied.		
	Generic identification and marking of plastics and elastomer components STD 103-0002 Issue 3, Valid 2009-03-06	G		G			Martin (Voith)	2022-01-20, Martin: still checking 2022-01-31. Martin. Accepted		
	Marking of aluminium parts STD 103-0010 Issue 4, Valid 2012-10-15	G		G			Martin (Voith)	2022-01-20, Martin: still checking 2022-01-31. Martin. Accepted		
	Compressed air ISO 8573-1 Issue 3, Valid 2010-04-15	G		G			Wassermann (Voith)			

VOLVO

REVIEW OF TECHNICAL SPECIFICATIONS, HW TR (RTS)

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	UN R155 – Cyber Security ISO 21434	G		G	2022-03-01, Wassermann: MRCU HW TC233 is used with integrated HSM --> details regarding CS has to be defined during proejct 2022-03-07: Anders: More information require from Volvo to define how this work shall be done 2022-03-10: Anders: Since the standard is accepted, Volvo can accept that the details will be defined during the development. 2022-03-15, Jacobasch: Volvo comment 2022-03-10 accepted	Transfer to MRCU TR	Wassermann (Voith)	2022-01-17, Wassermann: see H 2022-02-09: Sascha: Standard is accepted, details has to be agreed at later stage.		
B20	Cleanliness requirements, gearbox parts TR 24109805 Issue 2, Valid 2021-11-16	G	2023-04-18, JKib Standard is available	G		2023-04-21, Lutz: Gearbox oil cleanliness ISO4406: Can you please add the comment as you mentioned in your Email-feedback: "For delivery and what the gearbox filtering system can achieve, the ISO code is -/17/14 acc. To ISO 4406."				
B20	Gear data for ratio 1,9 TR 24570059 Issue 1, Valid 2023	G	2023-04-18, JKib not available yet.	G			Martin (Voith) Lutz(Voith)	2023-05-09: Anders Preliminary TR shared, release date w22.		
B20	Gear data for ratio 2,22 TR 24382431 Issue 1, Valid 2022	G	2023-04-25, JKib: Received by Volvo	G			Martin (Voith) Lutz(Voith)			

VOLVO

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5	**5-1 / Critical characteristics**									
	5-1 / special and Critical characteristics	G	2022-01-11, Jacobasch: no requirement, only information	G			Martin (Voith)	2022-01-11, Jacobasch: no requirement, only information		
	If the component(s) has some criticality requirements, list here all the criticality [1] , [2] and [3] characteristics or [SC] / [CC]. For each of these characteristics answer if it is : understood (column C & D) and achievable (column E to H)	G	2022-01-11, Jacobasch: no requirement, only information	G		2022-01-25: Anders: All characteristics will be on the outline drawing. OK with Volvo	Martin (Voith)	2022-01-11, Jacobasch: no requirement, only information		
	criticality [1] or [CC] characteristics	G	2022-01-11, Jacobasch: already defined	G			Martin (Voith)	2022-01-11, Jacobasch: already defined		
	Position of gear	G	2022-01-11, Jacobasch: already defined	G			Martin (Voith)	2022-01-11, Jacobasch: already defined		
	criticality [2] or [SC] characteristics	G	2022-01-11, Jacobasch: already defined	G			Martin (Voith)	2022-01-11, Jacobasch: already defined		
	positional diameter	G	2022-01-11, Jacobasch: already defined	G			Martin (Voith)	2022-01-11, Jacobasch: already defined		
	criticality [3] characteristics	G	2022-01-11, Jacobasch: already defined	G			Martin (Voith)	2022-01-11, Jacobasch: already defined		
	connection interface	G	2022-01-11, Jacobasch: already defined	G			Martin (Voith)	2022-01-11, Jacobasch: already defined		
	For development suppliers, check that a criticality analysis has been performed according to Volvo standard (105-0007) or equivalent (incl. S/D/P FMEA usage)	NA		NA				2022-01-20, Martin: still checking 2022-01-31. Martin: NA as not considered development suppliers		
	5-2/ Significant characteristics for regulatory compliance	G	2022-01-11, Jacobasch: no requirement, only information	G			Martin (Voith)	2022-01-11, Jacobasch: no requirement, only information		
	For Volvo Powertrain development suppliers : check that an emission analysis has been performed to identify the significant characteristics for regulatory compliance	G	2022-03-03: Anders: If there are components in the retarder with impact on drag loss and the emission certificate, they shall be marked with [3R]. This standard shall be marked on outline drawing and in the TR.	G			Martin (Voith)			
6	**TR - Technical Requirements**									
	List the TR document number(s) (references) applicable for the component(s). If no TR applicable for the component(s), enter NA (non applicable) in column C	G	2022-01-11, Jacobasch: no requirement, only information	G			Martin (Voith)	2022-01-11, Jacobasch: no requirement, only information		CLOSED
	4. Component and environment description									

VOLVO

REVIEW OF TECHNICAL SPECIFICATIONS, HW TR (RTS)

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	4.1 Component description Retarder is an additional brake supplementing the rest of the brake system in the vehicle. The component is mounted at the gearbox. The retarder is activated via a control lever in the cabin of the vehicle. The lever has positions for two or three different torque levels. There is also a position for automatic speed control and in some applications, there is a fifth position on the control lever as well. The oil retarder uses the hydrodynamic principle to deliver brake torque. Oil is introduced in a rotor and a stator by utilising a valve which is activated by air pressure. The rotor is engaged to the output shaft of the gearbox via a gear pair in order to increase the speed of the rotor and consequently improve the retarder performance at lower vehicle speeds. Depending on the activation pressure on the valve and retarder speed different amount of oil will be introduced in the rotor/stator package. Rotation of the rotor in the stator when the package is partly or totally filled with oil will create a brake torque. When this is the case, kinetic energy from the output shaft and by that propeller shaft and rear axles are transformed into heat. The heat resulting from retarder braking is transferred to the cooling system in the vehicle, via an oil-coolant heat exchanger	G	2022-01-11, Jacobasch: no requirement, only information	G			Martin (Voith)	2022-01-11, Jacobasch: no requirement, only information		CLOSED

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A	**B**	**C**	**D**	**E**	**F**	**G**	**H**	**I**	**J**	**K**
	4.2 Component description The retarder will be used with Volvo's AMT and electric PIE transmissions in truck and bus applications. Engine displacement varies from approximately 8 to 16 L, with drive torque levels between 1 400 Nm and up to 4 000+ Nm. Typical driving engine speeds are between 700 rpm and 1700 rpm, max engine brake speed of 2800 rpm. Lowest engine idle speed is 450 rpm. The speed on the retarder shaft will be from 0 to 5000 rpm. The electric motors vary between xxx Nm and xxx Nm. Typical driving speed are between xxx rpm and xxx rpm. The retarder will be exposed to severe conditions such as heat, vibrations, water, dust, salt, cleaning liquids, flying stones etc. Following list specifies which values of the parameters that the retarder shall be expected to work at: GCW: GCW19 – GCW200 Main volume at GCW40 – GCW65 Quality on coolant: Volvo standard Yearly usage (Vehicle): 25000 km/year < Usage < 450000 km/year 1200 h/year < Usage < 6600 h/year	G	2022-01-12, Jacobasch: please specify GCW and climate temperatures	G		2022-01-25: Anders: Not a requirement but more information about the truck using retarders.	Martin (Voith)	2022-01-12, Jacobasch: as confirmed in Aug. 2021 Voith guarantee 3.600 Nm (requirement 4.000+ Nm not confimred yet) 2022-01-20; Martin: braking torque aveilable from 200 - 5000 rpm. 2022-01-12, Jacobasch: With this comment, accepted.		
	5. Component and environment description The SUPPLIER should early in the project inform about missing information in the Technical Requirements that is important for the SUPPLIER component design.									
B20	**5.1 Cleanliness** **Gearbox interface** The gearbox interface shall not contaminate the gearbox oil. Cleanliness requirements in TR 24109805 shall be fulfilled. The constituent parts in contact with the transmission oil shall be tested. The gearbox oil cleanliness code is –/17/14 acc. To ISO 4406. For bearing life calculations, ISO 281 can be used with this code. See ISO 281:2007, Annex A, page 35 - Figure A.3: "eC factor for circulating oil lubrication with on-line filters – β 25(c) W 75 **Cooling system interface** The entire interior of the retarder i.e. from coolant inlet to coolant outlet shall have cleanliness according to Table 3 which is according to Volvo standard STD 107-0002. Particle sizes [µm]: 5 / 15 / 100 / 500* / 1000* Max number of particles/cm2, Nc/Ac: 6 000 / 390 / 3 / 0 / 0 Wetted surface, Ac [cm2]: 11000 Extraction fluid [cm3]: 20 000 (55000 according to thumb rule 5 ml/cm2 but limited to 20 000 due to practical reasons) Extraction method: Pressure rinse **Table 3** *Soft fibers excluded.	G		G	2023-04-18, JKib Standard is agreed for t/m interface components. For coolant interface components (HE, Bracket) still to be discussed!			2023-07-04: Anders: The requirement has been updatd with an alternative measurement based on weight. 2023-05-10: Anders: A different process can be used from the standard, if required. 2023-05-09: Anders: Can a different process be applied, not pressurized rinse. Other alternatives allowed in the standard, can they be applied? --> Check with cooling system.		

VOLVO

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<tr><th></th><th></th><th colspan="2">Requirements understanding</th><th colspan="4">Requirements feasibility</th><th colspan="3">Action plan tracking</th></tr>
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<tr><td>B20</td><td>The gearbox interface shall not contaminate the gearbox oil. Cleanliness requirements in TR 24109805 shall be fulfilled.</td><td>G</td><td></td><td>G</td><td></td><td></td><td>Martin (Voith)</td><td>2023-04-25: Anders: Connected to transportation and emballment.
2023-04-18: Anders: Changed number for TR, updated in the HW TR.</td><td></td><td></td></tr>
<tr><td></td><td>5.2 Environmental requirements</td><td></td><td></td><td></td><td></td><td></td><td></td><td></td><td></td><td></td></tr>
<tr><td>B20</td><td>5.2.1 Vibrations
The retarder must withstand the vibration environment of the installation in the trucks/busses.
The retarder shall sustain the vibrations according to international standards related to automotive business, ref. [2] STD ISO 16750-3 chapter (4.1.2.6) both sinusoidal and random test. For test requirements see chapter "Verification testing".
The retarder must withstand the vibrations stated in ER-684597 for the engine vibration loads.
ADDITIONAL MEASUREMENTS WILL BE PERFORMED DURING THE DEVELOPMENT FOR OTHER VEHICLES

The retarder must withstand the road dependent vibration loads according to below table:
<table><tr><th></th><th></th><th>COMMON LOADS</th><th>VEHICLE ROAD LOADS</th></tr><tr><td rowspan="3">MAXIMUM LOADS 1000 cycles of 1 s</td><td>Longitudinal (x)</td><td rowspan="3">Bolt Tension, – 1g vertical, thermal +20 °C</td><td>± 6g longitudinal</td></tr><tr><td>Lateral (y)</td><td>± 8g lateral</td></tr><tr><td>Vertical (z)</td><td>± 5.5g vertical</td></tr><tr><td rowspan="3">FATIGUE LOADS 5 million cycles of 1 s</td><td>Longitudinal (x)</td><td rowspan="3">Bolt Tension, – 1g vertical, thermal +100 °C</td><td>± 2g longitudinal</td></tr><tr><td>Lateral (y)</td><td>± 1g lateral</td></tr><tr><td>Vertical (z)</td><td>± 2g vertical</td></tr></table>Table 4: Road loads

The retarder must withstand torsional vibration according to:
RESULTS FROM VEHICLE TEST PERFORMED DURING DEVELOPMENT.</td><td>G</td><td></td><td>G</td><td></td><td>2023-04-24, Lutz:
As commented by Anders --> vehicle vibration/ acceleration measurements relevant for requirement finalization

2023-04-14: Anders: Discussion from Load book meetings, several test are yet to be performed to finalize the requirement.</td><td>Martin (Voith)</td><td></td><td></td><td></td></tr>
</table>

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	5.2.2 Surrounding temperatures The surrounding temperatures may be in the range from -40 ºC to 120 ºC (in areas close to exhaust pipes or other hot components). The retarder with all its components shall be able to withstand temperatures stated below without lack of function according to component specification or getting damaged. Min: -40 ºC Max: 120 ºC	G		G		2022-01-26: Anders: Temperature may be an issue for the air connector commonly used at Volvo (Raufoss). Further measurements required, to get exact temperatures. Check old ER-reports for temperature on the AMT. The low temepratures can be an issue for electrical trucks, where the retarder is separated from the ordinary cooling system. The oil viscosity is critical for the retarder use in cold temperatures. 2022-03-04: Change to 120 C.	Martin (Voith)	2022-01-20, Martin: -40°C without function; starting at -20°C limited function has to be checked and realised by Volvo 2022-02-04: Anders: Clarify in the TR at what temperatures inside the retarder, the retarder is full functional. 2022-02-08, Wassermann: lower max environment temperature to < 120°C		
	5.2.3 Chemicals The outside of the retarder may be subjected to the liquids listed below and this shall not cause any damage at the retarder. The effect of the liquids shall be tested acc.to ISO 1817. The chemicals standards are stated in section 1.1 and the related substances are following. • Transmission oil, see [4] in section 3.1 • Test liquids acc to [5] in section 3.1 • Solvent acc to [6] in section 3.1 • Washer fluid • Diesel fuel acc to [8] in section 3.1 • Engine oil [9] in section 3.1 • UREA (AD blue)	G		G		2022-01-26: Anders: Shall be considered as spill, not completely drain or soaked in the liquids. 2022-02-15: Anders: Part of verification.	Martin (Voith)	2022-01-20: Martin: Volvo has to check during the development	**B1-sample testing, exact time to be scheduled. Volume to be defined in the test.**	

VOLVO

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B20	5.2.4 **Noise** Noise pressure level: The retarder noise shall be measured according to ISO 3747:2010 at the supplier. The result shall be shared with Volvo for further assessment on vehicle level.] Strange-sounds, noise: Tonal noise shall be non-prominent. Twittering noise or other unusual sounds are not allowed. Surge noise shall be judged minor. Any observation of rough mechanical noise shall be judged and reported.	G		G		2023-04-14: Anders: Voith measurements are performed close to ISO standard. Results to be discussed between experts at both sides.	Martin (Voith)	2023-07-04: Anders: Test is running with input from Volvo. 2023-06-01: Anders: Additional measurements requested by Volvo for different speeds. 2023-05-16: Anders: ISO 9614-2 was applied and not ISO 3747:2010. Too much background noise.		
	6. Component and environment description									
B20	6.1.2 Chemicals in supply air The retarder is supplied with compressed air from the air supply system installed on the vehicle. The compressed air is routed through an air filter and an air dryer that is normally integrated in the air supply system. The retarder system shall have no problems when, the pressurized air supplied for the retarder unit contain liquids as: Water Engine oil < 50 mg/m³ Antifreeze liquid < 50 mg/m³: - Ethanol - Methyl-ethyl-ketone (additive, < 3 %) - Methyl-isobutyl-ketone (additive, < 3 %) Water in liquid phase is not allowed and the dew point of the supply air used for operation of the device must be at least 17°C lower than lowest ambient temperature at atmospheric pressure level.	G		G	Must be clarified with Mr. Christian Schneider	2023-05-10: Anders: Chapter updated according to comments. 2022-01-26: Anders: Can volumes be added to the liquids? 2022-04-06: Anders: Remove "Water", add volume for anti-freeze. 2022-05-17: Miguel: List for chemical testing shared by Mirco. Check if it is also applicable for HW TR. Volvo reviewing internally the data with material expert.	Juergen Kibler	**SchneiC, 2022-05-18:** **Water** -> 8573-1: 2010, class 2. Engine oil < 50 mg/m³ -> According to ISO 8573, Class 3 or better Antifreeze liquid < 50 mg/m³: - Ethanol - Methyl-ethyl-ketone (additive, < 3 %) - Methyl-isobutyl-ketone (additive, < 3 %) -> Only antifreeze fluids based on Ethanol, Isopropanol and Glycol are accepted. Water in liquid phase is not allowed and the dew point of the supply air used for operation of the device must be at least 17°C lower than lowest ambient temperature at atmospheric pressure level. -> The pressure dew point of supplied pressurized air and the included water (solid, fluid or gaseous) for operating the retarder (nominal system pressure) see ISO ISO 8573-1: 2010, class 2. Compressed air quality: - Filtered to 50 µm - Maximum 20000 particles/m3 -> The proportion of firm contamination (particles) in		

VOLVO

REVIEW OF TECHNICAL SPECIFICATIONS, HW TR (RTS)

Compliance Matrix

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A	B	C	D	E	F	G	H	I	J	K
	Compressed air quality: - Filtered to 50 µm - Maximum 20000 particles/m3 - Oil content (aerosol, liquid and vapor) max 1 mg/m3 (According to ISO 8573, Class 3 or better)							pressurized air may have a max. size of 40 µm and the concentration may not exceed 10 mg/m³. See also ISO 8573-1: 2010, class 7. - Oil content (aerosol, liquid and vapor) max 1 mg/m3 (According to ISO 8573, Class 3 or better) --> okay		
	6.1.3 Pressure The retarder system shall have no problems, handling supply pressure acc.to values below: Max supply pressure: 12,0 bar (in case of fault on the pressure limiting valve) Nominal supply pressure, brake system: 7,5-8,5 bar (during normal working conditions). Min supply pressure: 5 bar (in case of pressure drop, reduced max. torque)	G		G			Wassermann (Voith)	2022-01-17: accepted		
	6.1.4 Air consumption To set a braking torque from the retarder a corresponding amount of pressurized air is either let into (increase torque) or exhausted from (decrease torque) the retarder. The maximum consumption of pressurized air is described in the table below. **Braking torque (Nm) / Control pressure (bar) / Supply pressure (bar) / Air consumption** 0 => 3500 Nm (0 <= 100%) / Minimum 6 bars, Standard 10 bars / 8,3±0,2 bar / ~20 ltl **3500 Nm (continuous)** / Minimum 6 bars, Standard 10 bars / 8,3±0,2 bar / ~0 ltl/min **Table 4**	G		G	Must be clarified with Mr. Christian Schneider	2022-02-09: Anders: Requirement to be adjusted to new values for MRCU. 20 litres at full activation and some leakage for continuos torque. Value to be added from Voith.	Wassermann (Voith)	2022-02-08, Wassermann: air consumption at activation of the retarder depends on the final oil sump volume (values are not correct). In steady air pressure state the MRCU is designed to have no air consumption. The real air consumtion depends on the brake requests. Estimation: - acitivation to max torque: ~15-20 Nl		

VOLVO

REVIEW OF TECHNICAL SPECIFICATIONS, HW TR (RTS)

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A	**B**	**C**	**D**	**E**	**F**	**G**	**H**	**I**	**J**	**K**
B20	**6.1.4 Leakage** The below specified leakage limits are valid for a supply pressure of 8.5 Bar on the MRCU air supply. **Temperature range / New / Used (> 500km) / After lifetime** -40°C ... -31°C / 500.0 Nl/h / 1000.0 Nl/h / 1000.0 Nl/h -30°C ... -21°C / 15.0 Nl/h / 30.0 Nl/h / 30.0 Nl/h -20°C ... +110°C / 10.0 Nl/h / 15.0 Nl/h / 15.0 Nl/h +111°C ... +125°C / 1.0 Nl/h / 3.0 Nl/h / 5.0 Nl/h During the development with D-FMEA, the exact values of oil leakage shall be defined: - The oil leakage from the retarder into the gearbox shall not exceed xxx ml over a full retarder life cycle according to chapter 11.2. - There shall be no oil leakage from the retarder into the cooling system. - The total oil leakage from the retarder and heat exchanger shall not exceed xxx ml over a full retarder life cycle according to chapter 11.2.	Y		Y	Test to be defined?	2023-04-14: Anders: Hard to define a test how to verify leakage. Values to be added and a test method has to be aligned.	Dieter Laukemann	2023-07-04: Anders: Test specified in theory but it needs to be calibrated in the rig. 2023-05-09: Anders: Indication spray test acceptable for leakage test? 2023-05-16: Anders: Proposal from Voith on a stadard test with a paper on the ventilation. Details to be shared.		
	7. Component and environment description The coolant used in the retarder will be a mixture of concentrated coolant and water. The water in the coolant system can be expected to meet the requirements of the Volvo standard STD 1285,1. The coolant pipes shall follow the standard dimensions according to TR 21576670. The retarder system shall include a quick connector for drainage of the complete cooling system.									
	7.1.1 Coolant chemicals The mixture of water and concentrated coolant will contain concentrated coolant between the levels below. (% means percentage of total volume). The retarder system shall have no problems in between these two levels of concentrated coolant. Min: 40% Max: 60%. The concentrated coolant will consist of glycol, corrosion inhibitors and additives. • The base of the concentrated coolant will be Mono Ethylene Glycol (MEG). • The inhibitor system is based on Organic Acid Technology (OAT), which is a system using salt of organic acids as corrosion inhibitors. • Colouring is obtained by adding fluorescents that is 95% pure.	G		G			Martin (Voith)			

VOLVO

REVIEW OF TECHNICAL SPECIFICATIONS, HW TR (RTS)

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A	**B**	**C**	**D**	**E**	**F**	**G**	**H**	**I**	**J**	**K**
B20	7.1.2 Temperatures The temperatures of coolant at inlet and outlet of the retarder are shown in Table 5. These temperatures shall not cause any damage or problems for the retarder installation Table 5 The retarder has a ramp-down based on the coolant temperature on the return flow from the heat exchanger that starts at xxx C. The retarder torque shall be reduced to switched-off mode, when the temperature after the heat exchanger is 115°C. The target temperatures and overshoot temperatures are different depending on installation according to Table 6 below.	G		G		2023-04-14: Anders: Voith to add value for ramp-down temperature.	Martin (Voith)	2023-05-10: Anders: 100 C has been added according to information from Steffen Siegl. 2023-05-16: Anders: Details to be calibrated during the development.		

	Coolant inlet temperatures [°C]	Coolant outlet temperatures [°C]
Coolant temperatures at retarder.	-40 °C ≤ T ≤ 113 °C Under extreme conditions. TTT+1 °C possible	-40 °C ≤ T ≤ 115 °C 110 °C ≤ T ≤ 115 °C => limited to 5 s TTT: 110-113 °C
Temperatures shortly after engine start.	T ≤ 80 °C	
Temperatures during driving.	80 °C ≤ T ≤ TTT+1 °C T=TTT+1 °C => Severe driving conditions.	
Allowed coolant temperatures according to component specification.	-40 °C ≤ T ≤ 125 °C	-40 °C ≤ T ≤ 125 °C

Engine type (Exhaust legislation)	Target temperature for coolant output	Max coolant output temperature over shoot	Max duration of the temperature over shoot
Euro 6	+130-113 °C	+118 °C	5 s

VOLVO

REVIEW OF TECHNICAL SPECIFICATIONS, HW TR (RTS)

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A	B	C	D	E	F	G	H	I	J	K
B20	**The retarder shall not take any damage from gearbox oil temperatures according to below specified temperatures.** Transmission oil 97307 and 97318: Continuous working temperature of 90°C. Up to 15 % of total driving time at temperatures between 100-110°C. Up to 1% of total driving time at temperatures between 110-120°C. Maximum allowed peak temperature of 120°C. Transmission oil 97315: Continuous working temperature of 100°C. Up to 15 % of total driving time at temperatures between 110-120°C. Up to 1% of total driving time at temperatures between 120-130°C.	G	Oil standards 97…. ?					2023-05-10: Anders: 97307 is the internal Volvo transmission oil standard for tempered markets, most of these oils are retarder Type-C. 97318 is similar to 97307 but with longer change intervals. 97315 is similar standard, but for hot market, not Type-C classified. 2023-05-16: Anders: Endurance tests for B20 can be run with higher temperatures according to hot market. CFD can maybe be used to calculate the impact on shaft sealing? Function test to be performed to measure sealing temperatures.		
	7.2 Retarder cooling performance									
B20	**7.2.1 Pressure** **The retarder shall withstand a pressure at coolant inlet of maximum 3,5 bar relative pressure (over pressure).**	G		G		2022-01-27: Anders: Check internally for the cooling system, if we may have an increase in future installations. For BEV, the maximum pressure at the pump is 2,9 Bar. 2023-04-14: Anders: Pressure changed from 4 Bar to 3,5 Bar.	Martin (Voith)	2022-01-20, Martin: please check 4bar at H/E pressure currently at VR3250 is lower (~2 bar) 2022-02-15: Martin: In general, this requirement is not an issue but 4 Bar is not possible. It would require a new qualification. 2022-04-25, Kibler: Acc. To S.Jacobasch there is a committment from Volvo-side for 2,9 bar...? 2022-05-17: Miguel: Worst case is HDEP engines. Consider 4,25 bar. Load collective for pressure distribution within the cooling system to be share for HE validation. 2022-06-07, Kibler: Information shared with subsupplier. Ok B-sample. 2022-06-07: Miguel: Update TR with updated graphics		
						2022-01-27: Anders: Maybe required to have two curves, one optimized for BEV		2023-05-23: Anders: Voith to check internally. The question is how to implement the low power variant. With SW versions etc.	**B1-sample testing, exact time to be scheduled. Flow to**	

VOLVO

REVIEW OF TECHNICAL SPECIFICATIONS, HW TR (RTS)

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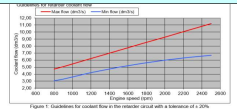
A	B	C	D	E	F	G	H	I	J	K
B20	 Figure 7: Guidelines for coolant flow in the retarder circuit with a tolerance of ± 20%	G		G		BEV: 2022-03-03: Anders: New curves shall be created during the devlopment. One for 500kW (or 450 kW) and one for 300 kW. 2022-03-04: Anders: Need to be defined after measurements. 2023-04-14: Anders: Varint for 300 kW added, details to be defined during the development for electric drivelines and possibly also 8L installations.	Martin (Voith)	2022-03-09, Jacobasch, Volvo Comment 2022-03-04 can be accept by Voith 2022-01-20,Martin: should be possible but has to be confirmed with final design of H/E bracket	**be defined from the test.**	
B20	**7.2.3 Tightness** The retarder heat exchanger circuits must be checked both from mechanical durability and leakage point of view. In some retarder heat exchangers, there is a transmission oil circuit additional to the retarder oil circuit and the coolant circuit. The coolers shall be tested by the supplier according to Table 7. Table 7	G	2022-01-20, Martin: gearbox cooling not included pressure coolant circuit test pressure 4,0 bar needs to be check - currently = 3,2 bar	G		2022-01-27: Anders: Review the requirement. 2023-04-14: Anders: Requirement updated with new values.	Martin (Voith)	2022-11-24: Anders: New simulation for electric HT circuit, pressure at retarder inlet is 3,5 Bar(A). 2022-01-20, Martin: gearbox cooling not included 2022-05-17: Miguel: Worst case is HDEP engines. Consider 4,25 bar. Load collective for pressure distribution within the cooling system to be share for HE validation pressure coolant circuit test pressure 4,0 bar needs to be check - currently = 3,2 bar 2022-04-21, Kibler: @A.Martin - what is check pressure at HE-supplier? 2022-06-07, Kibler: Information shared with subsupplier. Ok B-sample.	**2022-05-04**	

VOLVO

REVIEW OF TECHNICAL SPECIFICATIONS, HW TR (RTS)

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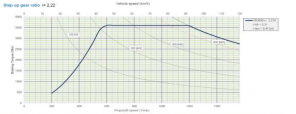
A	**B**	**C**	**D**	**E**	**F**	**G**	**H**	**I**	**J**	**K**
B20	7.3 Temperatures inside • The retarder must be able to work at oil temperatures in the range from -30°C to +200° without being damaged. • The retarder torque is reduced to 0 Nm when the oil temperature is 200°C. • Deregulation is taken care of by the control logic implemented by Voith. • Cold start protection is taken care of by the control logic implemented by Voith. • Define ramp-down temperature 160 C.	G	2022-01-20, Martin: for a short time. Has to be checked during development	G		2022-01-27: Anders: Short time situation, not applicable for normal usage. 215 C will damage sealings. Reduce to 200 C. 2023-04-14: Anders: Ramp down oil temperatures to be added.	Martin (Voith)	2023-05-09: Anders: Set temperature is 160 C. 2023-04-25: Anders: Temperature sensor is slower than the increase of oil temperature, so a safety factor is required to avoid overheating of the oil. Normal temperature is 140-150 C for start of derating. To be defined during the development trough test and verification. 2022-01-20, Martin: for a short time. Has to be checked during development		
	8. Performance Requirements									
	8.1 Braking performance									
	8.1.1 **Braking torque for ratio 2,22 and 1,9** The retarder must fulfil the following requirements: • There shall not be any braking torque peaks exceeding the brake torque more than 5% of maximum torque, outside the general tolerance when the retarder is applied, released or when the torque setting is changed. • The braking performance requirements shall be valid for transmission output shaft speed in the range of 150 to 2250 rpm and a gear ratio of 2,22. (0-150 to 2000 rpm for a gear ratio of 1,9) • The retarder shall withstand transmission output shaft speed levels up to 3000 rpm due to short-time abuse (Reduced lifetime especially on the sealing may be the outcome). This shall be valid for a retarder ratio of 2,22 and 1,9 Retarder maximum brake torque shall follow the envelope curve below, with a tolerance of maximum ±10%. Graph valid for a retarder ratio of 2,22 from output shaft and a maximum torque of 3600 Nm.  Figure 3: Retarder torque diagram for ratio 2,22 Synthetic overview, diagrams shall be replaced with measured data from test bench during RDS testing		2022-01-11, Jacobasch: 2,24 gear ratio not up-to-date (has to be defined). define short-time abuse? (6000 rpm with 2,24) --> max retarder speed 5.700 rpm		**2022-05-24, Kibler: Updated torque diagram with correct step-up ratio 2,219 attached.** 2022-04-21, Kibler: New torque diagram available --> 3600 Nm, i =2,2. Added into Word-file on Volvo SharePoint	2023-04-14: Anders: Requirement updated, Ratio 1,9 has been added and new graphs are defined.		**2022-08-15: Kibler: Chapter 8.1.1** "Retarder maximum brake torque shall follow the envelope curve below, with a tolerance of maximum ±10%." For the braking torque it is difficult to perform tests which are evaluating the complete envelope of the curve. We would like to check our so called project points (same method like at idle loss): •Braking torque ±10% at 1110 rpm (retarder shaft). •Braking torque ±10% at 3330 rpm (retarder shaft). •Braking torque ±10% at 5550 rpm (retarder shaft). We would like to modify this within the TR or RTS accordingly. **2022-05-24, Kibler: Updated torque diagram with correct step-up**		

VOLVO

REVIEW OF TECHNICAL SPECIFICATIONS, HW TR (RTS)

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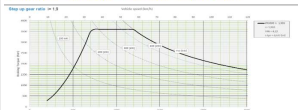
B20	Retarder maximum brake torque shall follow the envelope curve below, with a tolerance of maximum ±10%. Graph valid for a retarder ratio of 1.9 from output shaft and a maximum torque of 3600 Nm.  Figure 4: Retarder torque diagram for ratio 1.9. Synthetic overview, diagrams shall be replaced with measured data from test bench during B20 testing.	G		G			Martin (Voith)	**ratio 2,219 attached.** 2022-04-28, Kibler: Resend adjusted torque diagram for 3600Nm with i=2,219 and iHa=2,31 2022-01-20, Martin: Ratio has to defined / correct (2,2?) breaking function upto 5000 rpm Retarder speed. design for 5000 rpm ret. speed - misuse possible with limited torque. Test procedure has to be definded during development misuse will be recorded at ECU		
B20	**8.2 Idling losses** The idle losses of the inactive retarder shall not exceed the value stated below. • ≤1.0 kW at 3048 rpm (retarder shaft). **Retarder control** When the ABS is activated the vehicle control system will immediately require that the retarder torque is decreased to 0 Nm (except the idling losses).	G	2022-01-20, Martin: target is accepted, but has to confirmed during develoment (new design)	G		Exact values to be tested and documentet. Tolerances between individuals to be checked. //Anders 2022-03-04: Update with figures for 115CT 2023-04-14: Anders: Define curve for drag loss		2023-06-13: Anders: Add values from B01 report and tolerance accordingly. 2023-05-09: Anders: Report under review, planned update during May. 2022-01-20, Martin: target is accepted, but has to confirmed during develoment (new design)		

VOLVO

REVIEW OF TECHNICAL SPECIFICATIONS, HW TR (RTS)

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A	**B**	**C**	**D**	**E**	**F**	**G**	**H**	**I**	**J**	**K**
B20	**8.4 Torque response and limitations** The torque must be activated and deactivated quickly. For activation it is mostly a question about comfort and performance. For deactivation it is also a requirement to deactivate the torque quickly to handle ABS functionality. The torque in these requirements is measured by measuring the control air pressure. The response requirements are valid for normal operating temperatures. For ICE 85 – 110°C is considered normal operating temperature but for BEV and FCEV the normal operating will be lower. The exact operating temperature must be defined after vehicle calibration tests. For deactivation the requested torque to the MRCU will be set to zero within 0,1 s, after zero torque is requested from any control unit in the vehicle. Table 9	G	2022-01-20, Martin: -40°C is not possible. activation is measured normal oiltemp. at retarder (85°C - 110°C) during non-braking mode time has to be clarified 2022-03-03: Anders: New proposal from Voith for activation times. 2022-03-10: Anders: Temperatures to be updated, activation times in the table are valid at a temperature range of 85-110 C. Activation times outside that range has to be defined during testing. The MRCU SW has to consider ABS when response time when activating the retarder.	G	2022-04-25, Kibler: Values can be preliminary accepted - but have to be verified at A-sample testing.	2022-01-27: Limitations has to be clarified by Voith, Electric drivelines will require use below 85 C. All drivelines will be used at low temperatures, but limited. -40C can be discussed. Action plan to define how to agree on a requirement. /Anders 2023-04-14: Anders: Values to be updated.		2023-06-01: Anders: Values are updated to match B01 function test results. Check tolerances. 2023-05-09: Anders: Report under review, planned update during May. 2022-01-20, Martin: -40°C is not possible. activation is measured normal oiltemp. at retarder (85°C - 110°C) during non-braking mode time has to be clarified		
	9. Verification testing The tests stated in this chapter are intended to serve as complementary tests. Passing verification tests do not automatically imply that the product complies fully with the vehicle environment. Unless otherwise agreed, the tests shall be performed by the supplier, sub supplier or in external laboratories at supplier responsibility. The details for test procedure are defined in the DVP&R agreed between Volvo and the supplier.	G	2022-02-28, Jacobassch: no requirement	G						

Operation	Max time (s) 500 rpm	Max time (s) 1000 rpm	Max time (s) 1500 rpm	Max time (s) 2000 rpm	Max time (s) 2400 rpm	Definition
Apply braking torque	1,4	1,3	1,3	1,1	0,75	From 0% to 80% of maximum torque
Repeat braking torque	0,95	0,73	0,9	1,25	0,9	From 0% to 80% of maximum torque
Release braking torque	0,9	0,7	0,8	0,7	0,7	From 100% to 400 Nm

VOLVO

REVIEW OF TECHNICAL SPECIFICATIONS, HW TR (RTS)

Compliance Matrix

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A	**B**	**C**	**D**	**E**	**F**	**G**	**H**	**I**	**J**	**K**
	9.1 General default testing conditions The tests shall be performed under the following conditions unless otherwise stated. Ambient temperature: +20 °C → +25 °C Test voltage: 28,5 V ± 0,3 V Medium: dried air Supply pressure: 830 ± 20 kPa Supply tube inner diameter: 6 mm	G		G	2022-03-01, Jacobasch: ambient temp: +23 til -5 °C test voltage: 27 V +/- 0,5V inner diameter: tbc					
	9.2 Function test Function shall be checked after/during the tests (after or during depends on the description of the test) even if the relevant standard stipulates that a subsystem (e.g. MRCU) needs to be verified only. If the test does not require the DUT to be operational, then the DUT is assembled on a retarder after the test and the complete unit is tested on a retarder test bench at full retarder braking torque for 1000 s (retarder speed is increased from 0 to 5000 rpm linearly). If the complete retarder unit is the DUT, then there will be no additional component to be assembled on the retarder; the complete retarder unit which has undergone the test should be tested on a retarder test bench afterwards. During the test; MRCU and all relevant sensors' input and output values as well as the retarder torque values should be checked. Any deviations on torque larger than ±8% for sensors added to the ±10% for hydrodynamic accuracy are not accepted. If the test does require the DUT to be operational (Sections 12.7 and 12.8), then the DUT is tested on a complete retarder unit on a test bench whenever possible (thus, a complete retarder unit is exposed to the test conditions). If this is not possible, only the performance of MRCU should be evaluated in the same manner	G	2022-02-02, Lutz: must be aligned to eletronic (MRCU) tests (not relevant for mechanical parts, only electronic parts) --> Voith	G	2022-03-01, Jacobasch: to be done by Mirco 2022-03-07: Wassermann: Normally we verify the MRCU functions in the MRCU test bench. If this test is OK, the system is OK. 2022-03-10: Anders: Sometimes a complete function test shall be applied and sometimes the MRCU function test is enough. This can be agreed for each test.			**2022-04-21, Kibler: Comment by Anders dated 2022-03-10 can be accepted.**		

VOLVO

REVIEW OF TECHNICAL SPECIFICATIONS, HW TR (RTS)

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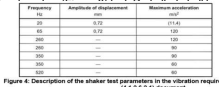
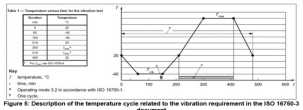
A	**B**	**C**	**D**	**E**	**F**	**G**	**H**	**I**	**J**	**K**
	9.3 Vibrations Vibration test shall be performed on the retarder according to international standards related to automotive business, i.e. ref. [2] ISO 16750-3 chapter (4.1.2.6) including both sinusoidal (Figure 4) [illegible]  **Figure 4: Description of the shaker test parameters in the vibration requirements from the ISO 16750-3 (4.1.2.6.2.1) document** [illegible]  **Figure 5: Description of the temperature cycle related to the vibration requirement in the ISO 16750-3 document** **Failure criterion:** Broken part or fail in function test after vibration test procedure.		2022-02-02, Lutz: valid for electronic MRCU, (ISO 16750-3 too high requirement for mechanical parts, only electronic parts) --> Voith			2023-04-24, Lutz: Vibrations + torsional vibrations: - Load spectrum to be created out of vehicle measurements with B-sample retarder --> alignment Volvo x Voith 2023-04-14: Anders Test for torsional vibrations to be defined.	Martin (Voith)	2023-07-05: Anders: Vibration test results are planned to be shared in August 2023. Test performed in trucks and test rigs.		

VOLVO

REVIEW OF TECHNICAL SPECIFICATIONS, HW TR (RTS)

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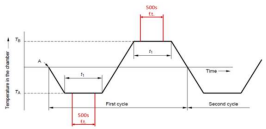
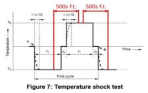
A	**B**	**C**	**D**	**E**	**F**	**G**	**H**	**I**	**J**	**K**
	 **Figure 6: Temperature variation test** Number of samples: 4 Failure criterion: Fail of function test during testing procedure.  **Figure 7: Temperature shock test** Number of samples: 4 Failure criterion: Fail of function test during testing procedure. Add test for torsional vibrations!	G		Y						

VOLVO

REVIEW OF TECHNICAL SPECIFICATIONS, HW TR (RTS)

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B20	**9.4 Dry heat test** According to IEC 60068-2-2 Bb Duration: 1000 h Temperature: 125 °C Installation situation: depressurized, non-activated Number of samples: 4 Failure criterion: Fail of function test after testing procedure. Test procedure: 1. Perform function test. 2. Perform dry heat test. 3. Perform function test.	NA		NA		2023-04-24, Lutz: Transfer to MRCU TR (not relevant for HW retarder)		2023-05-11: Jesper: Will be moved to MRCU TR, included in internal Voith test. Duration 48h however similar conditions are exposed in the endurance test -> 115deg. OK as confirmation. Add high temp endurance test according to Voith description. Steffen share more details to Jesper, Jesper add new requirement in the TR. 2023-05-09: Anders: Check with Jesper if this is coverd in MRCU TR.		
B20	**9.9 Shock test** The shock test shall be performed in acc with ISO 16750-3, section 4.2.3. The shock measured at the same position as in vibration test (Section 12.3). Pulse shape: half sinusoidal Peak acceleration: 20000 [m/s2] Duration: 0.08 [ms] Number of cycles: 1.6 million in each direction. Direction of shock: ±X (Longitudinal), ±Y (Transversal), ±Z (Vertical). Temperature: Room temperature Number of samples: 4 Installation situation: depressurized, non-activated. Failure criterion: Fail of function test after testing procedure.	G		G	2022-03-01, Jacobasch: should be aligned with overview testing MRCU 2022-04-25, Kibler: Test procedure for MRCU mechanical shock testing will be updated by Volvo.	2023-04-24, Lutz: Transfer to MRCU TR (not relevant for HW retarder) 2022-04-06: Anders: To be replaced with tailorized Volvo test on complete system. This is only for mechatronic units.		2023-04-25: Anders: Requiement moved to MRCU TR. 2022-04-29, Lutz: Is there a shock test for the mechanical retarder required? This shock test is only relevant for MRCU! 2022-05-04: Miguel: Evaluate if it is applicable as the mechanical parts are not rotating and the bearings not adjusted. 2022-05-17: Miguel: For HW this requirement is not applicable as there are no rotating parts when running the test. Update TR with this information.		

VOLVO

REVIEW OF TECHNICAL SPECIFICATIONS, HW TR (RTS)

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A	**B**	**C**	**D**	**E**	**F**	**G**	**H**	**I**	**J**	**K**
	9.10 Material testing The retarder sealing at the transmission side shall be subjected to a standard material tests acc. to ISO 1817 including swelling tests with Volvo Transmission oil 97305, 97307, 97315, 97318 (see [4] in section 3.1). The complete retarder shall be subjected to the fluids covered by acc. to STD 420-0004 with addition of: -Water -Solvent Failure criterion: Damage of parts after testing procedure. Note: Even if there may be no direct contact with all the fluids listed above, it is the system supplier's responsibility to make sure that any fluid splash on retarder does not influence the performance of any sealing.	G		G			Lutz (Voith)			
B20	**Salt spray test** According to STD 423-0010 (NSS) Duration: 480 h Installation situation: depressurized, non-activated. Number of samples: 1 Failure criterion: Failure of function test after testing procedure or visible corrosion.	G		Y		2023-04-24, Lutz: Number of samples is updated in the TR to 1x	Lutz (Voith)	2023-07-04: Anders: Test updated, three steps and updated time for approval. 2022-05-17: Kibler: Check if previous test with same materials are applicable to avoid running this test. 2022-06-07: Lutz: Confirm number of samples required.		

VOLVO

REVIEW OF TECHNICAL SPECIFICATIONS, HW TR (RTS)

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A	**B**	**C**	**D**	**E**	**F**	**G**	**H**	**I**	**J**	**K**
B20	9.7 **Impact strength – Falling weight** **Requirement** The component shall be resistant to small shocks/ strikes, from objects or by misuse by users, occurring during manufacturing or vehicle life. The impact resistance requirements are general due to the position and usage of the component. 9.7.1 **Impact strength - falling weight ("room" temp) - Test** **Verification method** Test according to STD 423-0036 Impact strength, falling weight method. The component shall be installed as in the vehicle. Test conditions corresponding to general requirement: Striker "B" 2500 g /50 cm /23 °C (or 10 Joules) **Pass criteria** No cracks permitted but visual damage in the plastic cover is accepted. 9.7.1 **Impact strength - falling weight (cold temp) - Test** **Verification method** Test according to STD 423-0036 Impact strength, falling weight method. The component shall be installed as in the vehicle. This test shall/ can be performed during the test Climatic cycling (GTVW 43) last "cold phase " Test conditions corresponding to general requirement Striker "A" 400 g /65 cm -40 °C (or 2 Joules). **Pass criteria** No cracks permitted but visual damage in the plastic cover is accepted. **Verification method** Test according to STD 423-0036 Impact strength, falling weight method. The component shall be installed as in the vehicle. Test conditions corresponding to general requirement: Striker "B" 2500 g /50 cm /23 °C (or 10 Joules) **Pass criteria** No cracks permitted but visual damage in the plastic cover is accepted. 9.7.1 **Impact strength - falling weight (cold temp) - Test** **Verification method** Test according to STD 423-0036 Impact strength, falling weight method. The component shall be installed as in the vehicle. This test shall/ can be performed during the test Climatic cycling (GTVW 43) last "cold phase " Test conditions corresponding to general requirement Striker "A" 400 g /65 cm -40 °C (or 2 Joules). **Pass criteria** No cracks permitted but visual damage in the plastic cover is accepted.	G		Y				2023-07-04: Anders: In room temperature this is possible, discussion ongoing on how to perform it in cold temperatures. Position of the weight has been updated in the req. 2023-06-01: Anders: Define the exact position for the weigth. 2023-05-11: Anders: Moved from MRCU TR, should be completed for complete retarder, installaed in the a realistic environment.		
	9.12 Verification test for degrees of protection (IP-Code) The test shall be performed according to ISO 20653. Protection classes: IP6K9K when assembled onto transmission. Installation: depressurized, non-activated. Dust test: Use the vertical flow test set-up shown in Figure 1 of ISO 20653. Number of test cycles should be 50. Failure criteria: Dust, water intrusion or foreign object access in RCM or other relevant equipment. Before jet water test, a salt spray test according to 13.11 shall be performed with the test samples. Test procedure: 1. Perform function test 2. Perform jet-water test 3. Open RCM and connectors for visual inspection. The product requirements shall be maintained.	G		G			Lutz (Voith)			

VOLVO

REVIEW OF TECHNICAL SPECIFICATIONS, HW TR (RTS)

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A	**B**	**C**	**D**	**E**	**F**	**G**	**H**	**I**	**J**	**K**
	10. Requirements on material and marking									
	10.1 Materials All rubber materials should be tested according to: ISO 1817 Rubber, vulcanized: Determination of the effect of liquids. Materials that are listed in Volvo STD 100-0002 are not allowed to be chosen for design purposes. PVC, Pb and Cr+6 compounds are prohibited to be used. The use of materials listed in Volvo STD 100-0003 should be limited. The retarder shall be free from listed prohibited chemical substances according to STD 100-0005. All the soldering shall be lead free. Reporting of substances and material composition shall fulfil STD 100-0006.	G		G			Martin (Voith)	2022-01-20, Martin: in first step is accepted, but has to be checked in detail		
B20	**10.2 Marking** The retarder unit shall be marked according to Volvo STD 5051,16 and shall contain the following information: • Component (name of retarder type). • Serial number • Manufacturing Date • Supplier Part number • Part number (Volvo GTT part number) • E-marking (Details described in MRCU TR) The part number and the manufacturing time shall be placed so that the text is visible when the retarder unit is assembled on the gearbox. Furthermore, components shall be marked according to the following rules: - if they contain polymeric components weighting 100 g or more, in accordance with STD 103-0002 - if they contain rubber components weighting 200 g or more, in accordance with STD 103-0002. - If they contain aluminium components weighting 200 g or more, in accordance with STD 103-0010	G		G		2023-04-25: Anders: Drag loss measurement and certification from TUV to be added. (Compare to VR3250) 2023-04-14: Anders: E-marking added	Martin (Voith)			

VOLVO

REVIEW OF TECHNICAL SPECIFICATIONS, HW TR (RTS)

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B20	**10.3 Recycling** All Volvo's products shall be developed with a "life cycle" approach to minimize environmental impact. The number of different materials should be kept as low as possible to facilitate future recycling. Materials that are not compatible at recycling shall be easy to separate from each other, e.g. iron, plastics and electrical components and wires. **Circularity and CO2 Footprint shall be done according to below listed documents:** Principles and framework: - ISO 14040:2006 Requirements and guidelines: - ISO 14044:2006	G		G		2023-04-14: Anders: Requirement yet to be clarified for retarder scoop.	Martin (Voith)	2023-07-04: Anders: The method is accepted, no details of consequence has been defined. 2023-05-23: Anders: Voith tool available and data is being recieved from sub-suppliers. 2023-05-09: Anders: Juergen to share a plan from Voith.		
	11. Quality and Durability									
	11.1 Prediction 24 Months' fault frequency for the component shall be lower than 0.5%. A failure rate analysis has to be carried out and documented by the supplier. The supplier may use its own reliability data if it has been based on previous operational experiences. The prediction shall be compared with the requirements and its relevance shall be approved by Volvo.	G	2022-01-18, Jacobasch: General yes, because of EOL in prodcution. PPM rate (0km) not specified here	G	*PPM = Parts per Million Martin to check for 115CT	2022-01-27: Anders: Add missing information, to get a common idea of the req. 0,5% in 2 years is Volvo target. 2023-05-03, Jkib: Refer to commercial and warranty discussions.	Juergen (Voith)	2023-05-23: Anders: If the fault frequency is exceeding 0,5% a ticket will be raised to improve the quality. This is to be considered as a guide to keep the quality and highlight issues. Not to be connected to warranty and commercial discussions. 2022-01-18, Jacobasch: General yes, because of EOL in prodcution. PPM rate (0km) not specified here		
	11.2.1 Gear ratio of 2,22 (71/32)		2022-01-18, Martin: step-up gear not defined yet. has to be aligned, durability and load		2023-04-24, Lutz: Gear geometry and lifetime	Update of requirement under development. New	Martin (Voith) Lutz(Voith)	2022-01-18, Martin: step-up gear not defined yet. has to be aligned, durability and load profile has to		

VOLVO

REVIEW OF TECHNICAL SPECIFICATIONS, HW TR (RTS)

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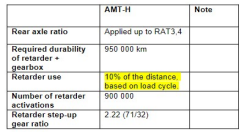
	tips to fill in the form	- Put "G" if question reviewed and the requirements are understood - Put "Y" if question reviewed and the requirements are unclear and need further explanations - Put "R" is this part of the technical specification is not existing yet (late), or of so poor quality that it cannot be used for a proper work - Put "NA" for Not applicable if the requirement is not applicable		- Put "G" for "Green" if question reviewed and agreed, requirement achievable - Put "Y" for "Yellow" if question reviewed and raises minor concern, requirement can be achieved but needs actions - Put "R" for "Red" if question reviewed and raises major concern, requirement cannot me met						
A	**B**	**C**	**D**	**E**	**F**	**G**	**H**	**I**	**J**	**K**
B20	 AMT-H / Note Rear axle ratio: Applied up to RAT3.4 Required durability of retarder + gearbox: 950 000 km Retarder use: 10% of the distance, based on load cycle. Number of retarder activations: 900 000 Retarder step-up gear ratio: 2.22 (71/32) Table 10 Gear data for ratio 2.22 shall be according to TR24382431.01.	G	profile has to be checked	G	responsibility lies by Volvo (Reason: Calulated gear lifetime by Voith does not reach the lifetime goal)	gear ratio and torque levels will be applied. //Anders 2022-01-28: New load collective added. //Anders 2022-03-10: Anders: New table with torque levels, distribution and time has been added. TR to be updated accordingly. 2022-06-15: Miguel: New load cycle shared. Results under investigation. It will/might be updated along the development. 2023-04-14: Anders: Requirement has been updated		be checked **2022-04-29, Lutz: Is this load spectrum extracted from a real vehicle measurement? The only difference to the load spectrum (from 2022-01-28) is the torque level in every stage (minimal lower) and the avg. speed at 2nd highest torque stage (2796 --> 2640 rpm). With this speed adjustment, the revolution frequ. has also to be updated.** **Nevertheless, this load spectrrum has to be discussed in next "techn. discussion" round due to very high damage sum.** **Goal: Spectrum extracted from current vehicle generation** **2022-05-04: Miguel: This spectrum is for i=2.219 ratio. Time share not adjusted, is it a syntethyc load spectrum or is it measured on real vehicle? Miguel to double check**		
B20	**11.2.2 Gear ratio of 1,9 (59/31)** AMT-H / Note Rear axle ratio: Applied above RAT3.4 Required durability of retarder + gearbox: 700 000 km Retarder use: 14% of the distance, based on load cycle. Number of retarder activations: 900 000 Retarder step-up gear ratio: 1.9 (59/31) Table 10 Refer to gear data TR.	G		G	2023-04-24, Lutz: Gear geometry and lifetime responsibility lies by Volvo	2023-04-14: Anders: Requirement has been updated" TR to be release and shared.	G			
	12. Aftermarket									

VOLVO

REVIEW OF TECHNICAL SPECIFICATIONS, HW TR (RTS)

Compliance Matrix

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A	**B**	**C**	**D**	**E**	**F**	**G**	**H**	**I**	**J**	**K**
	12.1 Maintenance and repair manual Supplier shall supply Volvo with maintenance and repair manual. In case of any adjustments, Volvo must be informed and give the approval before any changes are taking place. Volvo shall be informed if there is any training available at the supplier for the new component.	G		G	2022-03-09, Jacobasch: repair manual will not provided to OEM, only to operators/workshop		Strobel (Voith)	**2022-04-28, Kibler:** **Volvo is operator. So manuals should be delivered also to Volvo --> to be checked by Ralf Lechler!** **2022-05-04: Lechler: To be checked with the project management.**	**2022-05-04**	
	12.2 Special tools Special tools shall be avoided. If there is a need for special tools the supplier should: - Describe function and application of the tool in the manual. - Supply the Volvo retailers with the tools.	G		G			Strobel (Voith)			
	12.3 Spare parts Supplier shall provide Volvo with spare part proposals. The proposals shall be reviewed and approved by Volvo together with the supplier.	G		G			Strobel (Voith)			
	12.4 Remanufacturing Remanufacturing will be defined in a separate agreement.	G		G			Strobel (Voith)			
B20	**12.5 Service and spare part modification** • The supplier shall inform Volvo of modifications that make parts not interchangeable with previous versions. • The supplier shall also inform Volvo of modifications that make parts interchangeable but does not fulfil Volvo's requirements. • The supplier shall update service documentation. • Volvo shall approve all modifications and changes regarding spare parts. • The design of the component must give good accessibility to facilitate service and repair. • The retarder shall include a drain plug for the coolant according to standard Tema 1800n. • The retarder shall include an oil volume indicator.	G		Y	2023-06-13: Anders: Start discussion around different volume indicators. 2023-05-23: Anders: Check with AM on the new part to confirm the threads. The plug has a M14x1,5 2022-04-27: Oil level indicator and coolant drain plug to be defined in the concept.		Strobel (Voith)	2022-04-27, Kibler: **Volume indicator:** Check the design if a feature for checking oil level is possible. **Coolant drain plug:** Voith to check adding maching for mounting drain plug. Voith to check to deliver retarder with plug and Volvo could assembly the darin plug on their site. 2022-05-04: Miguel: To check the drain plug availability at Volvo. Volvo will take care of the plug and Voith will add the threads on the retarder. To be reviewed along the development.	**2022-05-04**	

VOLVO

REVIEW OF TECHNICAL SPECIFICATIONS, HW TR (RTS)

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A	**B**	**C**	**D**	**E**	**F**	**G**	**H**	**I**	**J**	**K**
	12.6 Spare part accessibility Details will be defined in a separate agreement. • Spare parts availability should be 100% for all decided parts at the time of serial production. • Volvo shall have the following spare part information: - Spare part drawings (only part identification measurement) - Part number - Material • It shall be easy to recognize every single part and it shall be impossible to mix up the parts. • The supplier shall provide Volvo with a drawing, illustrating assembly breakdown in spare parts. • Supplier shall be able to deliver spare parts up to 15 years after cancelled production. • In case of production cancellation and the supplier do not want to produce the parts within the 15 years stipulated above, Volvo shall have access to full production drawings.	G		G	2022-04-27: 15 years after EOP		Strobel (Voith)			
	13. Serial production									
	13.1 Serial production will be defined in a separate agreement. Product modification No changes may be done concerning material, design or manufacturing methods to approved initial samples without the consent of responsible design department at Volvo. Request for approval is handled through the quality organization at Volvo.	G		G	2022-02-28, Jacobasch: B-sample will be build-up in sample shop, serial concept is not defined y 2022-04-27: To be handled through the PPCN process.		Kandemir (Voith)			

VOLVO

REVIEW OF TECHNICAL SPECIFICATIONS, HW TR (RTS)

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B20	13.2 Transportation Packaging of the retarder and RCM shall be handled according to the packaging document. THIS DOCUMENT HAS NOT YET BEEN SET UP! • The retarders are plugged so that the cleanliness requirements stated in section 5.1 are fulfilled until the plugs are removed. • The electric connections must be protected during handling. • The pneumatic fittings must be protected during handling. • Appropriate measures must also be taken to prevent any part of the valve unit to rust during handling. • All packaging in cardboard, fiberboard or any other fibrous material is forbidden. • The empty packaging must be transportation effective i.e. take a minimal space.	G		Y	2022-02-28, Jacobasch: As mentioned in the requirment the packaguing concept has to be defined. For initial samples the packaging will be defined together as well	2023-04-14: Anders: Detials to be updated. Linked to cleanliness requirement for inlining design, if possible to combine and reuse.	Kandemir (Voith)	2023-07-05: Anders: Volvo to share a proposal on how the inlinging can look like.		
B20	**Lifting tools** The interfaces for lifting tools shall be detailed documented in the drawings and shall be designed to fit the specified lifting tools. The tool to be used is: Lifting eye: 88840014 Bracket: 88800508	G		G		2023-04-14: Anders: New updated pictures needed.				
	13.3 Sealing elements at the interfaces • All sealing elements at the retarder interface (such as O-Rings etc.) which prevent any contamination from intruding into the gearbox or any transmission oil from leaking out are within the supplier's scope of delivery.	G		G			Kandemir (Voith)			
	14. Supplier documents Supplier shall provide Volvo with exploded views depicting all internal components of the retarder. This is needed mainly for the fault searching of the retarder.									

VOLVO

REVIEW OF TECHNICAL SPECIFICATIONS, HW TR (RTS)

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	14.1 CAD requirements • The geometrical volume of the retarder shall be defined by the pack part from the supplier. • The model shall be solid and before delivery to VPT, checked that it is without leakages in the CAD-system and version that VPT use (IGS and STP formats are also permitted). • The model shall include at least full solid CAD models of the interfacing parts. The material information on these parts shall be added (Needed for vibration and contact analysis of the Volvo owned parts at the interfaces). • Drawings and CAD-models for special purposes shall be sent to Volvo on request (e.g. for packaging studies).	G		G			Martin (Voith)			
	14.2 Requirements on supplier drawing The following dimensions and info shall be stated on supplier drawing:	G	2022-01-20, Martin:• Elastic representation of the component, full models of the interfacing	G			Martin (Voith)	2022-01-20, Martin:• Elastic representation of the component, full models of the interfacing parts (for		
	14.3 FMEA • The system supplier shall carry out a design-FMEA and a process-FMEA. • The results of Voith internal FMEAs shall be discussed with Volvo. • Volvo will carry out a system-FMEA and an environmental-FMEA. • An interface FMEA could be carried out between Volvo and the system supplier.	G		G			Smialy (Voith)			
	14.4 Design review The system supplier shall carry out a design review before drawings are released. The results of Voith internal review shall be discussed with Volvo. Design reviews at the interfaces could be carried out between Volvo and the system supplier.	G	2022-01-18, Jacobasch: please specify what Volvo would like to see. You will get drawing + CAD (only with outline dimension). You can also get information if design is release internally at Voith (but not detailed information)	G		We handle this process on our regular technical meetings. CAD models are generally the most informative, but the outline drawing will be reviewed as well. No internal parts are of concern, if not requested from Voith. //Anders	Martin (Voith)	2022-03-09, Jacobasch, Comment from Volvo accepted 2022-01-18, Jacobasch: please specify what Volvo would like to see. You will get drawing + CAD (only with outline dimension). You can also get information if design is release internally at Voith (but not detailed information)		

VOLVO

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	14.5 Test result The summary of the test results performed by the system supplier shall be made available to Volvo. Information about the details of the tests is limited to verbal discussion.	G		G	2022-02-02, Lutz: The DVP&R is the basis for validation measures and documentation. In this validation plan, the measures and the summary of the results will be documented. 2022-03-10: Anders: OK		Lutz (Voith)			
	Study all the requirements mentioned in all the TR you received. List below all the requirements of all these TRs. For each of these requirements, answer if it is : understood Yes/no (column C & D) and fully achievable Yes/no (column E to H)	G	2022-01-18, Jacobasch: based on our information RTS included all requirement for HW and MRCU 2022-03-10, Anders: Correct, RTS is updated with all requirements	G			Martin (Voith)	2022-01-18, Jacobasch: based on our information RTS included all requirement for HW and MRCU		
	Below here is a checklist of needed generic items to be reviewed within the "Technical Requirements". If these items have already been listed above in the TR content, don't repeat it here. Just mention NA in column "C" with the comment "already listed above" in the column "D" For each item, answer if it's understood (column C & D) and achievable (column E to H)	G		G			Martin (Voith)			
	Cleanliness requirements & measurement method	NA		NA						
	Other measurement methods (includes dimensional control plan, if applicable)	NA		NA						
	Reliability targets (field fault frequency), if applicable	NA		NA						
	Durability targets, if applicable	NA		NA						
	Surface treatment requirements	NA		NA						
	Appearance aspects (color, embossing, gloss etc)	NA		NA						
	Comfort requirements (noise, smell, feel)	NA		NA						
	For development suppliers only : documentation about the applications and part functionalities for the different Volvo customers	NA		NA						
		NA		NA						
7	**Test Methods**									

VOLVO

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	List here the testing methods that are defined for the verification activities needed for the component, under supplier responsibility. If no testing method is defined, enter NA (non applicable) in column C	G		G	2022-02-02, Lutz: The DVP&R is the basis for validation measures and documentation. This DVP&R will be aligned with Volvo before the start of testing. The available testing methods will be listed in the DVP&R.	2022-03-03: Anders: Refer to the DVP&R in the TR, to be aligned bweteen Volvo/Voith in separate discussion.	Lutz (Voith)			
	All tests required for Process Validation, defined in the Technical Requirements document(s), are clearly defined and understood. Note: Process Validation tests must be performed on samples taken from the Significant production Run and the results included with PPAP documentation.	G		G	2022-02-02, Lutz: Which tests for process validation does Volvo mean? Please specify these tests here clearly. The DVP&R is the basis for validation measures and documentation. This DVP&R will be aligned with Volvo before the start of testing.	2022-03-03: All verification shall be done and accepted in front of the PPAP.	Lutz (Voith)			
8	**Master samples**									
	List below the master samples that you have received for the component(s). If no master sample has been received, enter NA (non applicable) in column C	G		G			Jacobasch (Voith)			
	.....									
9	**Applicable legislations & environmental requirements**									
	List below all the legislations that are applicable for the component. For each of these legislations answer if it is : understood (column C & D) and achievable (column E to H). If no legislation is applicable for the component(s), enter NA (non applicable) in column C	NA		NA						
	.....									

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	Identification and no-use of undesirable substances for the parts chemical content : - the list of undesirable substances to be considered is the GADSL (Global Automotive Declarable Substance List - Volvo Standard 100-005) exception is made for lead and chromium VI. For some few projects the list of undesirable substances to be considered is the Black and Grey lists (Volvo Standards 100-002 and 100-003). Compliance to the lists is requested.	NA		NA						
	Substances tracking : depending on the project, the supplier should be able to report substances in IMDS.	G		G			Martin (Voith)			
	REACH Regulation, for EU products or parts used in EU plants : no use of substances included in REACH's annex XIV except if specific authorization from European union	G		G			Martin (Voith)			
10	**Functional specifications**									
	List below any functional specification applicable for the component(s), not listed above	NA		NA						
	.....	NA		NA						

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A	**B**	**C**	**D**	**E**	**F**	**G**	**H**	**I**	**J**	**K**
11	**Other technical documents**									
	List below any other technical document which is part of the technical specification you have received, not already listed above	NA		NA						
	.....	NA		NA						
12	**Supplier Recommendations and input**	Yes / No	Description of the recommendation	Modification agreed / not agreed	Responsible					
	Is there a design improvement recommended with respect to the supplier's production process that would improve manufacturability, quality, process quality assurance or cost ?	No								
	Is there a design or a material change recommended that would bring an improvement for Volvo in terms of safety, quality, weight, assembly, serviceability, cost, standardization or any other feature / Function ?									
	Is there a need for investment in checking equipment ?									
	Do you foresee any restrictions to fulfill requirements stated in the documentation ?									
	Do you propose any requirements that are not specified in the documentation?									
	Vibration load spectrum (acc. to 4.2)The vibrations load spectrum mentioned in chapter 5.5.1/ 9.3/ 9.9 is related to ISO 16750-3. This spectrum is not suitable for the hole retarder due to too high accelerations for retarder housings. The spectrum is related to vibration sensitive parts (sensors, MRCU, harness)--> Please specify the vibration load spectrum clearly (consisting of 1. rough road, 2. traction mode, 3. retarder mode) incl. time and mileage shares out of representative vehicle measurements for retarder structural components.	Yes	2022-03-02: Anders: ER-report for 16L with VR3250 to be used for complete retarder until final measurements are performed on new installations. 2023-04-24, Lutz: Reference to HW Load book (No. 9.3 HW TR (RTS))	2023-05-10: Anders: Truck measuements will be performed on B01 application truck. 2022-03-02: Anders: ER-report for 16L with VR3250 to be used for complete retarder until final measurements are performed on new installations. 2022-05-04: Miguel: Load spectrum to be shared.						

VOLVO

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A	**B**	**C**	**D**	**E**	**F**	**G**	**H**	**I**	**J**	**K**
	G-loads/ Acceleration x-y-z-direction (acc. to 4.2)- If there are requirements regarding G-Loads, Volvo has to provide the max. accelerations for retarder structural components:x-direction (+/- ?? g): driving directiony-direction (+/- ?? g): cross directionz-direction (+/- ?? G + 1g of gravitiy): vertical direction- Volvo has to provide a test specification for each direction derived from a representative vehicle measurement for retarder structural components.	Yes	2022-03-02: Anders: ER-report for 16L with VR3250 to be used for complete retarder until final measurements are performed on new installations. 2023-04-24, Lutz: Reference to HW Load book (No. 5.2 HW TR (RTS))	2023-05-10: Anders: Truck measuements will be performed on B01 application truck. 2022-03-02: Anders: ER-report for 16L with VR3250 to be used for complete retarder until final measurements are performed on new installations. 2022-05-04: Miguel: G loads to be shared. Necessary for calculations						
	Torsional vibrations (acc. to 4.2)Torsional vibration could lead to any unforeseen effects in the retarder, especially with new powertrain developments (e.g. increased torsional vibrations due to down-speeding strategy, etc). Therefore the retarder has to be tested against torsional vibration at the test bench.A representative torsional vibration spectrum at the transmission output shaft has to be provided by Volvo.	Yes	2022-03-02: Anders: ER-report for 16L with VR3250 to be used for complete retarder until final measurements are performed on new installations. 2023-04-24, Lutz: Reference to HW Load book (No. 9.3 HW TR (RTS))	2023-05-10: Anders: Truck measuements will be performed on B01 application truck. 2022-03-02: Anders: ER-report for 16L with VR3250 to be used for complete retarder until final measurements are performed on new installations. 2022-05-04: Miguel: G loads to be shared. Necessary for calculations						

VOLVO

REVIEW OF TECHNICAL SPECIFICATIONS, HW TR (RTS)

Compliance Matrix

Part Number(s):

		Requirements understanding		Requirements feasibility				Action plan tracking		
	Requirement / Topic	Are the requirements clear and understood ? **"Green / Yellow / Red " "GYR" status**	Enter here any needed comment If the requirement is not understood, describe what needs to be clarified	Are the requirements achievable ? **"Green / Yellow / Red " "GYR" status**	If the requirements are not achievable, describe what the concern is	Needed Action	Responsible	Comments and updates on the action plan	Due date	Status Open / Closed
	tips to fill in the form	- Put "G" if question reviewed and the requirements are understood - Put "Y" if question reviewed and the requirements are unclear and need further explanations - Put "R" is this part of the technical specification is not existing yet (late), or of so poor quality that it cannot be used for a proper work - Put "NA" for Not applicable if the requirement is not applicable		- Put "G" for "Green" if question reviewed and agreed, requirement achievable - Put "Y" for "Yellow" if question reviewed and raises minor concern, requirement can be achieved but needs actions - Put "R" for "Red" if question reviewed and raises major concern, requirement cannot me met						
A	**B**	**C**	**D**	**E**	**F**	**G**	**H**	**I**	**J**	**K**
	Gross combination weight distribution (acc. to 4.2)If there are requirements regarding GCW, Volvo has to provide a test specification according to representative vehicle measurements (not only minimum and maximum).	Yes	2022-03-2: Anders: Is the GCW important for the retarder development? We only have it as general vehicle information.	2022-03-2: Anders: Is the GCW important for the retarder development? We only have it as general vehicle information. 2022-05-04: Miguel: General requirement, is it applicable? 2022-05-17: Miguel: Not applicable as a requirement but as general information. Specific requirements will be added in specific test.						
	Yearly usage (vehicle) (acc. to 4.2)Volvo has to provide a distrubtion [%] of the yearly usage in [km] and [h] (not only minimum and maximum).	Yes	2022-03-02: Anders: An updated list with correct ratio will be shared in TR. Hourly distribution is part of this graph.	2022-03-02: Anders: An updated list with correct ratio will be shared in TR. Hourly distribution is part of this graph. 2022-05-04: Miguel: Clarification required, just min and max. Is this just a general information or a requirement= nt, is it applicable? 2022-05-17: Miguel: Not applicable as a requirement but as general information. Specific requirements will be added in specific test.						

VOLVO

REVIEW OF TECHNICAL SPECIFICATIONS, HW TR (RTS)

Compliance Matrix

Part Number(s):

		Requirements understanding		Requirements feasibility				Action plan tracking		
	Requirement / Topic	Are the requirements clear and understood ? **"Green / Yellow / Red " "GYR" status**	Enter here any needed comment If the requirement is not understood, describe what needs to be clarified	Are the requirements achievable ? **"Green / Yellow / Red " "GYR" status**	If the requirements are not achievable, describe what the concern is	Needed Action	Responsible	Comments and updates on the action plan	Due date	Status Open / Closed
	tips to fill in the form	- Put "G" if question reviewed and the requirements are understood - Put "Y" if question reviewed and the requirements are unclear and need further explanations - Put "R" is this part of the technical specification is not existing yet (late), or of so poor quality that it cannot be used for a proper work - Put "NA" for Not applicable if the requirement is not applicable		- Put "G" for "Green" if question reviewed and agreed, requirement achievable - Put "Y" for "Yellow" if question reviewed and raises minor concern, requirement can be achieved but needs actions - Put "R" for "Red" if question reviewed and raises major concern, requirement cannot me met						
A	**B**	**C**	**D**	**E**	**F**	**G**	**H**	**I**	**J**	**K**
	Climate (acc. to 4.2)If there are requirements regarding climate, Volvo has to provide a test specification regarding temperature/ climate requirements for the retarder (HW) according to representative vehicle measurements (not only minimum and maximum/ very Cold climate - Very hot climate).	Yes	2022-03-2: Anders: We only have it as general vehicle information. Details are defined in the specific tests.	2022-03-2: Anders: We only have it as general vehicle information. Details are defined in the specific tests. nt, is it applicable? 2022-05-17: Miguel: Not applicable as a requirement but as general information. Specific requirements will be added in specific test.						
	Altitude/ topography (acc. to 4.2)If there are requirements regarding altitude/ topography, Volvo has to provide a test specification according to representative vehicle measurements (not only flat - very hilly).	Yes	2022-03-2: Anders: We only have it as general vehicle information. Details are defined in the specific tests.	2022-03-2: Anders: We only have it as general vehicle information. Details are defined in the specific tests. nt, is it applicable? 2022-05-17: Miguel: Not applicable as a requirement but as general information. Specific requirements will be added in specific test.						

VOLVO

REVIEW OF TECHNICAL SPECIFICATIONS, HW TR (RTS)

Compliance Matrix

Part Number(s):

		Requirements understanding		Requirements feasibility				Action plan tracking		
	Requirement / Topic	Are the requirements clear and understood ? **"Green / Yellow / Red " "GYR" status**	Enter here any needed comment If the requirement is not understood, describe what needs to be clarified	Are the requirements achievable ? **"Green / Yellow / Red " "GYR" status**	If the requirements are not achievable, describe what the concern is	Needed Action	Responsible	Comments and updates on the action plan	Due date	Status Open / Closed
	tips to fill in the form	- Put "G" if question reviewed and the requirements are understood - Put "Y" if question reviewed and the requirements are unclear and need further explanations - Put "R" is this part of the technical specification is not existing yet (late), or of so poor quality that it cannot be used for a proper work - Put "NA" for Not applicable if the requirement is not applicable		- Put "G" for "Green" if question reviewed and agreed, requirement achievable - Put "Y" for "Yellow" if question reviewed and raises minor concern, requirement can be achieved but needs actions - Put "R" for "Red" if question reviewed and raises major concern, requirement cannot me met						
A	**B**	**C**	**D**	**E**	**F**	**G**	**H**	**I**	**J**	**K**
	Road conditions (acc. to 4.2)If there are requirements regarding road conditions, Volvo has to provide a test specification according to representative vehicle measurements (not only smooth to very rough)? How many kilometers/ operating hours has the retarder to withstand these vibration load spectrum.	Yes	2022-03-2: Anders: We only have it as general vehicle information. Details are defined in the specific tests.	2022-03-2: Anders: We only have it as general vehicle information. Details are defined in the specific tests. nt, is it applicable? 2022-05-17: Miguel: Not applicable as a requirement but as general information. Specific requirements will be added in specific test.						
	Dirt concentration (acc. to 4.2)If there are requirements regarding dirt concentration, Volvo has to provide a test specification according to representative measurements (not only low to very high).	Yes	2022-03-2: Anders: We only have it as general vehicle information. Details are defined in the specific tests.	2022-03-2: Anders: We only have it as general vehicle information. Details are defined in the specific tests. nt, is it applicable? 2022-05-17: Miguel: Not applicable as a requirement but as general information. Specific requirements will be added in specific test.						
	Coolant temperature at retarder (acc. to 7.1.2)If there are requirements regarding coolant temperature at retarder, Volvo has to provide a test specification according to representative vehicle measurements (not only minimum and maximum).	Yes	2022-03-03: Set temperature on Eu6 is 110 C. Eu7 could go up to 113 C. 500kW is under discussion, same affect on oil temperature and changer intervals. 2023-04-24, Lutz: Reference to HW Load book (No. 7.1.2 HW TR (RTS))	2022-03-03: Set temperature on Eu6 is 110 C. Eu7 could go up to 113 C. 500kW is under discussion, same affect on oil temperature and changer intervals.						

VOLVO

REVIEW OF TECHNICAL SPECIFICATIONS, HW TR (RTS)

Compliance Matrix

Part Number(s):

		Requirements understanding		Requirements feasibility				Action plan tracking		
	Requirement / Topic	Are the requirements clear and understood ? **"Green / Yellow / Red " "GYR" status**	Enter here any needed comment If the requirement is not understood, describe what needs to be clarified	Are the requirements achievable ? **"Green / Yellow / Red " "GYR" status**	If the requirements are not achievable, describe what the concern is	Needed Action	Responsible	Comments and updates on the action plan	Due date	Status Open / Closed
	tips to fill in the form	- Put "G" if question reviewed and the requirements are understood - Put "Y" if question reviewed and the requirements are unclear and need further explanations - Put "R" is this part of the technical specification is not existing yet (late), or of so poor quality that it cannot be used for a proper work - Put "NA" for Not applicable if the requirement is not applicable		- Put "G" for "Green" if question reviewed and agreed, requirement achievable - Put "Y" for "Yellow" if question reviewed and raises minor concern, requirement can be achieved but needs actions - Put "R" for "Red" if question reviewed and raises major concern, requirement cannot me met						
A	**B**	**C**	**D**	**E**	**F**	**G**	**H**	**I**	**J**	**K**
	Pressure Pulsations (frequency dependent) (acc. to 7.2.1)If there are requirements regarding pressure pulsations in the cooling system at the retarder, Volvo has to provide a test specification according to representative vehicle measurements.	Yes	2022-03-03: Are there pressure pulzation in the cooling system? Measurements can be sent for reference retarder. Static pressure loads? 2023-04-24, Lutz: Reference to HW Load book (No. 7.2.1 HW TR (RTS))	2023-05-10: Anders: The pressure pulzations are very low and shall have no impact on the HE. 2022-03-03: Are there pressure pulzation in the cooling system? Measurements can be sent for reference retarder. Static pressure loads? 2022-05-17: Miguel: to review it internally. Related to pressure and tightness. Is there specific operating frequency for pressure pulsation for which the HE needs to be validated?						
	Inside retarder oil temperature (acc. to 7.3)Goal is to reduce the inside retarder oil temperatures by reducing the limitation limits. The impact on the down regulation share/ availability has to be validated in the vehicle tests.	Yes	2022-03-02: Anders: Retarder oil temperatures has to be measured with correct installations with relevant load cases, ambient temperatures, calibration etc. This will be done during the development, to get input for oil change intervals and quality. 2023-04-24, Lutz:	2022-03-02: Anders: Retarder oil temperatures has to be measured with correct installations with relevant load cases, ambient temperatures, calibration etc. This will be done during the						
	Transmission (t/m) oil temperature (acc. to 7.3)If there are requirements regarding transmission oil temperatures in contact with retatder (gear sealings), Volvo has to provide a test specification according to representative vehicle measurements.	Yes	2022-03-02: Anders: Volvo will inform about oil temperatures in gearbox. 2023-04-24, Lutz: Reference to HW Load book (No. 7.1.2b HW TR (RTS))	2023-05-10: Anders: Temperatures added in the TR. 2022-03-02: Anders: Volvo will inform about oil temperatures in gearbox. 2022-04-05: Miguel: To share information when it is ready						

VOLVO

REVIEW OF TECHNICAL SPECIFICATIONS, HW TR (RTS)

Compliance Matrix

Part Number(s):

		Requirements understanding		Requirements feasibility				Action plan tracking		
	Requirement / Topic	Are the requirements clear and understood ? **"Green / Yellow / Red " "GYR" status**	Enter here any needed comment If the requirement is not understood, describe what needs to be clarified	Are the requirements achievable ? **"Green / Yellow / Red " "GYR" status**	If the requirements are not achievable, describe what the concern is	Needed Action	Responsible	Comments and updates on the action plan	Due date	Status Open / Closed
	tips to fill in the form	- Put "G" if question reviewed and the requirements are understood - Put "Y" if question reviewed and the requirements are unclear and need further explanations - Put "R" is this part of the technical specification is not existing yet (late), or of so poor quality that it cannot be used for a proper work - Put "NA" for Not applicable if the requirement is not applicable		- Put "G" for "Green" if question reviewed and agreed, requirement achievable - Put "Y" for "Yellow" if question reviewed and raises minor concern, requirement can be achieved but needs actions - Put "R" for "Red" if question reviewed and raises major concern, requirement cannot me met						
A	**B**	**C**	**D**	**E**	**F**	**G**	**H**	**I**	**J**	**K**
	Retarder braking torque load spectrum (acc. to 11.2)Volvo has to provide a 3D classification (Ret. Load [Nm] x Ret. Speed [rpm] x Usage share [h and %]. Volvo has to provide a representative rainflow classification of the retarder braking torque. Volvo has to provide measurement sections (time based) of representative routes (braking torque, shaft speed, temperatures).	Yes	2022-03-02: Anders: An updated list with correct ratio will be shared in TR. Hourly distribution is part of this graph.	2023-05-10: Anders: Load cases defined in the TR. 2022-03-02: Anders: An updated list with correct ratio will be shared in TR. Hourly distribution is part of this graph. 2022-05-04: Miiguel: Check 11.2 chapter. 3D classification speed/torque/usage share(time)						
	Do you foresee some risks that have not been highlighted above ?									

FREE SPACE (FOR ANY FURTHER COMMENT / RECOMMENDATION / RISK etc) HIGHLIGHTED EITHER BY THE TEAM EITHER SUPPLIER OR BY VOLVO :

eg : design to cost targets, quantity, etc

VOLVO

REVIEW OF TECHNICAL SPECIFICATIONS, HW TR (RTS)

Compliance Matrix

Part Number(s):

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	tips to fill in the form	- Put "G" if question reviewed and the requirements are understood - Put "Y" if question reviewed and the requirements are unclear and need further explanations - Put "R" is this part of the technical specification is not existing yet (late), or of so poor quality that it cannot be used for a proper work - Put "NA" for Not applicable if the requirement is not applicable		- Put "G" for "Green" if question reviewed and agreed, requirement achievable - Put "Y" for "Yellow" if question reviewed and raises minor concern, requirement can be achieved but needs actions - Put "R" for "Red" if question reviewed and raises major concern, requirement cannot me met						
A	**B**	**C**	**D**	**E**	**F**	**G**	**H**	**I**	**J**	**K**

RTS SUMMARY STATUS

COMPLIANCE MATRIX SUMMARY STATUS	
Total number of requirements reviewed	133
Number of requirements to be clarified	1
Number of requirements that are not understood and/or need revision	0
Number of requirements achievable	109
Number of requirements raising minor concern	6
Number of requirements raising major concern	0

RECOMMENDATIONS SUMMARY STATUS	
Total number of recommendations	14
Total number of agreed recommendations	0

ACTION LIST STATUS	
Total number of actions raised	50
Total number of actions still OPEN	0

VOLVO

REVIEW OF TECHNICAL SPECIFICATIONS, MRCU (RTS)

Compliance Matrix

Part Number(s):

		Requirements understanding		Requirements feasibility				Action plan tracking		
	Requirement / Topic	Are the requirements clear and understood ? **"Green / Yellow / Red " "GYR" status**	Enter here any needed comment If the requirement is not understood, describe what needs to be clarified	Are the requirements achievable ? **"Green / Yellow / Red " "GYR" status**	If the requirements are not achievable, describe what the concern is	Needed Action	Responsible	Comments and updates on the action plan	Due date	Status Open / Closed
	tips to fill in the form	- Put "G" if question reviewed and the requirements are		- Put "G" for "Green" if question reviewed and agreed, requirement						
A	**B**	**C**	**D**	**E**	**F**	**G**	**H**	**I**	**J**	**K**
0	**Function description**									
	Have you received : description how it is meant to be used, what it should be used for, if confidentiality needed etc..: where is that stated among the documents sent to supplier									
1	**PVR**									
	List below the PVR(s) - part numbers - for the component(s) considered in this RTS (includes TR)	G	2022-01-11, Jacobasch: information, no requirement. TR is provided by Volvo, checking the TR is sep. issue (here no actions from Voith side)	G			Jacobasch (Voith)	2022-01-11, Jacobasch: information, no requirement. TR is provided by Volvo, checking the TR is sep. issue (here no actions from Voith side)		
	TR - 23894608	G	2022-01-11, Jacobasch: information, no requirement. TR is provided by Volvo, checking the TR is sep. issue (here no actions from Voith side)	G			Jacobasch (Voith)	2022-01-11, Jacobasch: information, no requirement. TR is provided by Volvo, checking the TR is sep. issue (here no actions from Voith side)		
2	**Drawings**									
	List below the component(s) drawings and the assembly drawings (references and issues). For each drawing, answer if the full content is : understood (column C & D) and achievable (column E to H) - that can include drawings, describing interface geometry (referential & specification to manage interface, eg assembly/ layout / installation drawings) - Purchasing contract must be a base for responsability split. development suppliers could receive assembly drawings from Volvo that need to be listed below too	G	2022-01-11, Jacobasch: to avoid missunderstanding, you need one drawing for the complete retarder, incl. MRCU --> no component drawing will be shared	G		2022-01-25: Anders: OK for Volvo to have a top level layout drawing with all necessary information and a spare part drawing.	Jacobasch (Voith)	2022-01-11, Jacobasch: to avoid missunderstanding, you need one drawing for the complete retarder, incl. MRCU --> no component drawing will be shared 2022-01-25: Sascha Jacobasch: With feedback from Volvo, this is accepted.		
	N/A	NA		NA			Jacobasch (Voith)			
	Checklist of items to be reviewed on the drawings content. For each item answer if it's understood (column C & D) and achievable (column E to H)	G	2022-01-11, Jacobasch: no requirement, only information how to answer the RTS	G			Jacobasch (Voith)			
	For development suppliers interfaces in the full environment (First Space Envelope, Packaging Module) provided by Volvo	G	2022-01-12, Jacobasch: has to be defined and aligned between Volvo/Voith during project	G		2022-01-25: Anders: All interfaces are not defined, to be done during the development. Comment is accepted from Volvo,	Jacobasch (Voith)	2022-01-12, Jacobasch: has to be defined and aligned between Volvo/Voith during project 2022-01-25: Sascha Jacobasch: With feedback from Volvo, this is accepted		
	Datum systems that allow a robust measurement of the parts dimensions	G	2022-01-11, Jacobasch: context for drawing not clear --> if Volvo expect clear tracebility (PN etc.) on drawing okay, otherwise explain in detail what Volvo expect	G		2022-01-25: Anders: Ok to not have complete datum system. To be added on Volvo side after delivery.	Jacobasch (Voith)	2022-01-11, Jacobasch: context for drawing not clear --> if Volvo expect clear tracebility (PN etc.) on drawing okay, otherwise explain in detail what Volvo expect 2022-01-25: Sascha Jacobasch: With feedback from Volvo, this is accepted.		
	General and geometric dimensions, tolerances, and notes on the drawings. Manufacturing feasibility commitment.	G		G			Jacobasch (Voith)			

VOLVO

REVIEW OF TECHNICAL SPECIFICATIONS, MRCU (RTS)

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	tips to fill in the form	- Put "G" if question reviewed and the requirements are		- Put "G" for "Green" if question reviewed and agreed, requirement						
A	**B**	**C**	**D**	**E**	**F**	**G**	**H**	**I**	**J**	**K**
	Part marking requirements and location (for part number, branding, production traceability etc)	G	2022-01-12: only for Retarder (system) --> label has PN, SN and prodcution date (further information has to be defined and aliigned togehter)	G		2022-01-25: Anders: E-marking and CO2-marking is required. Reference as for VR3250 marking plate. Branding required?	Jacobasch (Voith)	2022-01-12: only for Retarder (system) --> label has PN, SN and prodcution date (further information has to be defined and aliigned togehter) 2022-01-31: Sascha: Voith accept the req.		
	N/A	NA		NA						
3	**DSM (Digital Shape Model)**									
	List here the digital models describing the geometrical constraints on component(s). For each Digital Model, answer if the content is : understood (column C & D) and achievable (column E to H). If there are no Digital Models enter NA (non applicable) in column C	G	2022-01-11: please explain in detaild --> do you want outline dimensions of retarder (CAD)?	G		2022-01-25: Anders: CAD delivery and general technical meetings. CAD is according to Volvo definition.	Jacobasch (Voith)	2022-01-11: please explain in detaild --> do you want outline dimensions of retarder (CAD)? 2022-01-25: Sascha Jacobasch: With the Volvo comment, this is accepted/clear.		
	Complete Retarder	G	2022-01-11: please explain in detaild --> do you want outline dimensions of retarder (CAD)?	G		2022-01-25: Anders: CAD delivery and general technical meetings. CAD is according to Volvo definition.	Jacobasch (Voith)	2022-01-11: please explain in detaild --> do you want outline dimensions of retarder (CAD)? 2022-01-25: Sascha Jacobasch: With the Volvo comment, this is accepted/clear.		
	N/A	NA		NA						
4	**Standards**									
	List here all standards and sub-standard (Volvo or international standards) that are applicable for the component. **For each standard, answer if the content is : available at supplier location and understood** (column C & D) and achievable (column E to H). - if no standard is applicable for the component, enter NA in column C	G	2022-02-28, Jacobasch: no requirement	G			Jacobasch (Voith)	2022-02-28, Jacobasch: no requirement		
	Volvo Directive 001-0002 -Phase-out of chromium (VI) and lead	G	2022-01-18, Wassermann: Issue 1.2, 22/10/2014 available.	G						
	Volvo STD 100-0002 - Chemical substances which should not be present in processes or products within the Volvo Group. Volvo's black list.	G	2022-01-17, Wassermann: Issue 15, March 2021 available. In addition 100-0002L1.xls available	G						
	Volvo STD 100-0003 - Chemical substances which should not be present in processes or products within the Volvo Group. Volvo's grey list.	G	2022-01-17, Wassermann: Issue 18, March 2021 available. In addition 100-0003L1.xls available	G						
	Volvo STD 100-0005 - Chemical substances which shall not be present in products within the Volvo Group. Volvo's red list.	G	2022-01-17, Wassermann: Issue 10, March 2021 available.	G						
	Volvo STD 100-0006 - Reporting of substances and material composition to IMDS	G	2022-01-17, Wassermann: Issue 8, March 2021 available.	G						
	Volvo STD 103-0002 - Marking of plastic products	G	2022-01-17, Wassermann: Issue 3, March 2009 available.	G	2022-01-17, Wassermann: must be checked with MRCU supplier					
	Volvo STD 103-0010 - Marking of aluminum parts	G	2022-01-17, Wassermann: Issue 4, October 2012 available.	G	2022-01-17, Wassermann: must be checked with MRCU supplier					
	Volvo STD 105-0005 - Failure mode and effects analysis, FMEA	G	2022-01-18, Wassermann: Version 1, May 2009 available.	G	2022-01-18, Wassermann: must be checked with Voith Quality					

VOLVO

REVIEW OF TECHNICAL SPECIFICATIONS, MRCU (RTS)

Compliance Matrix

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A	B	C	D	E	F	G	H	I	J	K
	Volvo STD 515-0003 - Volvo EMC Standard	G	2022-01-18, Wassermann: Issue 5, February 2017 available.	G	2022-03-23: Wassermann: Test will be run according to ISO. If special test is required, it will be run before B20. Results might change when changing HW, and this is not considered as for today. 2022-01-18, Wassermann: must be checked with Voith DV					
	Volvo STD 5036,1 - Initial sample testing	G	2022-01-18, Wassermann: Issue 13, October 2011 available.	G	2022-03-09, Jacobasch: not only MRCU issue. bleongs to Retarder, but so far accepted 2022-02-08, Wassermann: check with Jacobasch 2022-01-18, Wassermann: must be checked with Voith Quality					
	Volvo STD 5051,3 - Label marking	G	2022-01-18, Wassermann: Issue 4, September 2016 available.	G	2022-02-08, Wassermann: label will be aligned with Volvo during the project, size on MRCU is limited 2022-01-18, Wassermann: must be checked with Voith Production					
	Volvo STD 5051,16 - Marking	G	2022-01-18, Wassermann: Issue 17, May 2020 available.	G	2022-02-08, Wassermann: label will be aligned with Volvo during the project, size on MRCU is limited 2022-01-18, Wassermann: must be checked with Voith Production / Engineering					
	Phoenix : 50135947 - ECU Power States Specification	G	2022-02-01: Issue 5.5.0 (ECU Power States Specification_5.5.0.pdf) available, can have influence to SW / HW of MRCU 2022-01-18, Wassermann: missing	G	2022-03-23, Wassermann: OK, we must discuss along the project how should we manage the power states 2022-03-17, Check the influence of type 2 2022-02-01, Wassermann: must be checked by Voith DV					
	Phoenix : 50136080 - CAN bus technical specification	G	2022-02-01: Issue 6.1 (ECU CAN interface test specification.pdf) available, can have influence to SW / HW of MRCU 2022-01-18, Wassermann: missing	G	2022-03-22, Miguel: CAN circuit and pin layout OK 2022-03-17, Wassermann: Layout and circuit to be checked with Rithesh. It should not be a problem 2022-02-01, Wassermann: must be checked by Voith DV					

VOLVO

REVIEW OF TECHNICAL SPECIFICATIONS, MRCU (RTS)

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	tips to fill in the form	- Put "G" if question reviewed and the requirements are		- Put "G" for "Green" if question reviewed and agreed, requirement						
A	B	C	D	E	F	G	H	I	J	K
	Phoenix : 50104249 - ECUs CAN interface test specification	G	2022-02-01: Issue 3.1 (ECU CAN interface test specification.pdf) available, can have influence to SW / HW of MRCU 2022-01-18, Wassermann: missing	G	2022-03-23, Wassermann: OK. Test will be run (probably before B20) 2022-03-22, Miguel: All CAN tests are required. Testing can be performed after having the full functional product i.e., B20 or C sample. We do not have any recommended transceiver list. Voith can choose any transceiver, but the tests are required to be conducted on the selected transceiver. 2022-03-17, Miguel: To be reviewed with Rithesh 2022-03-17, Wassermann: can we skip and approve this test using a CAN transceiver? 2022-02-01, Wassermann: must be checked by Voith DV					
	Phoenix : 50135907 - Generic diagnostic specification	G	2022-02-01: Issue 12.0.0 (SYS-GenericDiagnosticSpecification-12.0.0.pdf) available, can have influence to SW / HW of MRCU 2022-01-18, Wassermann: missing	G	2022-03-17, Wassermann: As for today, this can be accepted for diagnostics 2022-02-01, Wassermann: must be checked by Voith DV					
	Phoenix : 50135952 - Read and write specification	G	2022-02-01: Issue 14.5.0 (SYS-ReadAndWriteSpecification-14.5.0.pdf) available, can have influence to SW of MRCU 2022-01-18, Wassermann: missing	G	2022-03-17, Wassermann: As for today, this can be accepted for diagnostics 2022-02-01, Wassermann: must be checked by Voith DV					
	ER-XXX - Vibration requirements e.g. Vibration measurements Gearboxes	G	2022-01-18, Wassermann: missing 2022-02-03: ER for 16L done in 2015 can be used as a reference, until the new measurements are available. ER -661240	Y	2023-04-26: Jesper: Test planned for week22, 2023. Transmission being prepared. 2022-03-17, Wassermann: This can be accepted, but if the MRCU needs to be redesigned due to high vibration requirements, impact must be discuss 2022-03-02: Wassermann: Addressed to test engineers. 2022-03-02: Anders: Tortional vibration measurements have been shared with Voith test engineers.	2022-01-28:Requirement to be specified during development. Several reports may be required. //Anders	Siegl (Voith)	2022-04-26: Further vibration tests are planned with the C sample of the initial introducion of the MRCU. **2023-04-25: Vibration profile for Volvo has to be defined.**		
	SQAM - Supplier Quality Assurance Manual – Third Edition	G	2022-02-01: Fithh Edition 2019 available 2022-01-18, Wassermann: missing 2022-02-03: Anders: Not only MRCU, complete retarder to be considered.	G	2022-03-23, Wassermann: Still under review 2022-01-02, Wassermann: must be checked by project leader (forward to various departments) 2022-03-02: Wassermann: Under investigation at Voith Quality.	2022-01-28: Now uploaded on the SharePoint //Anders				
		NA		NA						

VOLVO

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5	**5-1 / Critical characteristics**									
	5-1 / special and Critical characteristics									
	If the component(s) has some criticality requirements, list here all the criticality [1] , [2] and [3] characteristics or [SC] / [CC]. For each of these characteristics answer if it is : understood (column C & D) and achievable (column E to H)	NA	2022-01-28: Anders: Results from FMEA to give the information.	NA	2023-03-09, Jacobasch: already answered for HW Retarder, compare RTS HW Retarder 2022-02-23: Wassermann: Check if this is required for MRCU. Already added for HW.					
	criticality [1] or [CC] characteristics	NA		NA	2023-03-09, Jacobasch: already answered for HW Retarder, compare RTS HW Retarder					
	N/A	NA		NA	2023-03-09, Jacobasch: already answered for HW Retarder, compare RTS HW Retarder					
	criticality [2] or [SC] characteristics	NA		NA	2023-03-09, Jacobasch: already answered for HW Retarder, compare RTS HW Retarder					
	N/A	NA		NA	2023-03-09, Jacobasch: already answered for HW Retarder, compare RTS HW Retarder					
	criticality [3] characteristics	NA		NA	2023-03-09, Jacobasch: already answered for HW Retarder, compare RTS HW Retarder					
	N/A	NA		NA	2023-03-09, Jacobasch: already answered for HW Retarder, compare RTS HW Retarder					
	For development suppliers, check that a criticality analysis has been performed according to Volvo standard (105-0007) or equivalent (incl. S/D/P FMEA usage)	G	2022-03-02: Wassermann: Ongoing FMEA.	G	2022-03-02: Anders: Volvo just need a confirmation that this is ongoing.					
		NA		NA						
	5-2/ Significant characteristics for regulatory compliance									
	For Volvo Powertrain components : if the component(s) characteristics have consequence on the emissions levels, list below all the "significant characteristics for regulatory compliance" (identified as 2R and 3R according to Volvo standard 105-0004). For each of these characteristics answer if it is : understood (column C & D) and achievable (column E to H). If the component does not have consequence on the emission levels, enter NA in column C.	NA		NA	2023-03-09, Jacobasch: already answered for HW Retarder, compare RTS HW Retarder					
	2R	NA		NA	2023-03-09, Jacobasch: already answered for HW Retarder, compare RTS HW Retarder					
	N/A	NA		NA	2023-03-09, Jacobasch: already answered for HW Retarder, compare RTS HW Retarder					
	3R	NA		NA	2023-03-09, Jacobasch: already answered for HW Retarder, compare RTS HW Retarder					
	N/A	NA		NA	2023-03-09, Jacobasch: already answered for HW Retarder, compare RTS HW Retarder					
	For Volvo Powertrain development suppliers : check that an emission analysis has been performed to identify the significant characteristics for regulatory compliance	NA		NA						

VOLVO

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	2022-03-25: Anders: The requirement from Volvo is that Voith is following the process to control all functions that may have impact on the emission. Volvo will not review it in detail since it´s connected to the D-FMEA performed by Voith. S-FMEA will be shared by Volvo.	G	2022-02-03: Anders: Valve leakage requirement , to control air pressure in the retarder when no torque is requested. This impact the drag loss of the system.	G	**2023-04-26: Jesper: Shall be considered in D-FMEA, C-samples (?)** 2022-03-17: Wassermann: Lubrication pulse will affect the drag loss. Voith needs to ensure to flash the correct SW to avoid malfunction of the lubrication pulse. 2022-02-23: Wassermann: Check what function that impact the drag loss and how to control this in production. 2022-01-17, Wassermann: must be discussed with Volvo. Seems not relevant for Retarder. 2022-03-02: Anders: Check and compare with similar systems how this could be applied on ECU or SW."		Wassermann (Voith) Siegl (Voith)	2022-05-09, Wassermann: Advanced D-FMEA for the MRCU. Voith will check internally if 2 D-FMEA are required (one for HW and one for MRCU). But for MRCU, D-FMEA should take place before B20 2022-04-29, Siegl: The impact on emission is evaluated during the FMEA analysis.		
		NA		NA						
6	**TR - Technical Requirements**									
	List the TR document number(s) (references) applicable for the component(s). If no TR applicable for the component(s), enter NA (non applicable) in column C	G	2022-02-18, Jacobasch: no requirement	G						
B20	1.6 Functions	G	2023-04-14: Driver Axle Protection signal possible to receive? 2023-05-24: DAP will be implemented.	Y	**2023-04-26:Jesper: System diagram to be updated with new input, input needed from Volvo.**		Siegl (Voith)	**2023-04-25: The DAP message as a TSC1 message can be used by the MRCU. A s/w change will be required.**		
B20/No action	1.6.1 Arbitration of requested torque **1.6.1 Arbitration of requested torque** A number of control units can request torque from the retarder. Since the request can be simultaneous there is an arbitration to decide which torque that shall be used as the set point. Following control units shall be able to request braking torque from the retarder: DimRM Req Id = SysL2_REQ_1098 Following control units shall be able to request braking torque from the retarder: a. VMCU b. ABS/EBS c. EECU d. TCM Note: The torque limitation for smart cruise is handled via a signal to the CCB. The CCB will limit the request of braking torque. DimRM Req Id = SysL2_REQ_1104 The arbitration of the different requested torque shall be done according to: a. No requested torque: If there are no requested torque to the retarder the braking torque shall be zero. b. No requested torque with control but with limit: If there is not any requested torque that wants to control the retarder the braking torque shall be zero. c. No requested torque with limit but with control: If there is not any requested torque that wants to limit the retarder torque the torque is equal to the control command with the highest torque. d. Requested torque with both limit and control: If there are requested torques that wants to control the torque and requested torques that wants to limit the torque, the requested torque is equal to the highest of the control command but limit to the lowest limit command.	G		G	**2023-04-14:Jesper: Added to TR as information**.					

VOLVO

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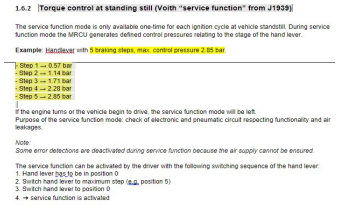
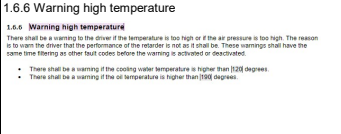
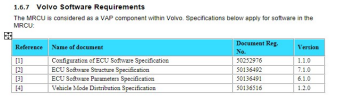
A	**B**	**C**	**D**	**E**	**F**	**G**	**H**	**I**	**J**	**K**
B20/No action	1.6.2 Torque control at standing still 	G		G	**2023-04-14:Jesper: Added to TR as information, also exist in J1939 standard. Service function steps (mPa) shall be defined during B20 developement aswell as amount of steps. May differ for different installations.**		Siegl (Voith)	**2023-04-25: The respective pressure value of the step is defined by the amount of steps and the maximum pressure. Special pressure values cannot be calibrated. For the service function there have to be percentage values on the used TSC1 message. 2023-04-26: Can be calibrated in the MRCU. Jesper confirm percentage values used on TSC1 message.**		
B20/No action	1.6.3 Torque reduction due to high water temperature	G		G	**2023-04-14: Jesper: added as information.**					
B20/No action	1.6.4 Torque limitation due to low oil temperature	G		G	**2023-04-14: Jesper: added as information.**					
B20/No action	1.6.5 Torque reduction due to high oil temperature	G		G	**2023-04-14: Jesper: added as information.**					
B20	1.6.6 Warning high temperature 	Y		Y	**2023-04-26: Jesper: Agreed not to set DTC as in a normal down regulation situation however can be set for higher temperatures than specified. Jesper check internally need for this. 2023-04-14: Jesper: We would like to have a DTC set for when above certain limits in oil or water. These limits need to be defined.**		Siegl (Voith)	**2023-04-25: Voith recommends not to use a DTC for the indication of a normal down regulation. On the CAN message ERC1 the state of retarder in "temperature down regulation mode" is provided. The message RF "Driveline Retarder Overheat Indicator" can be used. A DTC for exceeding the specified limits of the water/oil temperature is not yet implemented. If this is required a s/w change will be necessary.**		
B20	1.6.7 Volvo Software Requirements 	Y		Y	**2023-04-14: Jesper: Software specifications added to TR. To be evaluated after Voith have reviewed them.**		Siegl (Voith)	**2023-04-25: Specifications are currently reviewed by the Voith experts.**		
B20/No action	1.6.8 Chemicals in air supply	G		G	2023-04-14: Jesper: added as information.					
B20/No action	1.6.9 Pressure	G		G	2023-04-14: Jesper: added as information.					
B20/No action	1.6.10 Air Consumption	G		G	2023-04-14: Jesper: added as information.					
B20/No action	1.6.11 Leakage	G		G	2023-04-14: Jesper: added as information.					

VOLVO

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A	B	C	D	E	F	G	H	I	J	K
	1.7 General test conditions	G		G	2022-01-18, Wassermann: mapping between MRCU "operating mode" and FSC definiton must be provided by Voith 2022-02-23: Wassermann: Updated matrix to be sent to Miguel.					
	1.7.1 Initial and final status of component	NA	2022-01-18, Wassermann: 3 units should be sent to Volvo --> must be clarified!	NA	2022-01-28: Anders: Volvo cannot perform any additional tests on the parts, Voith will perform the inspection on behalf of Volvo. No need to send the parts after finalized test.					
	1.7.1.1 Initial function test normal climate	G		G	2022-01-18, Wassermann					
	1.7.1.2 Initial function test cold climate	G		G	2022-01-18, Wassermann					
	1.7.1.3 Initial function test hot climate	G		G	2022-01-18, Wassermann					
	1.7.1.4 Final function test normal climate	G		G	2022-01-18, Wassermann					
	1.7.1.5 Final function test cold climate	G		G	2022-01-18, Wassermann					
	1.7.1.6 Final function test hot climate	G		G	2022-01-18, Wassermann					
	1.7.1.7 Opening and inspection	G		G	2022-01-18, Wassermann: must be checked with Voith DV					
	1.8.1 Test Sequence	G	2022-01-18, Wassermann: Voith will provide test sequences planned for MRCU --> discussion with Volvo necessary	G	2022-03-23, Miguel: Test sequences approve as for today. Open issues within tests need to be clarified during project 2022-03-17, Miguel: Under review.					
B20/No action	1.8.2 Monitoring - Design review	G		G	2022-01-18, Wassermann: to be clarified, as MRCU is in series production upon Q3/2022 (for other customers). If seperate tests are necessary for Volvo this requirement could be recognized. 2022-01-28: Anders: Check internally if this can be removed. 2022-02-03: Anders: Remove					
B20	2.1 Reliability/ Durability	G	2023-04-17: Jesper: 900 000 activasions and 950 000 km for 2.22 gear ratio. 900 000 activasions and 700 000 km for 1.9 gear ratio. Pass criteria full functionality of the MRCU over load cycle. 2022-01-18, Wassermann: not complete 2022-02-01: Anders: A minimum of 1250 000 km and 1200 000 activations. Voith to get feedback on the complete system limitations.	G	2023-04-17: Jesper: To be confirmed during B01/B20 testing. 2022-01-18, Wassermann: mileage ok 2022-01-28: Add missing info			2023-04-26: MRCU tested at Voith for 1,2 million km, 4.96 million activation (95% completed). 2023-05-25: Lifetime test was passed.		

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A	B	C	D	E	F	G	H	I	J	K
B20	2.1.1 Reliability expectancy	G		G	**2023-04-17: Jesper Any update on reliability expectancy/failure rate of MRCU? TBD** 2022-02-03: Wassermann: Done for safety parts, not for other parts. To be checked if this can be added as well. 2022-01-18, Wassermann: must be checked with Voith DV		Wassermann (Voith) Siegl (Voith)	2022-05-09: Wassermann: For the safety related parts, the ISO 26262 is covering the reliability expectancy requirements. For the rest of the components, test is running. 2022-04-29, Siegl: It is a big effort to do a reliability/durability analysis for the hole unit. It has to be clarified with Volvo if this is necessary. **2023-04-26, Siegl: Tests are 95% done.** **2023-05-25: Lifetime test was passed.**		
B20	2.1.1.1 MTBF - Calculation	G	2022-01-18, Wassermann: not complete 2022-02-01: Anders: Check criteria with E&E (Miguel)	G	**2023-04-17: Jesper: Any test resport available from end of 2022?** 2022-03-23, Miguel: Considering a test temperature of 120 degrees, the minimum time required (pass criteria) is 1500 h. 2022-03-17, Miguel: Passing criteria will be added w.2211		Siegl (Voith)	2022-04-29, Siegl: This is done within the qualification test "Hochtemperaturdauerlauf". The rsults will be available by the end of 2022. **2023-04-26, Siegl: Test is 95% done.** **2023-05-25: Lifetime test was passed.**		
	2.1.2 Vibration	G		G						
B20	2.1.2.1 Random vibration & temperature cycling - Test	G		Y	**2023-04-17: Jesper: Vehicle vibration test running as input parameters. Jesper confirm with Anders, TBD** 2022-03-17, Miguel: Modified vibration and temperature cycling approve 2022-01-18, Wassermann: must be checked with planned test, we plan other temperature profile	2026-04-26: Combine 2.1.2.1 and 2.1.2.2.	Siegl (Voith)	**2023-04-26, Siegl: If the ISO 16750-3 is used, vehicle measurments are not needed.**		
B20	2.1.2.2 Sinus vibration & temperature cycling - Test	G		Y	**2023-04-17: Jesper: Vehicle vibration test running as input parameters. Jesper confirm with Anders, TBD** 2022-03-17, Miguel: Modified vibration and temperature cycling approve 2022-01-18, Wassermann: must be checked with planned test, we plan other temperature profile		Siegl (Voith)	**2023-04-26, Siegl: If the ISO 16750-3 is used, vehicle measurments are not needed.**		

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A	B	C	D	E	F	G	H	I	J	K
B20	2.1.2.3 Shock test (MRCU) The shock test shall be performed in acc with ISO 16750-3, section 4.2.3. The shock measured at the same position as in vibration test (Section 12.3). Pulse shape: half sinusoidal Peak acceleration: 20000 [m/s2] Duration: 0.08 [ms] Number of cycles: 1.6 million in each direction. Direction of shock: ±X (Longitudinal), ±Y (Transversal), ±Z (Vertical). Temperature: Room temperature Number of samples: 4 Installation situation: depressurized, non-activated. Failure criterion: Fail of function test after testing procedure	G	2022-02-03: Anders: Range gear shift to be checked.	Y	**2023-04-26: Jesper: Call for alignment on vibration tests. Which ones are more relevant for the application? Focus on this and remove the others. Decide how to evaluate functionality after vibrational test? Send to Voith/Test at Volvo?** 2023-04-14: Test procedure from HW TR copied to MRCU TR. Function test needed after Volvo test procedure (600 000 load cycles for range shift fork). Check how this shall be performed. 2022-04-07: Miguel: Voith will run C sample test in May. Requirements shared by Volvo will be reviewed internally in order to accept/relax the requirements, as the pulse durability is 2 ms instead of less than 1 ms and the acceleration peak can not be achieved. Follow up during week 16. 2022-03-25: Anders: New		Siegl (Voith)	2022-06-07: Siegl: Test proceduce agreed to be run at Volvo. Graphs/data with higher resolution still to be shared by verification team. 2022-05-09: Parallel meeting ongoin. Clear diagrams/plots with higher resolution to be shared by Volvo. Endurance proposal test shared by Volvo and to be analyzed by Voith during w.2219. 2022-04-26, Siegl: Voith is awaiting a revision of the test requirements from Volvo. **2023-04-26, Siegl: A function test/appraisal can be performed at Voith or the subsupplier after the shock test or the MRCU is put on the rig after the test.**		
B20	2.1.2.6 Component Critical Frequencies - Test	G	2022-01-18, Wassermann: MRCU is a mechatronical ECU --> focus on EE part? 2022-02-01: Anders: Complete MRCU to be considered.	G	**2023-04-17: Jesper: Any progress prior to B20?** 2022-03-17: Wassermann: test in resonance not planned. Suggestion: measure resonance and perform test before B20 2022-02-01: Wassermann: To be measured on C-samples. Timing of the test to be added.		Siegl (Voith)	**2023-04-26, Siegl: Measurements have to be planned.**		
B20	2.1.2.8 Component Vibration Endurance - Test	G	2022-01-18, Wassermann: when will profile available? Could result in change request to MRCU! 2022-02-01: Anders: Vibration ER to be used for reference truck. A new ER will be created during the project for the new trucks. 2022-03-02: Anders: Torsional vibration measurement stored on SharePoint, to be used for initial compliance study.	G	**2023-04-17: Jesper: Any progress prior to B20?** 2022-03-17: Wassermann: test in resonance not planned. Suggestion: measure resonance and perform test before B20 2022-02-01: Wassermann: Input from Voith field tests can be used for validation in addition to Volvo measurements.		Siegl (Voith)	**2023-04-26, Siegl: The Volvo specific excitation spectrum is needed. The axis has to be defined.**		
	2.1.3.1 Degrees of protection (IP code) Test	G		G						
B20	2.1.3.2 Dust - Test	G		G	**2023-04-17: Jesper: Test performed?** 2022-03-17: Miguel: 6K protection added. OK 2022-01-18, Wassermann: must be checked with planned test		Siegl (Voith)	**2023-04-26, Siegl: Dust test was passed on 2023-02-08.**		
	2.1.4 Moisture intrusion	G		G						
	2.1.5 Water intrusion	G		G						
B20	2.1.5.1 Ice water shock, Submersion - Test	G		G	**2023-05-03:** IPX7 test not yet performed. Water splash test will be performed end of June. **2023-04-17: Jesper: Test performed?** 2022-03-17: Miguel: OK 2022-01-18, Wassermann: must be checked with planned test, as we want to pre heat the MRCU (stronger requirement)		Siegl (Voith)	**2023-04-26, Siegl: This test was replaced by an water immersion test (IPX7/ ISO 20653) and a water splash test (ISO 16750-4) because of an issue with the harness plug, not the MRCU itself.**		

VOLVO

REVIEW OF TECHNICAL SPECIFICATIONS, MRCU (RTS)

Compliance Matrix

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A	B	C	D	E	F	G	H	I	J	K
	2.1.5.2 Degree of protection (IP code) - Test	G		G						
B20	2.1.5.3 Salt spray - Test	Y		Y	**2023-05-03: No corrosion on the inside of the MRCU after test. Jesper check the req's on corrosion on the outside, currently not in TR.** 2023-04-13: Jesper: Operating mode E is not possible to perform, lack of compressed air in test chamber. OK to deviate from E? 2022-03-25: Anders: Requirement from sub-supplier. OK 2022-03-23: Miguel: Why are you performing test Ka instead of Kb? Special reason? 2022-01-18, Wassermann: must be checked with planned test.	**2023-04-13: Jesper check if OK to deviate from this requirement.**	Siegl (Voith)	**2023-04-26, Siegl: This test can only be performed in Mode D1 by our supplier. Will 144h be enough?**		
B20	2.1.5.4 Pressure wash (adhesion and tightness) - Test	G	2022-04-25: TR updated 2022-03:25: Anders: Update TR with correct and detailed test proceedure. 2022-01-18, Wassermann: Lab Code 26500-759?	G	**2023-04-17: Jesper: Test performed?** 2022-04-07: Miguel: 100 bars as pressure accepted. 2022-03:25: Anders: New information sent on Volvo process. Main difference is the pressure. 2022-03-23, Wassermann: Current procedure to be shared by Voith. Volvo to review it. 2022-03-23: Miguel: Lab Code 265000-759 removed. Agree on high pressure values required		Siegl (Voith)	**2023-04-26, Siegl: Dust test was passed on 2023-02-17.**		
	2.2.1 Operating temperature	G		G	2022-03-09, Jacobasch: comment Volvo 2022-03-02 accepted 2022-01-18, Wassermann: operating temperature Tmin (environment) should ne lowered to +120°C	2022-03-02: Anders: OK to lower requirement to 120 C.				
B20	2.2.1.1 High Temperature Lifetime Endurance Test	G		G	2023-05-17: Jesper: Replaces "2.2.1.1 Heat resistance - Aeging in heat Test" and "2.2.1.3. High temperature, Operation Test". Update TR.					
~~**B20**~~	~~2.2.1.1 Heat resistance - Ageing in heat - Test~~	~~G~~	~~2022-01-18, Wassermann: not complete~~	~~G~~	~~**2023-04-17: Jesper: Test performed?**~~ ~~2022-05-09: Miguel: MRCU test overview proposal for heat resistance ageing in heat test OK~~ ~~2022-03-17: Miguel: It should be ok, but need validation confirmation~~ ~~2022-01-18, Wassermann: must be checked with planned test (planned ~3100h).~~		~~Siegl (Voith)~~	~~2022-04-26, Siegl: Achievable with qualification test "Hoch-Temperaturdauerlauf"~~ ~~**2023-04-26, Siegl: Test is 95% done.**~~		

VOLVO

REVIEW OF TECHNICAL SPECIFICATIONS, MRCU (RTS)

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A	B	C	D	E	F	G	H	I	J	K
B20	2.2.1.2 Cold temp wake-up - Test	G		G	**2023-05-03: Will be performed together with endurance test and new PCB layou -> most likely done in october 2023.** **2023-04-17: Jesper: Test performed?** 2022-03-17: Wassermann: Test can be considered before B20. 2022-01-18, Wassermann: new test, must considered at Voith DV		Siegl (Voith)	**2023-04-26, Siegl: As this is a new test, it has to be put in place. This is not done yet.**		
~~**B20**~~	~~2.2.1.3 High temperature, Operation - Test~~	~~G~~		~~G~~	~~**2023-05-03: Awaiting completed test -> done with 24V constant supply. 3111 hours target of testing time rather than 500 hours. Jesper check need of modulation, probably ok without.**~~ ~~2023-04-17: Jesper: Test performed?~~ ~~2022-03-23, Wassermann: Supplier voltage can be modelated but need clarification with sub supplier~~ ~~2022-03-18: Wassermann: To be clarified if test can be adjusted~~ ~~2022-01-18, Wassermann: must be checked with planned test (planned ~3100h). Not considered: modulated operating voltage.~~		~~Siegl (Voith)~~	~~2022-04-26, Siegl: Achievable with qualification test "Hoch-Temperaturdauerlauf"~~ ~~**2023-04-26, Siegl: Test is 95% done. There was no modulation of the supply voltage.**~~		
	2.2.2 Climate cycling	G		G	2022-03-18: Headline test 2022-01-18, Wassermann: some parameters could be different, especially at low tempertaure (e.g. air leakage)					
	2.2.2.1 Stabilization time - Test	G		G						
	2.2.2.2 Rapid change of temperature (thermal shock) - Test	G		G						
B20	2.2.2.3 Temperature cycling - Test	G		G	**2023-04-17: Jesper: Test performed?** 2022-05-09: Miguel: MRCU test overview proposal for temperature cycling test OK 2022-03-18: Miguel: To review internally with validation team 2022-03-18: Wassermann: Test it is not planned. 2022-03-09, Wassermann: in clarification with Volvo		Siegl (Voith)	2022-04-26, Siegl: There is no respective test available yet. For reference there will be a thermal shock test of the PCBA w/o MRCU housing. Furthermore our supplier is performing a thermal shock test with the whole MRCU. If this is not sufficient, Voith can perform a temperature cycling test according to the Volvo requirements. 2022-09-30 (MRCU thermal shock test) **2023-04-26, Siegl: The MRCU thermal shock test (DIN EN 60068-2-14 Na) was passed on 2022-11-21. The thermal shock test of the PCBA w/o MRCU housing was passed in 2023-03.**		

VOLVO

REVIEW OF TECHNICAL SPECIFICATIONS, MRCU (RTS)

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A	B	C	D	E	F	G	H	I	J	K
B20	2.2.2.4 Temperature step - Test	G		G	**2023-05-03: Chapter 4.5.2 does not exist, Jesper check what has been done on TCM. Temp step test exist at Voith, according to ISO 60068-2-14 and was passed in Nov 2022.** 2023-04-23: Jesper: Let's check the steps and see if we need further testing. 2022-03-18: Wassermann: To clarify steps. In case steps are too low, test will be redo with more steps 2022-03-09, Wassermann: in clarification with Volvo		Siegl (Voith)	**2023-04-26, Siegl: There is no chapter 4.5.2 in ISO 16750-4:2010(E).**		
	2.2.3 Process oven temperature	G		G	2022-03-18: Miguel: OK 2022-01-18, Wassermann: must be checked with planned test.					
	2.2.3.1 Heat resistance - short term - Test	G	2022-01-18, Wassermann: Temperature +80°C vs. 100°C in 2.2.3?	G	2022-03-18: Miguel: OK 2022-03-17: Miguel: It should be ok, but need validation confirmation 2022-03-09, Wassermann: in clarification with Volvo					
	2.2.4 Moisture	G		G	2022-03-18: Miguel: Headline 2022-03-09, Wassermann: in clarification with Volvo					
	2.2.4.1 Composite temperature/Humidity cyclic - Test	G		G	2022-03-18: Miguel: OK 2022-03-09, Wassermann: in clarification with Volvo					
	2.2.4.2 Damp heat, steady state - Test	G		G	2022-03-18: Miguel: OK 2022-03-09, Wassermann: in clarification with Volvo					
	2.2.5 Air pollution	G	2022-01-18, Wassermann: which pollutions?	G	2022-03-18: Miguel: OK 2022-03-18: Protection 6K9K 2022-03-02: Anders: Check if this requirement is required or not.					
	2.3.1 Chemicals	G	2022-02-01, Wassermann	G	2022-05-09: Wassermann: Still list to be shared. 2022-03-18: Wassermann: Still under evaluation with supplier. List will be provided next week 2022-02-01, Wassermann: chemicals to be checked against MRCU specification (SchneiC)		Wassermann (Voith) Siegl (Voith)	2022-06-07, Jesper: OK according to the list and information provided by Voith. Test according to standard. 2022-04-26, Siegl: If the requirements in the supplier specification are fulfilled, the Volvo requirements will be met. If there are differences, there will be delta tests. 2022-10-31		
B20	2.3.1.1 Resistance to chemical loads - Test	G	2022-02-01, Wassermann	G	**2023-05-03: Jesper: Test planned at supplier, no date available yet.** 2022-05-09: Wassermann: Still list to be shared. 2022-03-18: Wassermann: Still under evaluation with supplier. List will be provided next week 2022-02-01, Wassermann: chemicals to be checked against MRCU specification (SchneiC)		Wassermann (Voith) Siegl (Voith)	2022-06-07, Jesper: OK according to the list and information provided by Voith. Test according to standard. 2022-04-26, Siegl: If the requirements in the supplier specification are fulfilled, the Volvo requirements will be met. If there are differences, there will be delta tests. 2022-10-31		

VOLVO

REVIEW OF TECHNICAL SPECIFICATIONS, MRCU (RTS)

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A	B	C	D	E	F	G	H	I	J	K
	2.3.2 Impact strength	G	2022-02-01, Wassermann	G	2022-02-01, Wassermann					
~~B20~~	~~2.3.2.1 Impact strength - falling weight ("room" temp) - Test~~	~~G~~	~~2022-02-01, Wassermann~~	~~Y~~	~~**2023-05-11: Jesper:** Concern regarding interface between MRCU and retarder, secure functionality after impact. Not possible to perform internally, Steffen check possiblity at supplier, most likely to perform only on MRCU (in climate chamber). Follow up with Cristoph Lutz. 2023-05-03: Jesper: Free fall test was passed for MRCU. 2022-03-18: Wassermann: Test will be run, but visual damage in the plastic cover is accepted. 2022-02-01, Wassermann: test not planned for MRCU, new requirement~~		~~-~~	~~-~~		
~~B20~~	~~2.3.2.2 Impact strength - falling weight (cold temp) - Test~~	~~G~~	~~2022-02-01, Wassermann~~	~~Y~~	~~**2023-05-11: Jesper:** Concern regarding interface between MRCU and retarder, secure functionality after impact. Not possible to perform internally, Steffen check possiblity at supplier, most likely to perform only on MRCU (in climate chamber). Follow up with Cristoph Lutz. 2023-05-03: Jesper: Test not planned for now but should be no problem. Jesper check if needed -> how to execute? Compare to TCM. 2022-03-18: Wassermann: Test will be run, but visual damage in the plastic cover is accepted. 2022-02-01, Wassermann: test not planned for MRCU, new requirement~~		~~-~~	~~-~~		
	2.3.3 Material and composite materials properties	G	2022-02-01, Wassermann	G	2022-03-18: Wassermann: OK 2022-02-01, Wassermann: must be checked for all plastic parts					
	2.3.3.1 Material properties – Documentation	G	2022-02-01, Wassermann	G	2022-03-18: Wassermann: OK 2022-02-01, Wassermann: forward of datasheets possible?					
	2.4 Maintainability	G	2022-02-01, Wassermann: chapter reference not longer correct	G	2022-03-18: Wassermann: OK 2022-02-01, Wassermann: MRCU could be removed by unscrew 4 screws and dismount 2 HDSCS plugs. To be clarified: VOSS 232					
	2.4.1 Maintainability - Evaluation	G	2022-02-01, Wassermann	G	2022-02-01, Wassermann					

VOLVO

REVIEW OF TECHNICAL SPECIFICATIONS, MRCU (RTS)

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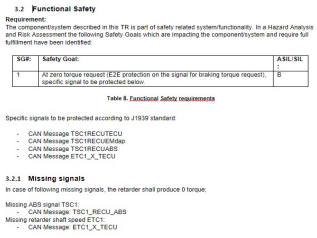
	tips to fill in the form	- Put "G" if question reviewed and the requirements are		- Put "G" for "Green" if question reviewed and agreed, requirement						
A	B	C	D	E	F	G	H	I	J	K
	3.1.1 Fire safety	G	2022-02-01, Wassermann: also relevant for retarder itself? * A crash/collision/rollover shall not lead to short circuit or leakage of burning liquids * Design should be done in order to avoid accumulation of dirt/organic material and to make it easy to keep them clean, especially areas which are exposed to he	G	2022-03-18: Wassermann: OK 2022-02-01, Wassermann: check with retarder HW					
	3.1.1.1 Flammability (burning behaviour) - Test	G	2022-02-01, Wassermann	G	2022-03-18: Wassermann: OK 2022-02-01, Wassermann: test not planned for MRCU, new requirement					
B20	3.1.1.2 Flammability plastics materials (UL94) - Test	G	2022-02-01, Wassermann	G		Material change request sent to Voith supplier, will change during mid B20/C-samples. 2022-03-18: Wassermann: Material of the cover needs to be change. Not possible for B-sample. To be checked for				
B20	3.2 Functional Safety  3.2 **Functional Safety** **Requirement:** The component/system described in this TR is part of safety related system/functionality. In a Hazard Analysis and Risk Assessment the following Safety Goals which are impacting the component/system and require full fulfillment have been identified: SG#: Safety Goal: ASIL/SIL 1 All zero torque request (E2E protection on the signal for braking torque request), specific signal to be protected below. B **Table 8. Functional Safety requirements** Specific signals to be protected according to J1939 standard: - CAN Message TSC1RECU/TECU - CAN Message TSC1RECU/EMdap - CAN Message TSC1RECU/ABS - CAN Message ETC1_X_TECU 3.2.1 **Missing signals** In case of following missing signals, the retarder shall produce 0 torque; Missing ABS signal TSC1: - CAN Message: TSC1_RECU_ABS Missing retarder shaft speed ETC1: - CAN Message: ETC1_X_TECU	G	2022-02-01, Wassermann: please complete --> specified in SOW --> move to TR MRCU	G	**2023-04-14**: Jesper: Signals to be protected added in TR aswell as action on missing signal. To be reviewed. Must be given in J1939 standard that the TSC1 signal is monitored. 2022-03-18: Wassermann: Safety requirements to be added in the TR 2022-02-01, Wassermann: ASIL B is considered for MRCU		Siegl (Voith)	2022-06-07, Wassermann: If J1939 is applicable, there should not be a problem. If we are out of the standard, SW updates might be required causing possible delays and/or cost impact. 2022-06-07, Miguel: Meeting to align with SW/E&E required. Siegl to send a time slot proposal along w2225. 2022-04-29, Siegl: The safety goal "Zero torque request (E2E protection on the signal for braking torque request)/ASIL B" has to be clarified. 2023-04-26, Siegl: SG to be clarified. Signal protection may need s/w change as the DAP message (TSC1) has to be newly implemented. 2023-05-11: Jesper: ID of the DAP need to be shared. MRCU shall also listen to the ABS		
	4.1 Design for recycling and minimizing environmental impact	G	2022-02-01, Wassermann: also relevant for retarder itself?	G	Mwa x JacobaS --> close					
	4.2 Design for recycling and minimizing environmental impact – UD Trucks	G	2022-02-01, Wassermann: also relevant for retarder itself?	G	2022-03-18: Wassermann: OK					
	4.3 Material selection	G	2022-02-01, Wassermann: also relevant for retarder itself?	G	2022-03-18: Wassermann: OK					
	4.3.1 Material selection – Design review	G	2022-02-01, Wassermann: also relevant for retarder itself?	G	2022-03-18: Wassermann: OK					
	4.4 Substances not to be present in product	G	2022-02-01, Wassermann: also relevant for retarder itself?	G	2022-03-18: Wassermann: OK					
	4.4.1 Substances in product - Reporting	G	2022-02-01, Wassermann: also relevant for retarder itself?	G	2022-03-18: Wassermann: OK					
	4.5 Avoid critical materials	G	2022-02-01, Wassermann: also relevant for retarder itself?	G	2022-03-18: Wassermann: OK					
	4.5.1 Avoid critical materials - Design review	G	2022-02-01, Wassermann: also relevant for retarder itself?	G	2022-03-18: Wassermann: OK					

VOLVO

REVIEW OF TECHNICAL SPECIFICATIONS, MRCU (RTS)

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	5.1 Vehicle regulations and certification	G	2022-02-01, Wassermann	G	2022-02-01: ECE R10 planned for MRCU. AIS 004 part 3 and GB 14023-2011 not planned yet --> certificate necessary? Voith will also check internally. UNECE 105 (ADR) --> impact on retarder?		Siegl (Voith)	**2023-05-11: Jesper:** Cross check TR status. 2022-06-07: China and India certification are not required. Delete them from TR. 2022-05-09: Miguel: Check if vehicle regulations and certifications to China and India are required 2022-04-29, Siegl: The MRCU will be certified according to UN/ECE R10.05. A certification in accordance with other regulations will be performed on request. (An offer shall be provided to Volvo.)		
	~~5.1.1 Vehicle regulations and Certification - Design review~~	~~NA~~	~~2022-02-01, Wassermann~~	~~NA~~	~~2022-02-01: ECE R10 planned for MRCU. AIS 004 part 3 and GB 14023-2011 not planned yet --> certificate necessary? Voith will also check internally. UNECE 105 (ADR) --> impact on retarder?~~	~~DELETE~~	~~Siegl (Voith)~~	~~2022-05-09: Miguel: Check if vehicle regulations and certifications to China and India are required 2022-04-29, Siegl: The MRCU will be certified according to UN/ECE R10.05. A certification in accordance with other regulations will be performed on request. (An offer shall be provided to Volvo.)~~		
	6.1 Component weight	G	2022-02-01, Wassermann	G	2022-03-18: Miguel: OK 2022-03-18: Wassermann: 2.5 Kg confirmed 2022-02-01: RCM still in text. Weight of MRCU will be < 2,5kg (estimation).					
	7.1.1 Silicone free	G	2022-02-01, Wassermann	G	2022-02-01: MRCU will contain silicon, materials are forwarded to Volvo --> add description		Siegl (Voith)	2022-06-07: Jesper: OK 2022-06-07: Wassermann: 2 silicon components are included in the MRCU. An O-ring in the cover and a PCB glue (not liquid). No risk foreseen. 2022-05-09: Miguel: Volvo to review the list and send feedback to Mirco 2022-04-29, Siegl: The list of materials was fowarded to Volvo. Voith is awaiting a response as exceptions might be accepted upon Volvo approval.		
	7.1.1.1 Silicone free - Design review	G	2022-02-01, Wassermann: B-release for Volvo, but MRCU already in production.	G	2022-03-23: Wassermann: OK 2022-02-01: MRCU will contain silicon, materials are forwarded to Volvo --> add description					
	7.1.2 Sulphur free rubber	G	2022-02-01, Wassermann	G	2022-03-23: Wassermann: OK 2022-02-01: must be checked with supplier and Voith DV					
	7.1.2.1 Sulphur - Design review	G	2022-02-01, Wassermann: B-release for Volvo, but MRCU already in production.	G	2022-03-23: Wassermann: OK 2022-02-01: must be checked with supplier and Voith DV					

VOLVO

REVIEW OF TECHNICAL SPECIFICATIONS, MRCU (RTS)

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	7.1.3 Lead Free	G	2022-02-01, Wassermann	G	2023-05-17: Jesper: In the specification to PCB supplier. 2022-02-01: must be cross checked with Voith DV					
	7.1.3.1 Lead free - Design review	G	2022-02-01, Wassermann	G	2022-02-01, Wassermann					
	7.1.4 Connectors	G	2022-02-01, Wassermann: must be changed of connectors for MRCU.	G	2022-03-18: Miguel: TR needs to be updated with the connector. Then OK Suggestion for TR					
	7.1.5 Pin description	G	2022-02-01, Wassermann: must be changed of connectors for MRCU.	G	2023-05-17: Jesper: Connectors in TR, OK 2022-03-18: Miguel: TR needs to be updated with the connector. Then OK Suggestion for TR					
	7.1.5.1 Pin description - Documentation	G	2022-02-01, Wassermann	G	2022-02-01, Wassermann					
	7.1.6 Printed Circuit Board (PCB) Assemblies and handling	G	2022-02-01, Wassermann	Y	2022-03-18: Wassermann: Still under investigation 2022-02-01: must be cross checked with Voith DV		Siegl (Voith)	2022-06-07, Siegl: Feedback will be provided with the information that supplier is missing. 2022-05-09: Miguel: Jesper to review SDS coating material selection matrix (IPCJ-STD-001 standard) missing information. 2022-04-29, Siegl: TR can be accepted, except the coating material selection matrix. The SDS has to be checked for the coating and there are no details in the IPC J-STD-001. **2023-04-26, Siegl: Feedback from subsupplier pending.**		
	7.1.6.1 Design and process handling	G	2022-02-01, Wassermann: must be checked within Voith	G						
B20	7.2.1 End Of Line functional - Test	G	2022-02-01, Wassermann: must be checked within Voith	G	**2023-05-17: Jesper: Considers the whole system. EOL definition pending. Discuss with Anders, shall we move to HW TR?** 2022-03-18: Wassermann: To be defined along the project					
B20	7.2.1.1 EoF - Design review	G	2022-02-01, Wassermann: B-release for Volvo, but MRCU already in production.	G	**2023-05-17: Jesper: Considers the whole system. EOL definition pending. Discuss with Anders, shall we move to HW TR?** 2022-02-01, Wassermann: B-release for Volvo, but MRCU already in production.					
	7.2.2 In Circuit Test	G	2022-02-01, Wassermann: ICT test yes, review and agreement with Volvo must be checked by Voith	G	2023-05-17: Steffen check if possible to share process description from sub supplier. 2022-02-01, Wassermann: ICT test yes					
	7.2.2.1 ICT - Design review	G	2022-02-01, Wassermann: ICT test yes, review and agreement with Volvo must be checked by Voith	G	2022-02-01, Wassermann: ICT test yes					

VOLVO

REVIEW OF TECHNICAL SPECIFICATIONS, MRCU (RTS)

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	Requirement / Topic	Are the requirements clear and understood ? **"Green / Yellow / Red " "GYR" status**	Enter here any needed comment If the requirement is not understood, describe what needs to be clarified	Are the requirements achievable ? **"Green / Yellow / Red " "GYR" status**	If the requirements are not achievable, describe what the concern is	Needed Action	Responsible	Comments and updates on the action plan	Due date	Status Open / Closed
	tips to fill in the form	- Put "G" if question reviewed and the requirements are		- Put "G" for "Green" if question reviewed and agreed requirement						
A	B	C	D	E	F	G	H	I	J	K
B20	7.3.1 ECU Power States Volvo Standard 7.3.1 **ECU Power states Volvo Standard** Reference / Name of document / Document Reg. No. / Version [1] / ECU Power States Specification / 30135947 / 5.3.0 Not all requirements in the standard above applies, see document "Applicable Standards" for extract of what applies on the MRCU.	Y	2023-04-14: Jesper: Under review at Voith.	G			Siegl (Voith)	**2023-04-25: Specifications are currently reviewed by the Voith experts.**		
	7.3.2 Voltage rating	G	2022-02-01, Wassermann: why table 3.3V or 5V?	G	2022-02-01, Wassermann: class H for 24V is ok					
	7.3.2.1 Slow decrease and increase of supply voltage - Test	G	2022-02-01, Wassermann: must be aligned to HW tests --> Voith	G	2022-03-23: Wassermann: Test will be run according to ISO. If special test is required, it will be run before B20. Results might change when changing HW, and this is not considered as for today. 2022-03-09, Jacobasch: compare test ovierwiev provided to Volvo		Siegl (Voith)	2023-05-17: Jesper: Steffen to check which test have been completed and update RTS **2023-05-23: Test was passed on 2023-01-19.**		
	7.3.2.2 Momentary drop in supply voltage - Test	G	2022-02-01, Wassermann: must be aligned to HW tests --> Voith	G	2022-03-23: Wassermann: Test will be run according to ISO. If special test is required, it will be run before B20. Results might change when changing HW, and this is not considered as for today. 2022-03-09, Jacobasch: compare test ovierwiev provided to Volvo		Siegl (Voith)	2023-05-17: Jesper: Steffen to check which test have been completed and update RTS **2023-05-23: Test was passed on 2023-01-23.**		
	7.3.2.3 Over voltage - Test	G	2022-02-01, Wassermann: must be aligned to HW tests --> Voith	G	2022-03-23: Wassermann: Test will be run according to ISO. If special test is required, it will be run before B20. Results might change when changing HW, and this is not considered as for today. 2022-03-09, Jacobasch: compare test ovierwiev provided to Volvo		Siegl (Voith)	2023-05-17: Jesper: Steffen to check which test have been completed and update RTS **2023-05-23: Test with supply voltage of 36 V during 1h at temperature Tmax-20° C was passed on 2023-01-27.** **Test with supply voltage of 48V during 2 minutes at room temperature is not planned right now.**		
	7.3.2.4 Power Supply Interruption - Random Test	G	2022-02-01, Wassermann: must be aligned to HW tests --> Voith	G	2022-03-23: Wassermann: Test will be run according to ISO. If special test is required, it will be run before B20. Results might change when changing HW, and this is not considered as for today. 2022-03-09, Jacobasch: compare test ovierwiev provided to Volvo		Siegl (Voith)	2023-05-17: Jesper: Steffen to check which test have been completed and update RTS **2023-05-23: Description of requirement not plausible (Test Setup A/B? Switch S2?...)** **Test according to ISO 16750-2 (sec. 4.9) was passed on 2023-01-25.** **2023-05-24: Jesper check internally what Case A and Case B considers. Test passed according to ISO described above, additional test needed?**		

VOLVO

REVIEW OF TECHNICAL SPECIFICATIONS, MRCU (RTS)

Compliance Matrix

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	tips to fill in the form	- Put "G" if question reviewed and the requirements are		- Put "G" for "Green" if question reviewed and agreed requirement						
A	B	C	D	E	F	G	H	I	J	K
	7.3.2.5 Reset behaviour at voltage drop - Test	G	2022-02-01, Wassermann: must be aligned to HW tests --> Voith	G	2022-03-23: Wassermann: Test will be run according to ISO. If special test is required, it will be run before B20. Results might change when changing HW, and this is not considered as for today. 2022-03-09, Jacobasch: compare test ovierwiev provided to Volvo		Siegl (Voith)	2023-05-17: Jesper: Steffen to check which test have been completed and update RTS **2023-05-23: Test according to ISO 16750-2 (sec. 4.6.2) was passed on 2023-01-23.** Test with reqired modifications is not planned.		
	7.3.2.6 Reversed voltage - Test	G	2022-02-01, Wassermann: must be aligned to HW tests --> Voith	G	2022-03-23: Wassermann: Test will be run according to ISO. If special test is required, it will be run before B20. Results might change when changing HW, and this is not considered as for today. 2022-03-09, Jacobasch: compare test ovierwiev provided to Volvo		Siegl (Voith)	2023-05-17: Jesper: Steffen to check which test have been completed and update RTS **2023-05-23: Test according to ISO 16750-2 (sec. 4.7.2) Case 1 was passed on 2023-01-25.** Test of case 2 is not planned.		
	7.3.2.7 Superimposed alternating voltage - Test	G	2022-02-01, Wassermann: must be aligned to HW tests --> Voith	G	2022-03-23: Wassermann: Test will be run according to ISO. If special test is required, it will be run before B20. Results might change when changing HW, and this is not considered as for today. 2022-03-09, Jacobasch: compare test ovierwiev provided to Volvo		Siegl (Voith)	2023-05-17: Jesper: Steffen to check which test have been completed and update RTS **2023-05-23: Test according to ISO 16750-2 (sec. 4.4) severity 2 was passed on 2023-01-17.**		
	7.3.2.8 Superimposed pulse voltage - Test	G	2022-02-01, Wassermann: must be aligned to HW tests --> Voith	G	2022-03-23: Wassermann: Test will be run according to ISO. If special test is required, it will be run before B20. Results might change when changing HW, and this is not considered as for today. 2022-03-09, Jacobasch: compare test ovierwiev provided to Volvo		Siegl (Voith)	2023-05-17: Jesper: Steffen to check which test have been completed and update RTS **2023-05-23: Test not planned right now.** **2023-05-24: Can be performed with new improved PCB for EMC.**		
	7.3.3 Power consumption	G	2022-02-01, Wassermann: must be aligned to HW tests --> Voith	G	2022-03-23: Wassermann: Test will be run according to ISO. If special test is required, it will be run before B20. Results might change when changing HW, and this is not considered as for today. 2022-03-09, Jacobasch: compare test ovierwiev provided to Volvo		Siegl (Voith)	2023-05-17: Jesper: Steffen to check which test have been completed and update RTS **2023-05-23: Measurements are available.**		

VOLVO

REVIEW OF TECHNICAL SPECIFICATIONS, MRCU (RTS)

Compliance Matrix

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	tips to fill in the form	- Put "G" if question reviewed and the requirements are		- Put "G" for "Green" if question reviewed and agreed, requirement						
A	B	C	D	E	F	G	H	I	J	K
	7.3.3.1 Direct current supply voltage and current consumption - Test	G	2022-02-01, Wassermann: must be aligned to HW tests --> Voith	G	2022-03-23: Wassermann: Test will be run according to ISO. If special test is required, it will be run before B20. Results might change when changing HW, and this is not considered as for today. 2022-03-09, Jacobasch: compare test ovierwiev provided to Volvo		Siegl (Voith)	2023-05-17: Jesper: Steffen to check which test have been completed and update RTS **2023-05-23: Measurements are available but not according to the ECU Power States Specification (50135947). Latest measurements (room temperature) show about 3A as average value of current consumption in control pressure build up (peaks up to 6A).** **If there is no torque request an average value of current consumption is about 100mA.** **In sleep mode < 100 µA.**		
	7.3.4 Grounding	G	2022-02-01, Wassermann: must be aligned to HW tests --> Voith	G	2022-03-23: Wassermann: Test will be run according to ISO. If special test is required, it will be run before B20. Results might change when changing HW, and this is not considered as for today. 2022-03-09, Jacobasch: compare test ovierwiev provided to Volvo		Siegl (Voith)	2023-05-17: Jesper: Steffen to check which test have been completed and update RTS **2023-05-23: Test not done yet.** **2023-05-24: Grounding on T31, valves and housing are grounded to this terminal.**		
	7.3.4.1 Grounding - Test	G	2022-02-01, Wassermann: must be aligned to HW tests --> Voith	G	2022-03-23: Wassermann: Test will be run according to ISO. If special test is required, it will be run before B20. Results might change when changing HW, and this is not considered as for today. 2022-03-09, Jacobasch: compare test ovierwiev provided to Volvo		Siegl (Voith)	2023-05-17: Jesper: Steffen to check which test have been completed and update RTS **2023-05-23: Test not done yet.**		
	7.3.4.2 Insulation resistance - Test	G	2022-02-01, Wassermann: must be aligned to HW tests --> Voith	G	2022-03-23: Wassermann: Test will be run according to ISO. If special test is required, it will be run before B20. Results might change when changing HW, and this is not considered as for today. 2022-03-09, Jacobasch: compare test ovierwiev provided to Volvo		Siegl (Voith)	2023-05-17: Jesper: Steffen to check which test have been completed and update RTS **2023-05-23: Test not passed yet.** **2024-05-24: Check if improved with new PCB layout.**		
	7.3.4.3 Withstand voltage - Test	G	2022-02-01, Wassermann: must be aligned to HW tests --> Voith	G	2022-03-23: Wassermann: Test will be run according to ISO. If special test is required, it will be run before B20. Results might change when changing HW, and this is not considered as for today. 2022-03-09, Jacobasch: compare test ovierwiev provided to Volvo		Siegl (Voith)	2023-05-17: Jesper: Steffen to check which test have been completed and update RTS **2023-05-23: Test not done yet.**		

VOLVO

REVIEW OF TECHNICAL SPECIFICATIONS, MRCU (RTS)

Compliance Matrix

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A	B	C	D	E	F	G	H	I	J	K
	7.3.5 Open circuit protection	G	2022-02-01, Wassermann: must be aligned to HW tests --> Voith	G	2022-03-23: Wassermann: Test will be run according to ISO. If special test is required, it will be run before B20. Results might change when changing HW, and this is not considered as for today. 2022-03-09, Jacobasch: compare test ovierwiev provided to Volvo		Siegl (Voith)	2023-05-17: Jesper: Steffen to check which test have been completed and update RTS **2023-05-23: Test according to ISO 16750-2 (sec. 4.9) was passed on 2023-01-25.**		
	7.3.5.1 Open circuit protection - Test	G	2022-02-01, Wassermann: must be aligned to HW tests --> Voith	G	2022-03-23: Wassermann: Test will be run according to ISO. If special test is required, it will be run before B20. Results might change when changing HW, and this is not considered as for today. 2022-03-09, Jacobasch: compare test ovierwiev provided to Volvo		Siegl (Voith)	2023-05-17: Jesper: Steffen to check which test have been completed and update RTS **2023-05-23: Test according to ISO 16750-2 (sec. 4.9) was passed on 2023-01-25.**		
	7.3.6 Short circuit protection	G	2022-02-01, Wassermann: must be aligned to HW tests --> Voith	G	2022-03-23: Wassermann: Test will be run according to ISO. If special test is required, it will be run before B20. Results might change when changing HW, and this is not considered as for today. 2022-03-09, Jacobasch: compare test ovierwiev provided to Volvo		Siegl (Voith)	2023-05-17: Jesper: Steffen to check which test have been completed and update RTS **2023-05-23: Test according to ISO 16750-2 (sec. 4.10) was passed on 2023-01-31.** **Deviations from the ISO were not tested.**		
	7.3.6.1 Short circuit protection - Test	G	2022-02-01, Wassermann: must be aligned to HW tests --> Voith	G	2022-03-23: Wassermann: Test will be run according to ISO. If special test is required, it will be run before B20. Results might change when changing HW, and this is not considered as for today. 2022-03-09, Jacobasch: compare test ovierwiev provided to Volvo		Siegl (Voith)	2023-05-17: Jesper: Steffen to check which test have been completed and update RTS **2023-05-23: Test according to ISO 16750-2 (sec. 4.10) was passed on 2023-01-31.** **Deviations from the ISO were not tested.** **2023-05-23: Jesper: Compare with TCM test, additional test from ISO required?**		
B20	7.3.7 Memory and CPU load requirements	G	2022-02-01, Wassermann: must be aligned to HW tests --> Voith	Y	2022-03-18: Wassermann: Results will be ready mid of this year. Agreement/alignment should not be a problem		Siegl (Voith)	2022-06-07, Wassermann: First feedback will be sent w2231. For VAP, mid of next year (April) 2022-04-26, Siegl: Volvo pass criteria not defined yet. Serial s/w will be used as a reference. 2023-04-26. Siegl: Will be available after VAP integration (end of 2023).		

VOLVO

REVIEW OF TECHNICAL SPECIFICATIONS, MRCU (RTS)

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A	B	C	D	E	F	G	H	I	J	K
B20	7.3.7.1 Memory and CPU load - Measurements	G	2022-02-01, Wassermann: must be aligned to HW tests --> Voith	Y	2022-03-18: Wassermann: Results will be ready mid of this year. Agreement/alignment should not be a problem		Siegl (Voith)	2022-06-07, Wassermann: First feedback will be sent w2231. For VAP, mid of next year (April) 2022-04-26, Siegl: Volvo pass criteria not defined yet. Serial s/w will be used as a reference. 2023-04-26. Siegl: Will be available after VAP integration (end of 2023).		
	7.4 EMC	G	2022-02-01, Wassermann: must be aligned to HW tests --> Voith	G	**2023-05-17: Jesper: Optimization ongoing on EMC capabilities of the MRCU. Layout work ongoing -> Likely to be implemented in Nov 2023.** 2022-03-23: Wassermann: Test will be run according to ISO. If special test is required, it will be run before B20. Results might change when changing HW, and this is not considered as for today. 2022-03-09, Jacobasch: compare test ovierwiev provided to Volvo					
	7.4.1 STD 515-0003 Conducted Transient emission - Test	G	2022-02-01, Wassermann: must be aligned to HW tests --> Voith	G	2022-03-23: Wassermann: Test will be run according to ISO. If special test is required, it will be run before B20. Results might change when changing HW, and this is not considered as for today. 2022-03-09, Jacobasch: compare test ovierwiev provided to Volvo					
	7.4.2 STD 515-0003 Conducted RF emission – Voltage method - Test	G	2022-02-01, Wassermann: must be aligned to HW tests --> Voith	G	2022-03-23: Wassermann: Test will be run according to ISO. If special test is required, it will be run before B20. Results might change when changing HW, and this is not considered as for today. 2022-03-09, Jacobasch: compare test ovierwiev provided to Volvo					
	7.4.3 STD 515-0003 Conducted transient susceptibility on power supply leads and I/O's connected to power supply - Test	G	2022-02-01, Wassermann: must be aligned to HW tests --> Voith	G	2022-03-23: Wassermann: Test will be run according to ISO. If special test is required, it will be run before B20. Results might change when changing HW, and this is not considered as for today. 2022-03-09, Jacobasch: compare test ovierwiev provided to Volvo					

VOLVO

REVIEW OF TECHNICAL SPECIFICATIONS, MRCU (RTS)

Compliance Matrix

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A	B	C	D	E	F	G	H	I	J	K
	7.4.4 STD 515-0003 Conducted transient susceptibility on signal leads - Test	G	2022-02-01, Wassermann: must be aligned to HW tests --> Voith	G	2022-03-23: Wassermann: Test will be run according to ISO. If special test is required, it will be run before B20. Results might change when changing HW, and this is not considered as for today. 2022-03-09, Jacobasch: compare test ovierwiev provided to Volvo					
	7.4.5 STD 515-0003 Power-supply quality - Test	G	2022-02-01, Wassermann: must be aligned to HW tests --> Voith	G	2022-03-23: Wassermann: Test will be run according to ISO. If special test is required, it will be run before B20. Results might change when changing HW, and this is not considered as for today. 2022-03-09, Jacobasch: compare test ovierwiev provided to Volvo					
	7.4.6 STD 515-0003 Immunity to micro power cuts - Test	G	2022-02-01, Wassermann: must be aligned to HW tests --> Voith	G	2022-03-23: Wassermann: Test will be run according to ISO. If special test is required, it will be run before B20. Results might change when changing HW, and this is not considered as for today. 2022-03-09, Jacobasch: compare test ovierwiev provided to Volvo					
	7.4.7 STD 515-0003 Immunity to high-voltage supply - Test	G	2022-02-01, Wassermann: must be aligned to HW tests --> Voith	G	2022-03-23: Wassermann: Test will be run according to ISO. If special test is required, it will be run before B20. Results might change when changing HW, and this is not considered as for today. 2022-03-09, Jacobasch: compare test ovierwiev provided to Volvo					
	7.4.8 STD 515-0003 Radiated emissions measured at the foot of the antenna - Test	G	2022-02-01, Wassermann: must be aligned to HW tests --> Voith	G	2022-03-23: Wassermann: Test will be run according to ISO. If special test is required, it will be run before B20. Results might change when changing HW, and this is not considered as for today. 2022-03-09, Jacobasch: compare test ovierwiev provided to Volvo					
	7.4.9 STD 515-0003 Radiated emissions measured in accordance with ECE R10 - Test	G	2022-02-01, Wassermann: must be aligned to HW tests --> Voith	G	2022-03-23: Wassermann: Test will be run according to ISO. If special test is required, it will be run before B20. Results might change when changing HW, and this is not considered as for today. 2022-03-09, Jacobasch: compare test ovierwiev provided to Volvo					

VOLVO

REVIEW OF TECHNICAL SPECIFICATIONS, MRCU (RTS)

Compliance Matrix

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	tips to fill in the form	- Put "G" if question reviewed and the requirements are		- Put "G" for "Green" if question reviewed and agreed, requirement						
A	B	C	D	E	F	G	H	I	J	K
	7.4.10 STD 515-0003 Component test - ALSE method - Test	G	2022-02-01, Wassermann: must be aligned to HW tests --> Voith	G	2022-03-23: Wassermann: Test will be run according to ISO. If special test is required, it will be run before B20. Results might change when changing HW, and this is not considered as for today. 2022-03-09, Jacobasch: compare test ovierwiev provided to Volvo					
	7.4.11 STD 515-0003 Radiated susceptibility component - Test	G	2022-02-01, Wassermann: must be aligned to HW tests --> Voith	G	2022-03-23: Wassermann: Test will be run according to ISO. If special test is required, it will be run before B20. Results might change when changing HW, and this is not considered as for today. 2022-03-09, Jacobasch: compare test ovierwiev provided to Volvo					
	7.4.12 STD 515-0003 Radiated susceptibility CV - Test	G	2022-02-01, Wassermann: must be aligned to HW tests --> Voith	G	2022-03-23: Wassermann: Test will be run according to ISO. If special test is required, it will be run before B20. Results might change when changing HW, and this is not considered as for today. 2022-03-09, Jacobasch: compare test ovierwiev provided to Volvo					
	7.4.13 STD 515-0003 Immunity to electrostatic discharge - Test	G	2022-02-01, Wassermann: must be aligned to HW tests --> Voith	G	2022-03-23: Wassermann: Test will be run according to ISO. If special test is required, it will be run before B20. Results might change when changing HW, and this is not considered as for today. 2022-03-09, Jacobasch: compare test ovierwiev provided to Volvo					
	7.4.14 STD 515-0003 Immunity to low-frequency magnetic fields - Test	G	2022-02-01, Wassermann: must be aligned to HW tests --> Voith	G	2022-03-23: Wassermann: Test will be run according to ISO. If special test is required, it will be run before B20. Results might change when changing HW, and this is not considered as for today. 2022-03-09, Jacobasch: compare test ovierwiev provided to Volvo					
	7.4.15 STD 515-0003 Emission of low-frequency magnetic fields - Test	G	2022-02-01, Wassermann: must be aligned to HW tests --> Voith	G	2022-03-23: Wassermann: Test will be run according to ISO. If special test is required, it will be run before B20. Results might change when changing HW, and this is not considered as for today. 2022-03-09, Jacobasch: compare test ovierwiev provided to Volvo					

VOLVO

REVIEW OF TECHNICAL SPECIFICATIONS, MRCU (RTS)

Compliance Matrix

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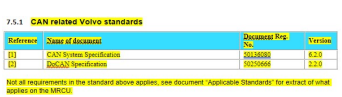
	tips to fill in the form	- Put "G" if question reviewed and the requirements are		- Put "G" for "Green" if question reviewed and agreed requirement						
A	B	C	D	E	F	G	H	I	J	K
B20	7.5.1 CAN related Volvo standards  7.5.1 CAN related Volvo standards Reference / Name of document / Document Reg. No. / Version [1] CAN System Specification 50336080 6.2.0 [2] DoCAN Specification 50350666 2.2.0 Not all requirements in the standard above applies, see document "Applicable Standards" for extract of what applies on the MRCU.	Y	2023-04-14: Jesper: Under review at Voith.				Siegl (Voith)	**2023-04-25: Specifications are currently reviewed by the Voith experts.**		
	7.5.2 CAN interface	G	2022-02-01, Wassermann: must be aligned to HW tests --> Voith	G	2022-03-23: Miguel: OK 2022-03-18: Miguel: To be reviewed with Rithesh					
	7.5.2.1 ECU CAN Interface - Test	G	2022-02-01, Wassermann: must be aligned to HW tests --> Voith	G	2023-05-17: CAN interface should be OK. 2022-03-23: Wassermann: Test will be run 2022-03-22, Miguel: All CAN tests are required. Testing can be performed after having the full functional product i.e., B20 or C sample. We do not have any recommended transceiver list. Voith can choose any transceiver, but the tests are required to be conducted on the selected transceiver. 2022-03-18: Miguel: To be reviewed with Rithesh					
B20	7.6.1 Diagnostic	G	2022-02-01, Wassermann: must be aligned to HW tests --> Voith	G				**2023-05-17: Jesper: Check and share Volvo CANdela file, will help Voith with diagnostic implementation.**		
B20	7.6.1 Diagnostic related Volvo standards  7.6 Diagnostics and control 7.6.1 Diagnostic related Volvo standards Reference / Name of document / Document Reg. No. / Version [1] Diagnostic Implementation Requirements 2 (DIR2) 50259243 1.9.0 [2] SVS - Read and Write Specification 50135952 14.3.0 [3] Unified Diagnostic Services 2 (UDS2) 50259278 1.18.0 Not all requirements in the standard above applies, see document "Applicable Standards" for extract of what applies on the MRCU.	Y	2023-04-14: Jesper: Under review at Voith.	Y			Siegl (Voith)	**2023-04-25: Specifications are currently reviewed by the Voith experts.**		
	7.6.1.1 Diagnostic - Design review	G	2022-02-01, Wassermann: must be aligned to HW tests --> Voith	G						
	7.6.2 HW Watchdog	G	2022-02-01, Wassermann	G	2022-02-01, Wassermann					
Update	7.6.2.1 Watchdog - Design review	G	2022-02-01, Wassermann: must be checked within Voith 2022-02-03: Migeul: Check the exact requirement for this review.	Y	2022-03-18: Not ready for RTS, but will be ready for B sample		Siegl (Voith)	2022-04-26, Siegl: Will be reviewed during project development. Before B20 sample (2023-11-01) **2023-04-26. Siegl: Will be available after VAP integration (end of 2023).**		
	8.1 Part handling by GTO/ AM	G	2022-02-01, Wassermann	G	2022-02-01, Wassermann					

VOLVO

REVIEW OF TECHNICAL SPECIFICATIONS, MRCU (RTS)

Compliance Matrix

Part Number(s):

		Requirements understanding		Requirements feasibility				Action plan tracking		
	Requirement / Topic	Are the requirements clear and understood ? **"Green / Yellow / Red " "GYR" status**	Enter here any needed comment If the requirement is not understood, describe what needs to be clarified	Are the requirements achievable ? **"Green / Yellow / Red " "GYR" status**	If the requirements are not achievable, describe what the concern is	Needed Action	Responsible	Comments and updates on the action plan	Due date	Status Open / Closed
	tips to fill in the form	- Put "G" if question reviewed and the requirements are		- Put "G" for "Green" if question reviewed and agreed, requirement						
A	**B**	**C**	**D**	**E**	**F**	**G**	**H**	**I**	**J**	**K**
	8.1.1 Part handling/ Free fall - Test	G	2022-02-01, Wassermann	G	2023-05-17: Jesper: Free fall test completed and passed in January 2023. 2022-02-01, Wassermann: standard must be cross checked					
	9.1 Marking	G	2022-02-01, Wassermann: must be checked within Voith, means customized marking of MRCU for Volvo. 2022-02-03: Wassermann: Send example of the marking plate used today. Limited space on the plats, can this be used at volvo?	G	2023-05-17: Jesper: Jesper to cross check applicable requirements and method on other component systems within Volvo.					
	9.1.1 Marking - Design review	G	2022-02-01, Wassermann	G	2022-02-01, Wassermann					
	Study all the requirements mentioned in all the TR you received. List below all the requirements of all these TRs. For each of these requirements, answer if it is : understood Yes/no (column C & D) and fully achievable Yes/no (column E to H)	G		G						
section	requirement									
	…..	NA		NA						
	Below here is a checklist of needed generic items to be reviewed within the "Technical Requirements". If these items have already been listed above in the TR content, don't repeat it here. Just mention NA in column "C" with the comment "already listed above" in the column "D" For each item, answer if it's understood (column C & D) and achievable (column E to H)	G		G						
	Cleanliness requirements & measurement method	NA		NA						
	Other measurement methods (includes dimensional control plan, if applicable)	NA		NA						
	Reliability targets (field fault frequency), if applicable	NA		NA						
	Durability targets, if applicable	NA		NA						
	Surface treatment requirements	NA		NA						
	Appearance aspects (color, embossing, gloss etc)	NA		NA						
	Comfort requirements (noise, smell, feel)	NA		NA						
	For development suppliers only : documentation about the applications and part functionalities for the different Volvo customers	NA		NA						
		NA		NA						
7	**Test Methods**									
	List here the testing methods that are defined for the verification activities needed for the component, under supplier responsibility. If no testing method is defined, enter NA (non applicable) in column C	G		G	2022-02-02, Lutz: The DVP&R is the basis for validation measures and documentation. This DVP&R will be aligned with Volvo before the start of testing. The available testing methods will be listed in the DVP&R.	2022-03-03: Anders: Refer to the DVP&R in the TR, to be aligned bweteen Volvo/Voith in separate discussion.	Lutz (Voith)			
	All tests required for Process Validation, defined in the Technical Requirements document(s), are clearly defined and understood. Note: Process Validation tests must be performed on samples taken from the Significant production Run and the results included with PPAP documentation.	G		G	2022-02-02, Lutz: The DVP&R is the basis for validation measures and documentation. This DVP&R will be aligned with Volvo before the start of testing. The available testing methods will be listed in the DVP&R.	2022-03-03: All verification shall be done and accepted in front of the PPAP.	Lutz (Voith)			
		NA		NA						

VOLVO

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	tips to fill in the form	- Put "G" if question reviewed and the requirements are		- Put "G" for "Green" if question reviewed and agreed, requirement						
A	**B**	**C**	**D**	**E**	**F**	**G**	**H**	**I**	**J**	**K**
8	**Master samples**									
	List below the master samples that you have received for the component(s). If no master sample has been received, enter NA (non applicable) in column C	G		G			Jacobasch (Voith)			
	…..	NA		NA						
9	**Applicable legislations & environmental requirements**									
	List below all the legislations that are applicable for the component. For each of these legislations answer if it is : understood (column C & D) and achievable (column E to H). If no legislation is applicable for the component(s), enter NA (non applicable) in column C	NA		NA						
	…..	NA		NA						
	Identification and no-use of undesirable substances for the parts chemical content : **-** the list of undesirable substances to be considered is the GADSL (Global Automotive Declarable Substance List - Volvo Standard 100-005) exception is made for lead and chromium VI. For some few projects the list of undesirable substances to be considered is the Black and Grey lists (Volvo Standards 100-002 and 100-003). Compliance to the lists is requested.	NA		NA						
	Substances tracking : depending on the project, the supplier should be able to report substances in IMDS.	G		G						
	REACH Regulation, for EU products or parts used in EU plants : no use of substances included in REACH's annex XIV except if specific authorization from European union	G		G						
		NA		NA						
10	**Functional specifications**									
	List below any functional specification applicable for the component(s), not listed above	NA		NA						
	…..	NA		NA						

VOLVO

REVIEW OF TECHNICAL SPECIFICATIONS, MRCU (RTS)

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	tips to fill in the form	- Put "G" if question reviewed and the requirements are		- Put "G" for "Green" if question reviewed and agreed, requirement						
A	**B**	**C**	**D**	**E**	**F**	**G**	**H**	**I**	**J**	**K**
11	**Other technical documents**									
	List below any other technical document which is part of the technical specification you have received, not already listed above	NA		NA						
	.....	NA		NA						
12	**Supplier Recommendations and input**	Yes / No	Description of the recommendation	Modification agreed / not agreed	Responsible					
	Is there a design improvement recommended with respect to the supplier's production process that would improve manufacturability, quality, process quality assurance or cost ?									
	Is there a design or a material change recommended that would bring an improvement for Volvo in terms of safety, quality, weight, assembly, serviceability, cost, standardization or any other feature / Function ?									
	Is there a need for investment in checking equipment ?									
	Do you foresee any restrictions to fulfill requirements stated in the documentation ?									
	Do you propose any requirements that are not specified in the documentation?									
	Do you foresee some risks that have not been highlighted above ?									

FREE SPACE (FOR ANY FURTHER COMMENT / RECOMMENDATION / RISK etc) HIGHLIGHTED EITHER BY THE TEAM EITHER SUPPLIER OR BY VOLVO :

eg : design to cost targets, quantity, etc

VOLVO

REVIEW OF TECHNICAL SPECIFICATIONS, MRCU (RTS)

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	tips to fill in the form	- Put "G" if question reviewed and the requirements are		- Put "G" for "Green" if question reviewed and agreed requirement						
A	B	C	D	E	F	G	H	I	J	K

RTS SUMMARY STATUS

COMPLIANCE MATRIX SUMMARY STATUS	
Total number of requirements reviewed	224
Number of requirements to be clarified	6
Number of requirements that are not understood and/or need revision	0
Number of requirements achievable	167
Number of requirements raising minor concern	15
Number of requirements raising major concern	0
Number of requirements N/A	41

RECOMMENDATIONS SUMMARY STATUS	
Total number of recommendations	0
Total number of agreed recommendations	0

ACTION LIST STATUS	
Total number of actions raised	15
Total number of actions still OPEN	0

RTS Revisions Log

Part Number(s): _____

Part(s) stage(s) and version(s): _____

Drawing Number(s): _____

Reviews Updates	**Description of the main technical changes.** **Should also be mentioned here :** **- part number changes** **- revision level changes**	**Date for Supplier Technical Specification Understanding**
A release		
B release		
C release		
P release		

Date of RTS Latest Update :

Date of RTS Initiation :

Date for Supplier Technical Specification Agreement