load test:

CQA (HV)

RUBBER

SPECIFICATIONS

load test: Refer. OEM letter no: TCRS-86 dtd: 06.01.2016
Since all other parameters are confirming and Spring Compression and load values shall not be checked - left- out.

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...ones : 26841966
Gr... : HYVEHASSURE

Government of India
Ministry of Defence (DGQA)
Controllerate of Quality Assurance
(Heavy Vehicles)
Avadi, CHENNAI-600 054

No. 98626/03/IND-VII RUBBER GEN

22 Nov 05

The Sr General Manager
HVF, Avadi
CHENNAI-600 054

Kind attn Shri V Rajaraman, Addl GM (QA,MP)

SPECIFICATION FOR RUBBER COMPONENTS

Ref our letter of even No. dated 12 Sep 05.

2. Equivalent CQA (HV) specifications for rubber compounds for the rubber parts of Transmission system, Pneumatic system, Cooling system, Lubrication system, Fuel system and Hull & Turret assys of tank T-72 Ajeya have been compiled by CQA (HV) in association with DMSRDE, Kanpur and leading private industries, notably M/s Sundaram Industries, Madurai. The specification CQA (HV)/CR for Polychloroprene compound got updated with a new table 2 incorporating one more grade, a copy of which is enclosed for replacing the existing table 2. There is no amendment to other specifications forwarded vide our letter under reference.

The details of parts governed by CQA (HV) specn are enclosed as follow :-

a) Details of rubber compounds used in Transmission system.
b) Details of rubber compounds used in Pneumatic system.
c) Details of rubber compounds used in Cooling system.
d) Details of rubber compounds used in Lubrication system.
e) Details of rubber compounds used in Fuel system.
f) Details of rubber compounds used in Hull/Turret assys.

The drawings of these items are being amended. Meanwhile, you are requested to arrange procurement of stores (Rubber item) to CQA (HV) specification by suitably incorporating the same in the procurement contract.

Encl. As above

(G VENKATAKRISHNAN)
JOINT CONTROLLER
FOR CONTROLLER

Copy to:- N7 O

1. The Director,
DQAV (DGQA/VEH-3)
DHQ PO, New Delhi – 110 011 - For information, please.

2 JC (AHSP)

Please ref text above. A set of ibid rubber parts list and CQA (HV) specifications for various rubber compounds are forwarded herewith for your reference. Please incorporate the reference of these specifications in the respective drawings. This has the approval of Controller, please.

JC (QID) - For information and necessary action, please.

Encl: As above

SPECIFICATION NO: CQA (HV)/NBR
FOR
ACRYLONITRILE-BUTADENE RUBBER (NBR) COMPOUNDS

ISSUED BY

CONTROLLERATE OF QUALITY ASSURANCE
(HEAVY VEHICLES)
AVADI, CHENNAI-600 054

ISSUE 1.0

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Acknowledgement

Guidance and services, rendered for preparing this specification, by DMSRDE, Kanpur is duly acknowledged. Also, CQA (HV) extends sincere thanks to Dr.R.K.Singh, Addl.Director, DMSRDE and a number of private industries, notably M/S Sundaram Industries, Madurai who helped in framing the specification with valuable suggestions and comments.

Specification No COA (HV)/NBR for Acrylonitrile-Butadiene Rubber (NBR) Compounds

1. Scope:

1.1 This specification covers seven synthetic rubber compounds based on Acrylonitrile-Butadiene Rubber (NBR). These NBR compounds are intended for manufacture of items in the form of extrusions, mouldings, sheets and items cut or punched from sheets, which have very good resistance to chemical, hydrocarbon fuels and oils, along with better high temperature resistance and low temperature flexibility upto -20°C. These rubber items have to function under different climatic / environmental / working conditions such as humid-air, oil vapour, contact with oil, operating under air / hydraulic pressure, abrasive sand particles and working temperature maximum upto 120°C and occasionally upto 130°C. This specification is prepared primarily towards specific requirements of Defence applications especially for Main Battle Tanks.

2. Designation:

2.1 Compounds shall be classified by their vulcanized hardness designated as shown below.

Table 1

Designation	Hardness after Vulcanization (Shore A)
N1	50 - 60
N2	60 - 70
N3	70 – 80
N4	80 – 85

Note: Medium Nitrile Grade which contains 33- 34% ACN shall be used.

3. Composition:

3.1 The compounds shall be based on Acrylonitrile-Butadiene Rubber of Medium Nitrile grade(33-34% ACN) reinforced with carbon black, vulcanized with sulphur/organic accelerator (Efficient/Semi Efficient Vulcanisation only), activated with stearic acid and zinc oxide and normally containing atleast 2.5 phr of suitable anti-ageing additives (antioxidants & antiozonants).

3.2 No factice or other extender or reclaimed or ground vulcanized rubber shall be used. Use of Plasticizer / processing aid is normally restricted to 10 phr.

3.3 All ingredients of the mix shall be free from grit and extraneous materials. The selection and processing of the ingredients shall be such that the vulcanizates are free from surface imperfections, blisters or porosity. Also no leaching out of plasticizer/ processing-aid is permissible under normal storage conditions.

4. Test Samples:

4.1 **Rubber Mixes:** From each batch of rubber mix, test slabs of approximately 150 x 150 x 2 mm (3 nos) as per ASTM D3182 and test buttons of ϕ 29 mm and 12.5mm thick (6 nos) shall be prepared for testing for compliance with the requirements of Table 2.

The test slabs and buttons shall be vulcanized for a time and at a temperature appropriate for the mix as per Rheometric data.

4.2 **Rubber Items:** Sample items of each design may be taken at random intervals from the lot may be tested for compliance with the requirements given in Table 2 as per the details given in the contract.

4.3 Chemical analysis may be carried out on either test slab or sample items, as practicable, to verify the base rubber, % acrylonitrile (ACN) and ash content. The methods described in ASTM D297/ISO 5247 shall be followed for such tests. Ash content should match in test slab and product within a difference of ±2 %.

5. Free from defects:

5.1 Finished rubber items shall be free from surface imperfections, porosity, voids, inclusions, flow marks and other defects which would impair satisfactory performance.

6. Packing:

6.1 Finished products shall be wrapped / packed using black and opaque polyethylene sheet or bags.

7. Storage condition and shelf life:

7.1 Finished rubber items, prior to being put into use, should be stored in accordance with recommendations given in BS 3574/ ISO 2230 / BS 3F-69. Items should have minimum 3 years of shelf life if stored in accordance with BS 3F-69.

8. QA Plan

8.1 The proposed QA plan for production of rubber product shall be complied with by the manufacturer.

Table 2: PHYSICO-MECHANICAL PROPERTIES OF ACRYLONITRILE-BUTADIENE RUBBER (NBR) VULCANISATES

Properties	Requirements				Test Methods
	N1	N2	N3	N4	
Hardness, Shore A	50-60	60-70	70-80	80-85	Relevant BS/ ASTM methods shall be followed
Density, g/cc	Agreed value ± 0.05				
Tensile strength, MPa, (Min)	10	10	12	13	
Elongation at break, %, (Min)	400	300	250	170	
Compression set, at 120°C for 24 hrs. %, (Max)	30	30	30	25	
Volume change, at 120°C for 24 hrs, in Hydoil (OM 15) %, (Max)	0 -10	0 -10	0 -10	0 -10	
Resistance to low temperature, °C	-20	-20	-20	-20	
Heat ageing in air, at 100°C for 24 hrs, change in EB%	-40	-40	-40	-40	
Ash content, % (Max)	8	8	8	8	
Polymer content % (Min)	50	50	40	35	

References:

1. BS 903 - Methods of testing vulcanized rubber
   - Part A1- Determination of density
   - Part A2- Determination of tensile stress-strain properties
   - Part A6- Determination of compression set after constant strain
   - Part A13- Determination of the stiffness of rubber at low temperature
   - Part A16- Determination of resistance of vulcanized rubber to liquids
   - Part A26- Determination of hardness
   - Part B11 and B12- Rubber (polymer) determination
2. BS 3574 – Recommendation for the storage of vulcanized rubber
3. BS 3F68 – Controlled storage of vulcanized rubber for use in aerospace applications.
4. BS 3F69 – Packing and identification of vulcanized rubber items
5. TY 38.005.1166.73 – Rubber mixes for aircraft components.
6. TY 005.216.75 – Technical rubber articles, sheet and rubber stock for special machines and engine for them
7. ASTM Part 37 – General test method for rubbers

SPECIFICATION NO: CQA (HV)/FKM
FOR
FLUOROCARBON RUBBER COMPOUND

ISSUED BY

CONTROLLERATE OF QUALITY
ASSURANCE
(HEAVY VEHICLES)
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Acknowledgement

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Specification No: COA(HV)/FKM for Fluorocarbon Rubber Compound

1. **Scope:**

1.1 This specification covers synthetic rubber compound based on Fluorocarbon rubber. This Fluorocarbon rubber compound is intended for manufacture of items in the form of extrusions, mouldings, sheets and items cut or punched from sheets which have very good resistance to chemicals, hydrocarbon fuels and oils, along with better high temperature resistance and low temperature flexibility upto -20°C. These rubber items have to function under different climatic / environmental / working conditions such as humid-air, oil vapour, contact with oil, operating under air / hydraulic pressure, abrasive sand particles and working temperature upto 200°C. This specification is drafted primarily towards specific requirements of Defence applications especially for Main Battle Tanks.

2. **Designation:**

2.1 Compound shall be classified by vulcanized hardness designated as shown below.

Table 1

Designation	Hardness after Vulcanization (Shore A)
FKM*	75-85

Note: * Fluorocarbon rubber with 67-68.5 % Fluorine content to be used.

3. **Composition:**

3.1 The compound shall be based on Fluorocarbon rubber (67-68.5 % fluorine) reinforced with carbon black, vulcanized with suitable curatives Minimum base polymer content shall not be less than 50 %.

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3.2 All ingredients of the mix shall be free from grit and extraneous materials. The selection and processing of the ingredients shall be such that the vulcanizates are free from surface imperfections, blisters or porosity.

4. **Test Samples:**

4.1 **Rubber Mixes:** From each batch of rubber mix, test slabs of approximately 150 x 150 x 2 mm (3 Nos) as per ASTM D3182 and test buttons of ϕ 29 mm and 12.5mm thick (6 Nos) shall be prepared for testing for compliance with the requirements of Table 2.

The test slabs and buttons shall be vulcanized for a time and at a temperature appropriate for the mix as per Rheometric data. Post curing shall be carried out on test slabs and on the product.

4.2 **Rubber Items:** Sample items of each design may be taken at random intervals from the lot may be tested for compliance with the requirements given in Table 2 as per the details given in the contract.

4.3 Chemical analysis may be carried out on either test slab or sample items, as practicable, to verify the base polymer, % of fluorine and ash content. The methods described in ASTM D297/ISO S247 shall be followed for such tests. Ash content shall match in test slab and product within a difference of ±2 %.

5. **Free from defects:**

5.1 Finished rubber items should be free from surface imperfections, porosity, voids, inclusions, flow marks and other defects which would impair satisfactory performance.

6. Packing:

6.1 Finished products shall be wrapped / packed using black and opaque polyethylene sheet or bags.

7. Storage conditions and shelf life:

7.1 Finished rubber items, prior to being put into use, should be stored in accordance with recommendations of BS 3574/ ISO 2230/ BS 3F-69. Items should have minimum 5 years of shelf life if stored in accordance with BS 3F69. It can be extended upto 10 years after testing as per list schedule given in BS 3F-68.

8. QA Plan

8.1 The proposed QA plan for production of rubber product shall be complied with by the manufacturer.

Table 2: PHYSICO-MECHANICAL PROPERTIES OF FLUOROCARBON VULCANISATES

Properties	FKM	Test Method
Hardness, Shore A	75-85	Relevant BS/ASTM Methods shall be followed
Density, g/cc	Agreed value ± 0.05	
Tensile strength, MPa, Min	15	
Elongation at break, %, Min	200	
Residual elongation after break, % Max	10	
Compression set, at 200°C for 24 hrs, in Hydoil (OM 15) %, Max	25	
Volume change, at 150°C for 24 hrs, in Hydoil (OM 15) %, Max	0-10	
Resistance to low temperature, °C	-20	
Heat ageing in air, at 200°C for 72 hrs, change in EB%	-50 to + 25	
Ash content, % Max	10	

References:

1. BS 903 - Methods of testing vulcanized rubber
   - Part A1- Determination of density
   - Part A2- Determination of tensile stress-strain properties
   - Part A6- Determination of compression set after constant strain
   - Part A13- Determination of the stiffness of rubber at low temperature
   - Part A16- Determination of resistance of vulcanized rubber to Liquids
   - Part A26- Determination of hardness
   - Part B11 and B12- Rubber (polymer) determination
2. BS 3574 – Recommendation for the storage of vulcanized rubber
3. BS 3F68 – Controlled storage of vulcanized rubber for use in aerospace applications
4. BS 3F69 – Packing and identification of vulcanized rubber items
5. TY 38.005.1166.73 – Rubber mixes for aircraft components.
6. TY 005.216.75 – Technical rubber articles, sheet and rubber stock for special machines and engine for them
7. ASTM Part 37 – General test method for rubbers

SPECIFICATION NO: CQA (HV)/CR
FOR
POLYCHLOROPRENE COMPOUND

ISSUED BY

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Specification No: CQA (HV)/CR for Polychloroprene compound

1. **Scope:**

1.1 This specification covers synthetic rubber compound based on **Polychloroprene Rubber.** This rubber compound is intended for manufacture of items in the form of extrusions, mouldings, sheets and items cut or punched from sheets which have very good resistance to chemicals, hydrocarbon fuels and oils, along with better weather resistance and low temperature flexibility upto -20°C. These rubber items have to function under different climatic / environmental / working conditions such as humid-air, oil vapour, contact with oil, operating under air / hydraulic pressure, abrasive sand particles and working temperature upto 100°C. This specification is drafted primarily towards specific requirements of Defence applications especially for Main Battle Tanks.

2 **Designation:**

2.1 Compound shall be classified by vulcanized hardness designated as shown below.

Table 1

Designation	Hardness after Vulcanization (Shore A)
CR1*	40-50
CR2*	60-70

Note: * **Polychloroprene** of W type shall be used.

3. **Composition:**

3.1 The compound shall be based on Polychloroprene of W grade, reinforced only with carbon black, vulcanized with suitable curatives and containing atleast 2.5 phr of suitable anti ageing additives (antioxidants & antiozonants). Minimum base polymer content shall not be less than 50%.

3.2 No factice or other extender or reclaimed or ground vulcanized rubber shall be used. Plasticizer / processing aid should not exceed 10 phr.

3.3 All ingredients of the mix shall be free from grit and extraneous materials. The selection and processing of the ingredients shall be such that the vulcanizates are free from surface imperfections, blisters or porosity. Also no leaching out of plasticizer/ processing-aid is permissible under normal storage conditions.

4. <u>Test Samples</u>:

4.1 **Rubber Mixes**: From each batch of rubber mix, test slabs of approximately 150 x 150 x 2 mm (3 Nos) as per ASTM D3182 and test buttons of ϕ 29 mm and 12.5mm thick (6 Nos) shall be prepared for testing for compliance with the requirements of Table 2.

The test slabs and buttons shall be vulcanized for a time and at a temperature appropriate for the mix as per Rheometric data.

4.2 **Rubber Items**: Sample items of each design may be taken at random intervals from the lot may be tested for compliance with the requirements given in Table 2 as per the details given in the contract.

4.3 Chemical analysis may be carried out on either test slab or sample items, as practicable, to verify base polymer, chlorine content and ash content. The methods described in ASTM D297/ISO S247 shall be followed for such tests. Ash content should match in test slab and product within a difference of ±2 %.

5. <u>Free from defects</u>:

5.1 Finished rubber items shall be free from surface imperfections, porosity, voids, inclusions, flow marks and other defects which would impair satisfactory performance.

6. **Packing:**

6.1 Finished products shall be wrapped / packed using black and opaque polyethylene sheet or bags.

7. **Storage conditions and shelf life:**

7.1 Finished rubber items, prior to being put into use, should be stored in accordance with recommendations given in BS 3574/ ISC 2230/ BS 3F69. Items should have minimum 5 years of shelf life if stored in accordance with BS 3769.

8. **QA Plan**

8.1 The proposed QA plan for production of rubber product shall be complied with by the manufacturer.

Table 2: PHYSICO-MECHANICAL PROPERTIES OF POLYCHLOROPRENE VULCANISATES

Properties	CR1	CR2	Test methods
Hardness, Shore A	40-50	60-70	Relevant BS/ASTM Methods shall be followed
Density, g/cc	Agreed value ± 0.05		
Tensile strength, MPa, Min	13	14	
Elongation at break, %, Min	400	350	
Residual elongation after break, % Max	25	30	
Compression set, at 70°C for 24 hrs, in air %, Max	30	25	
Volume change at 70°C for 24 hrs, in Oil OM - 15 %, Max	50	50	
Resistance to low temperature, °C	-20	-20	
Heat ageing in air, at 70°C for 144 hrs, change in EB%	-25 to 0	-25 to 0	
Ash content, % max	8	8	

References:

1. BS 903 - Methods of testing vulcanized rubber
   - Part A1- Determination of density
   - Part A2- Determination of tensile stress-strain properties
   - Part A6- Determination of compression set after constant strain
   - Part A13- Determination of the stiffness of rubber at low temperature
   - Part A16- Determination of resistance of vulcanized rubber to liquids
   - Part A26- Determination of hardness
   - Part B11 and B12- Rubber (polymer) determination
2. BS 3574 – Recommendation for the storage of vulcanized rubber
3. BS 3F68 – Controlled storage of vulcanized rubber for use in aerospace applications
4. BS 3F69 – Packing and identification of vulcanized rubber items
5. TY 38.005.1166.73 – Rubber mixes for aircraft components.
6. TY 005.216.75 – Technical rubber articles, sheet and rubber stock for special machines and engine for them
7. ASTM Part 37 – General test method for rubbers

SPECIFICATION NO: CQA (HV)/NBR+CR
FOR
ACRYLONITRILE-BUTADIENE RUBBER (NBR) AND POLYCHLOROPRENE (CR) BLEND COMPOUND

ISSUED BY

CONTROLLERATE OF QUALITY ASSURANCE
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Specification No COA (HV)/NBR+CR for NBR and Polychloroprene blend compound

1. Scope:

1.1 This specification covers synthetic rubber compound based on blend of **NBR and Polychloroprene Rubber.** This rubber compound is intended for manufacture of items in the form of extrusions, mouldings, sheets and items cut or punched from sheets which have good resistance to chemicals, hydrocarbon fuels and oils, along with better weather resistance, high temperature resistance and low temperature resistance -20°C. These rubber items have to function under different climatic / environmental / working conditions such as humid-air, oil vapour, contact with oil, operating under air / hydraulic pressure, abrasive sand particles and working temperature upto 100°C. This specification is drafted primarily towards specific requirements of Defence applications especially for Main Battle Tanks.

2. Designation:

2.1 Compound shall be classified by vulcanized hardness designated as shown below.

Table 1

Designation	Hardness after Vulcanization (Shore A)
BNC*	55-65

Note: * NBR with 33-34% ACN and Polychloroprene of W type

3. Composition:

3.1 The compound shall be based on blend of NBR (33-34% ACN) and Polychloroprene of W grade, reinforced with carbon black, vulcanized with sulfur / accelerator, activated with ZnO and stearic acid and containing atleast 2.5 phr of suitable anti-ageing additives (antioxidants & antiozonants). Minimum polymers content shall not be less than 30% and NBR content in the blend shall be atleast 50%.

3.2 No factice or other extender or reclaimed or ground vulcanized rubber shall be used. Plasticizer / processing aid should not exceed 10 phr.

3.3 All ingredients of the mix shall be free from grit and extraneous materials. The selection and processing of the ingredients shall be such that the vulcanizates are free from surface imperfections, blisters or porosity. Also no leaching out of plasticizer/ processing-aid is permissible under normal storage conditions.

4. Test Samples:

4.1 **Rubber Mixes:** From each batch of rubber mix, test slabs of approximately 150 x 150 x 2 mm (3 Nos) as per ASTM D3182 and test buttons of ϕ 29 mm and 12.5mm thick (6 Nos) shall be prepared for testing for compliance with the requirements of Table 2.

The test slabs and buttons shall be vulcanized for a time and at a temperature appropriate for the mix as per Rheometric data.

4.2 **Rubber Items:** Sample items of each design may be taken at random intervals from the lot may be tested for compliance with the requirements given in Table 2 as per the details given in the contract.

4.3 Chemical analysis may be carried out on either test slab or sample items, as practicable, to verify the base rubber, % acrylonitrile (ACN), chlorine content and ash content. The methods described in ASTM D297/ISO S247 shall be followed for such tests. Ash content shall match in test slab and product within a difference of ±2 %.

5. Free from defects:

5.1 Finished rubber items shall be free from surface imperfections, porosity, voids, inclusions, flow marks and other defects which would impair satisfactory performance.

6. **Packing:**

6.1 Finished products shall be wrapped / packed using black and opaque polyethylene sheet or bags.

7. **Storage conditions and shelf life:**

7.1 Finished rubber items, prior to being put into use, should be stored in accordance with recommendations given in BS 3574/ ISO 2230/ BS 3F69. Items should have minimum 4 years of shelf life if stored in accordance with BS 3F69.

8. **QA Plan**

8.1 The proposed QA plan for production of rubber product shall be complied with by the manufacturer.

Table 2: PHYSICO-MECHANICAL PROPERTIES OF ACRYLONITRILE-BUTADIENE RUBBER (NBR) AND POLYCHLOROPRENE BLEND VULCANISATE

Properties	BNC	Test Method
Hardness, Shore A	55-65	Relevant BS/ASTM Methods shall be followed
Density, g/cc	Agreed value ± 0.05	
Tensile strength, MPa, Min	10	
Elongation at break, %, Min	250	
Residual elongation after break, % Max	15	
Compression set, at 70°C for 24 hrs, %, Max	30	
Volume change, at 15 – 20 °C for 24 hrs, in **Benzene**, %, Max	45	
Volume change, **a).** at 70°C for 24 hrs, in **Oil OM-15** **b). Diesel (15-25°C)** %, Max	15 20	
Resistance to low temperature, °C	-20	
Heat ageing in air, at 100°C for 24 hrs, change in EB%	-45 to 0	
Ash content, % Max	8	

References:

1. BS 903 - Methods of testing vulcanized rubber
   - Part A1- Determination of density
   - Part A2- Determination of tensile stress-strain properties
   - Part A6- Determination of compression set after constant strain
   - Part A13- Determination of the stiffness of rubber at low temperature
   - Part A16- Determination of resistance of vulcanized rubber to liquids
   - Part A26- Determination of hardness
   - Part B11 and B12- Rubber (polymer) determination
2. BS 3574 – Recommendation for the storage of vulcanized rubber
3. BS 3F68 – Controlled storage of vulcanized rubber for use in aerospace applications
4. BS 3F69 – Packing and identification of vulcanized rubber items
5. TY 38.005.1166.73 – Rubber mixes for aircraft components.
6. TY 005.216.75 – Technical rubber articles, sheet and rubber stock for special machines and engine for them
7. ASTM Part 37 – General test method for rubbers

(35)

SPECIFICATION NO: CQA (HV)/HNBR
FOR
HYDROGENATED ACRYLONITRILE-BUTADIENE RUBBER (HNBR) COMPOUNDS

ISSUED BY

CONTROLLERATE OF QUALITY ASSURANCE
(HEAVY VEHICLES)
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Specification No COA (EV)/HNBR for Hydrogenated Acrylonitrile-Butadiene Rubber (HNBR) compounds

1. Scope:

1.1 This specification covers synthetic rubber compound based on (HNBR). This HNBR compound is intended for manufacture of items in the form of extrusions, mouldings, sheets and items cut or punched from sheets which have very good resistance chemicals, hydrocarbon fuels and oils, along with better high temperature resistance and low temperature flexibility up to -20°C. These rubber items have to function under different climatic / environmental / working conditions such as humid-air, oil vapour, contact with oil, operating under air / hydraulic pressure, abrasive sand particles and working temperature upto 140°C.. This specification is drafted primarily towards specific requirements of Defence applications especially for Main Battle Tanks.

2. Designation:

2.1 Compound shall be classified by their vulcanized hardness designated as shown below.

Table 1

Designation	Hardness after Vulcanization (Shore A)
HN*	60 – 70

Note: * HNBR of grade which contains 37% ACN

3. Composition:

3.1 The compound shall be based on Hydrogenated Acrylonitrile-Butadiene Rubber with 37% ACN reinforced only with carbon black, vulcanized with peroxide, activated with stearic acid and zinc oxide and containing at least 1.5 phr of suitable anti-ageing additives (antioxidants & antiozonants). Minimum polymer content shall not be less than 50%.

3.2 No factice or other extender or reclaimed or ground vulcanized rubber shall be used. Plasticizer / processing aid should not exceed 10 phr.

3.3 All ingredients of the mix shall be free from grit and extraneous materials. The selection and processing of the ingredients shall be such that the vulcanizates are free from surface imperfections, blisters or porosity. Also no leaching out of extender or plasticizer is allowed.

4. Test Samples:

4.1 **Rubber Mixes:** From each batch of rubber mix, test slabs of approximately 150 x 150 x 2 mm (3 Nos) as per ASTM D3182and test buttons of ϕ 29 mm and 12.5mm thick (6 Nos) shall be prepared for testing for compliance with the requirements of Table 2.

The test slabs and buttons shall be vulcanized for a time and at a temperature appropriate for the mix as per Rheometric data. Post curing of samples shall be carried at 150°C for 4 hrs.

4.2 **Rubber Items:** Sample items of each design may be taken at random intervals from the lot may be tested for compliance with the requirements given in Table 2 as per the details given in the contract.

4.3 Chemical analysis may be carried out on either test slab or sample items, as practicable, to verify the base polymer, % of acrylonitrile (ACN) and ash content. The methods described in ASTM D297/ISO 8247 shall be followed for such tests. Ash content shall match in test slab and product within a difference of ±2 %.

5. Free from defects:

5.1 Finished rubber items shall be free from surface imperfections, porosity, voids, inclusions, flow marks and other defects which would impair satisfactory performance.

6. **Packing:**

6.1 Finished products shall be wrapped / packed using black and opaque polyethylene sheet or bags.

7. **Storage conditions and shelf life:**

7.1 Finished rubber items, prior to being put into use, should be stored in accordance with recommendations given in BS 3574/ ISO 2230/ BS 3F69. Items should have minimum 5 years of shelf life if stored in accordance with BS 3F69.

8. **QA Plan**

8.1 The proposed QA plan for production of rubber product shall be complied with by the manufacturer.

Table 2: PHYSICO-MECHANICAL PROPERTIES OF HNBR VULCANISATES

Properties	HN	Test method
Hardness, Shore A	60-70	Relevant BS/ASTM Methods shall be followed
Density, g/cc	Agreed value ±0.05	
Tensile strength, MPa, Min	15	
Elongation at break, %, Min	300	
Compression set, at 140°C for 72 hrs, in air %, Max	20	
Volume change, at 140°C for 24 hrs, in working fluid % Max	0-5	
Resistance to low temperature, °C	-20	
Heat ageing in air, at 140°C for 72 hrs, change in EB, %Max	-15	
Ash content, % Max	8	

References:

1. BS 903 - Methods of testing vulcanized rubber
   - Part A1- Determination of density
   - Part A2- Determination of tensile stress-strain properties
   - Part A6- Determination of compression set after constant strain
   - Part A13- Determination of the stiffness of rubber at low temperature
   - Part A16- Determination of resistance of vulcanized rubber to liquids
   - Part A26- Determination of hardness
   - Part B11 and B12- Rubber (polymer) determination
2. BS 3574 – Recommendation for the storage of vulcanized rubber
3. BS 3F68 – Controlled storage of vulcanized rubber for use in aerospace applications
4. BS 3F69 – Packing and identification of vulcanized rubber items
5. TY 38.005.1166.73 – Rubber mixes for aircraft components.
6. TY 005.216.75 – Technical rubber articles, sheet and rubber stock for special machines and engine for them
7. ASTM Part 37 – General test method for rubbers

(A)

SPECIFICATION NO: CQA (HV)/EPDM
FOR
ETHYLENE-PROPYLENE DIENE MONOMER RUBBER (EPDM) COMPOUND

ISSUED BY

CONTROLLERATE OF QUALITY ASSURANCE
(HEAVY VEHICLES)
AVADI, CHENNAI-600 054

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19/2021

Specification No COA (HV)/EPDM for Ethylene-Propylene Diene Monomer Rubber (EPDM) compounds

1. Scope:

1.1 This specification covers synthetic rubber compound based on) Ethylene-Propylene Diene Monomer Rubber (EPDM). This EPDM compound is intended for manufacture of items in the form of extrusions, mouldings, sheets and items cut or punched from sheets, which have very good resistance to weather, ozone, UV light and low temperature flexibility upto -20°C. These rubber items have to function under different climatic / environmental / working conditions such as humid-air, oil vapour, contact with oil, abrasive sand particles and working temperature maximum upto 120°C. This specification is prepared primarily towards specific requirements of Defence applications especially for Main Battle Tanks.

2. Designation:

2.1 Compound shall be classified by their vulcanized hardness designated as shown below.

Table 1

Designation	Hardness after Vulcanization (Shore A)
EP*	45 – 55

Note: * EPDM of grade which contains minimum 50% Ethylene.

3. Composition:

3.1 The compounds shall be based on EPDM, with minimum 50% Ethylene grade reinforced with carbon black, vulcanized with peroxide. Minimum polymer content shall not be less than 30%.

3.1 No factice or other extender or reclaimed or ground vulcanized rubber shall be used. Plasticizer shall not exceed 10 phr and paraffinic oil may be used as processing aid.

3.2 All ingredients of the mix shall be free from grit and extraneous materials. The selection and processing of the ingredients shall be such that the vulcanizates are free from surface imperfections, blisters or porosity. Also no leaching out of plasticizer/ processing-aid is permissible under normal storage conditions.

4. **Test Samples:**

4.1 **Rubber Mixes:** From each batch of rubber mix, test slabs of approximately 150 x 150 x 2 mm (3 nos) as per ASTM D3182 and test buttons of ϕ 29 mm and 12.5mm thick (6 nos) shall be prepared for testing for compliance with the requirements of Table 2.

The test slabs and buttons shall be vulcanized for a time and at a temperature appropriate for the mix as per Rheometric data.

4.2 **Rubber Items:** Sample items of each design may be taken at random intervals from the lot may be tested for compliance with the requirements given in Table 2 as per the details given in the contract.

4.3 Chemical analysis may be carried out on either test slab or sample items, as practicable, to verify the base rubber and ash content. The methods described in ASTM D297/ISO S247 shall be followed for such tests. Ash content should match in test slab and product within a difference of ±2 %.

5. **Free from defects:**

5.1 Finished rubber items shall be free from surface imperfections, porosity, voids, inclusions, flow marks and other defects which would impair satisfactory performance.

6. Packing:

6.1 Finished products shall be wrapped / packed using black and opaque polyethylene sheet or bags.

7. Storage conditions and shelf life:

7.1 Finished rubber items, prior to being put into use, should be stored in accordance with recommendations given in BS 3574/ ISO 2230/ BS 3F69. Items should have minimum 5 years of shelf life if stored in accordance with BS 3F69.

8. QA Plan

8.1 The proposed QA plan for production of rubber product shall be complied with by the manufacturer.

Table 2: PHYSICO-MECHANICAL PROPERTIES OF ETHYLENE-PROPYLENE DIENE MONOMER RUBBER (EPDM) COMPOUNDS

Properties	EP	Test Method
Hardness, Shore A	45-55	Relevant BS/ASTM Methods shall be followed
Density, g/cc	Agreed value ± 0.05	
Tensile strength, MPa, Min	10	
Elongation at break, %, Min	500	
Residual elongation after break, % Max	40	
Tear strength, N/mm , Min	20	
Compression set, at 100°C for 24 hrs %, Max	40	
Ozone resistance, at 100 pphm Ozone concentration, Test temperature 40 °C, Elongation 50 %, Duration 72 hrs	No visible cracks	
Resistance to low temperature, °C	-20	
Heat ageing in air, at 100 °C for 72 hrs, change in EB, %	-25 to 0	
Ash content, % Max	8	

References:

1. BS 903 - Methods of testing vulcanized rubber
   - Part A1 Determination of density
   - Part A2- Determination of tensile stress-strain properties
   - Part A6- Determination of compression set after constant strain
   - Part A13- Determination of the stiffness of rubber at low temperature
   - Part A16- Determination of resistance of vulcanized rubber to liquids
   - Part A26- Determination of hardness
   - Part B11 and B12- Rubber (polymer) determination
2. BS 3574 – Recommendation for the storage of vulcanized rubber
3. BS 3F68 – Controlled storage of vulcanized rubber for use in aerospace applications
4. BS 3F69 – Packing and identification of vulcanized rubber items
5. TY 38.005.1166.73 – Rubber mixes for aircraft components.
6. TY 005.216.75 – Technical rubber articles, sheet and rubber stock for special machines and engine for them
7. ASTM Part 37 – General test method for rubbers

QA PLAN

This QA plan covers the QC/QA activities to be followed at every stage of manufacturing of rubber products to ensure that all specifications, drawing and order requirements are fulfilled.

The stages are dived as under:-

1. QC of Raw Materials
2. QC of In-process Materials
3. QC of Finished Products.

1. QC of Raw Materials

a) All the raw materials (i.e) base rubber, chemicals, fillers etc used for manufacturing of rubber products should be procured from reputed suppliers alongwith proper test certificates. Certificates should be made available to AHSP /Inspecting agencies visiting the plant for verification.

b) All the ingredients used for making rubber compounds should be within expiry dates. Important properties like moisture content should be checked at the time of receipt of raw materials with evidence of records.

c) For material procured as pre-compounded or master batch Ex-import, the following information should be furnished as and when required.
   i. Date of receipt by the manufacturing unit.
   ii. Expiry date or storage life of the compound.
   iii. Relevant test certificates

d) All the ingredients of the mix shall be free from grit and extraneous materials for which the firm shall have proper storage facilities and identification of various chemicals to avoid mix up.

e) First in First out system to be followed to take care of shelf life.

2. QC of Production

a) Weighing of ingredients as per compound formulation using calibrated weighing balance having adequate accuracy.

b) All test equipments should be in a state of calibration.

c) Mixing of ingredients may be carried out in two roll mill or internal mixer. The following process parameters should be controlled properly by the firm for consistency in quality of production.,

i. Temperature of roll ii. Nip gap iii. Time of mixing iv. Roll speed & friction ratio	In case of two roll mill.
i. Mixing temperature ii. Dump temperature iii. Duration of mixing	In case of internal mixer

Necessary records shall be maintained by the manufacturer for the above parameters. Processing of the ingredients shall be such that the vulcanizates are free from surface imperfection, blisters or porosity.

d) Each lot/batch shall be identified separately and traceability to be established.

e) Flow characteristics like, viscosity, plasticity are to be established for each batch of mix by using Mooney viscometer and Wallace rapid plastimeter respectively and duly documented.

f) Curing of test slab and button and products shall be carried out as per relevant rheometric/test data. The following parameters shall be controlled properly.

i. Moulding temperature - should be uniform and constant at the time of loading the compound
ii. Curing time
iii. Moulding pressure
iv. Pumping operation to release entrapped air

g) Step by step operating flow chart and procedure is to be established for manufacturing rubber products.

h) All relevant records pertaining to processing parameters, flow characteristics, curing characteristics for each and every batch shall be maintained at manufacturers end and the same should be available to AHSP/inspecting agency for audit check as and when required.

i) Checking the quality of rubber stock, test pieces and finished product and the compliance of them to the specifications / drawing requirements shall be carried out by the manufacturer. The test results shall be documented.

j) Rubber stock, test pieces and products shall be presented for acceptance against each batch with due identification. While processing rubber stock for pilot/bulk, the same to be intimated to Zonal inspectorate for witnessing.

k) Physico-Mechanical, chemical properties shall be checked on test pieces and product (wherever possible), in compliance with requirements given in the respective specification/drawings.

l) QC of production may be witnessed by the inspection agency during production of pilot batch or bulk production of the rubber product.

3. QC of finished products

This is product specific and will be carried out as per specification of the finished product. In addition, the test slab and the rubber product may undergo TGA to ascertain the following,

a). Percentage of base polymer
b). Relative conformance of rubber product with respect to test slab.

TGA may be carried out at the discretion of inspection agency.

Details of Rubber components being used in Transmission system of Tank Ajeya

Sl No	Item Number / Description	Rubber Grade as per drawing	Raw rubber as per Russian specn.	Actual Working Environment		Recommendation	
				Temp (° C)	Medium	CQA(HV) Specification	Rubber grade
I GROUP 40-GEAR BOX							
1	175-40-137 – Plug	4326-1 Alt. 5 13029	CKH 18 CKH 18+CKH 26	-10 to + 120	Servo Transmission - GX Oil.	CQA(HV)/NBR	N3
2	432-40-035-2, Seal (Middle drum booster cup)	IRP 1316	CKΦ 26	-10 to + 200	Servo Transmission - GX Oil.	CQA(HV)/FKM	FKM
3	432-40-036-2, Seal	IRP 1316	CKΦ 26	-10 to + 200	Servo Transmission - GX Oil.	CQA(HV)/FKM	FKM
4	432-40-037-2, Seal	IRP 1316	CKΦ 26	-10 to +200	Servo Transmission - GX Oil.	CQA(HV)/FKM	FKM
5	432-40-047-4, Seal	IRP 1316	CKΦ 26	-10 to +200	Servo Transmission - GX Oil.	CQA(HV)/FKM	FKM
6	432-40-103, Sealing ring	9831	CKH 26	-10 to +120	Servo Transmission - GX Oil.	CQA(HV)/NBR	N2
7	175-40-010 - Ring packing	IRP 1078, Alt. 933	CKH 26 + CKH 18 CKH 26	-10 to + 120	Servo Transmission - GX Oil, water, Radiator coolant	CQA(HV)/NBR	N3

Sl No	Item Number / Description	Rubber Grade as per drawing	Raw rubber as per Russian specn.	Actual Working Environment		Recommendation	
				Temp (° C)	Medium	CQA(HV) Specification	Rubber grade
8	432-40-127-2. Seal	IRP 1316	CKΦ 26	-10 to +200	Servo Transmission - GX Oil.	CQA(HV)/FKM	FKM
9	432-40-143-2. Seal	IRP 1316	CKΦ 26	-10 to +200	Servo Transmission - GX Oil.	CQA(HV)/FKM	FKM
II GROUP 41-FAN DRIVE WITH CARDEN DRIVES							
1	172-40-027 – Sealing ring	9831	CKH 26	-10 to 120	Grease	CQA(HV)/NBR	N2
2	172-45-054 – Packing ring	9831	CKH 26	-10 to 120	Grease	CQA(HV)/NBR	N2
3	172-66-129 - Ring	IRP 1078 Alt.9831	CKH 18+CKH 26 CKH 26	-10 to 120	Servo Transmission - GX Oil, traces of water in oil.	CQA(HV)/NBR	N3
4	175-41-09e – Sealing ring	9831	CKH 26	-10 to 120	Servo Transmission - GX Oil	CQA(HV)/NBR	N2
5	175-41-101 – Sealing ring	9831 Alt. 4326-1	CKH 26 CKH 18	-10 to 120	Servo Transmission - GX Oil, traces Water in oil.	CQA(HV)/NBR	N2
III GROUP 42-MOUNTING OF CONTROL LINKAGE OF BRAKE AND FILTERS OF RH & LH GEAR BOXES							
1	172-42-015 – Sealing ring	IRP 1078 Alt.9831 B14-1 513029	CKH 18+ CKH 26 CKH 26 CKH 18 CKH 18+ CKH 26	-10 to 120	Servo Transmission - GX Oil, traces of water in oil.	CQA(HV)/NBR	N3

Sl No	Item Number / Description	Rubber Grade as per drawing	Raw rubber as per Russian speen.	Actual Working Environment		Recommendation	
				Temp (° C)	Medium	CQA(HV) Specification	Rubber grade
2	172-42-036 – Packing ring	B14-1 Alt.9831	CKH 18 CKH 26	-10 to 120	Servo Transmission - GX Oil, Water, coolant	CQA(HV)/NBR	N3
3	172-60-211 – Ring	TC 98-1	CKH 18	-10 to 120	Servo Transmission - GX Oil, Water, coolant	CQA(HV)/NBR	N1
4	432-42-022 – Ring, packing	9831	CKH 26	-10 to 120	Servo Transmission - GX Oil, traces of water in oil.	CQA(HV)/NBR	N3
IV GROUP 45 – INTERMEDIATE GEAR BOX WITH SUCTION PUMP & STARTER GENERATOR DRIVE, MOUNTING OF IGB							
1	172-45-027-1 – Buffer	9831 Alt.4326-1	CKH 26 CKH 18	-10 to 120	Servo Transmission - GX Oil, traces of water in oil	CQA(HV)/NBR	N2
2	172-45-087-1 - Shaft oil seal	IRP 1078 Alt. 9831	CKH 18+CKH26 CKH 26	-10 to 120	Servo Transmission - GX Oil, traces of water in oil	CQA(HV)/NBR	N3
3	175-45-022-1 - Buffer	9831 Alt.4326-1	CKH 26 CKH 18	-10 to 120	Servo Transmission - GX Oil, traces of water in oil	CQA(HV)/NBR	N2
4	175-45-046 - Buffer	9831	CKH 26	-10 to 120	Servo Transmission - GX Oil, traces of water in oil	CQA(HV)/NBR	N2

Sl No	Item Number / Description	Rubber Grade as per drawing	Raw rubber as per Russian specn.	Actual Working Environment		Recommendation	
				Temp (° C)	Medium	CQA(HV) Specificatiou	Rubber grade
5	175-45-052 - 052-01 } Buffer - 052-02	9831 Alt.4326-1	CKH 26 CKH 18	-10 to 120	Servo Transmission - GX Oil, traces of water in oil	CQA(HV)/NBR	N2
6	175-45-082- Sealing ring	9831 Alt.4326-1	CKH 26 CKH 18	-10 to 120 -10 to 120	Servo Transmission - GX Oil, traces of water in oil	CQA(HV)/NBR	N3
7	175-45-035, - 01 - 02 } Buffer - 03	9831 Alt.4326-1	CKH 26 CKH 18	-10 to 120	Servo Transmission - GX Oil, traces of water in oil	CQA(HV)/NBR	N2
8	175-45-118- Ring packing	IRP 1078 Alt. 9821	CKH 18+CKH26 CKH 26	-10 to 120	Servo Transmission - GX Oil, traces of water in oil	CQA(HV)/NBR	N3
9	175-45-119- Ring packing	IRP 1078 Alt. 9831	CKH 18+CKH26 CKH 26	-10 to 120	Servo Transmission - GX Oil, traces of water in oil	CQA(HV)/NBR	N3
10	175-45-120- Ring packing	IRP 1078 Alt. 9831	CKH 18+CKH26 CKH 26	-10 to 120	Servo Transmission - GX Oil, traces of water in oil	CQA(HV)/NBR	N3
11	175-47-005- Sealing ring	9831 Alt.4326-1	CKH 26 CKH 18 -->	-10 to 120 -10 to 120 (air)	Servo Transmission - GX Oil, traces of water in oil	CQA(HV)/NBR	N3

Sl No	Item Number / Description	Rubber Grade as per drawing	Raw rubber as per Russian spec.	Actual Working Environment		Recommendation	
				Temp (° C)	Medium	CQA(HV) Specification	Rubber grade
12	175-47-019- Sealing ring	IRP 1078 Alt. 9831 B14-1	CKH 18+CKH26 CKH 26 CKH 18	-10 to 120	Servo Transmission - GX Oil, traces of water in oil	CQA(HV)/NBR	N3
13	175 47-020- Sealing ring	IRP 1078 Alt. 9831 B14-1	CKH 18÷CKH26 CKH 26 CKH 18	-10 to 120	Servo Transmission - GX Oil, traces of water in oil	CQA(HV)/NBR	N3
14	54-41-059- Buffer	HO 68-1	CKH 26÷CR	-10 to 120	Water, low freezing liquid with oil traces.	CQA(HV)/NBR+ CR	BNC
15	40Y 16-7 or 16 – 13 – Hose TY 005-6016-80	129-1, 1K (Inner layer) HO 68-1 (Outer layer)	CKH 18 + CKH26 CKH 26 + Neoprene	-10 to 120	Servo Transmission - GX Oil, water on ID Air on OD	CQA(HV)/NBR CQA(HV)/NBR+ CR	N2 BNC
V GROUP 46 – PUMPS OF HYDRAULIC CONTROL AND POWER TRAIN LUBRICANT SYSTEM							
1	432-46-045- Stopper	4326-1	CKH 18	Atm. temperature	Servo Transmission - GX Oil, air, water	CQA(HV)/NBR	N3
2	432-46-049- Stopper	4326-1	CKH 18	Atm. temperature	Servo Transmission - GX Oil, air, water	CQA(HV)/NBR	N3

Sl No	Item Number / Description	Rubber Grade as per drawing	Raw rubber as per Russian specn.	Actual Working Environment		Recommendation	
				Temp (° C)	Medium	CQA(HV) Specification	Rubber grade
VI GROUP 48 – MOUNTING OF GB WITH PUMPS AND FINAL DRIVES							
1	172-66-128- Ring	IRP 1078 A't. 9831	CKH 13+CKH2 6 CKH 26	-33 to 120	Servo Transmission - GX Oil, traces of water in oil	CQA(HV)/NBR	N3

Details of Rubber components being used in pneumatic system of Tank Ajeya

Sl No	Item Number / Description	Rubber Grade As per drawing	Raw rubber as per Russian speen.	Actual Working Environment		Recommendation	
				Temp (° C)	Medium	CQA(HV) Specification	Rubber grade
1	172-11-131 - Ring Packing	513029 - Ty-005-216-75	CKH-18, CKH-26	- 10 to + 100	Air, Oil, Condensed water vapour	CQA(HV)/NBR	N3
2	172-60-128 - Bushing	HO-68-1	CKH – 18, NEOPRENE	- 10 to + 100	Air	CQA(HV)/NBR + CR	BNC
3	172-60-149 Ring	513029	CKH – 18, CKH – 26	- 10 to + 100	Air, traces of oil ,water vapour	CQA(HV)/NBR	N3
4	175 60-069 – Gasket	HO-68-1	CKH – 18, Neoprene	- 10 to + 100	Air	CQA(HV)/NBR + CR	BNC
5	175-60-171 – Bush	512059 AIL 3311	CKH – 18, NEOPRENE	- 10 to + 100	Air	CQA(HV)/CR	CR4
6	175-70-193 – Rubber sheath	3311	HK	- 10 to + 100	Air, water, oil penetration, to protect from dust moisture, pr diff due to temp diff	CQA(HV)/CR	CR4
7	155-19-111 – Plug	98-1	CKH-18	- 10 to + 100	Air, traces of oil, water vap	CQA(HV)/NBR	N1
8	155-38-113 – Ring. packing	3825	CKH-40	- 10 to + 120.	Air, traces of oil and water vapour	CQA(HV)/NBR	N4
9	155-38-199-B – Gasket (ADY-2C Cover)	2543[3-4-1 Rubber 638-MA-2 - 584	CKH – 18M, Neoprene	- 10 to + 100	Air, traces of oil & water vapour.	CQA(HV)/CR	CR4

Sl. No	Item Number / Description	Rubber Grade As per drawing	Raw rubber as per Russian speen.	Actual Working Environment		Recommendation	
				Temp (° C)	Medium	CQA(HV) Specification	Rubber grade
10	155-38-200A – Seal	HO – 55 – 1 Alt : 3508H or 633	CKH – 18, Neoprene	- 10 to + 100	Air, traces of oil & water vapour	CQA(HV)/NBR + CR	BNC
11	155-38-275 – Valve	4326-1 Alt: 513029	CKH – 18 CKH – 18, 26	- 10 to + 100	Air, traces of oil& water vapour	CQA(HV)/NBR	N3
12	155-38-388- Shock Absorber	HO – 68 – 1 Alt: 7842	CKH – 18, Neoprene	- 10 to + 120	Air, Water	CQA(HV)/NBR + CR	BNC
13	520-10-003-04 Gasket 17X42 (Ty 005-6016-80)	HO – 68 – 1	CKH – 18, Neoprene	- 10 to + 100	Air	CQA(HV)/NBR + CR	BNC
14	520-10-003-01 Gasket 17X32 (Ty 005-6016-80)	HO – 68 – 1	CKH – 18, Neoprene	- 10 to + 100	Air	CQA(HV)/NBR + CR	BNC
15	172-60-294- Plug	HO – 68 – 1	CKH – 18, Neoprene	- 10 to + 100	Air	CQA(HV)/NBR + CR	BNC
16	155-38-278A – Packing	3311 Alt : 1847	HK HK	- 10 to + 100	Air, traces of oil & water vapour	CQA(HV)/CR	CR1
17	155-38-480 – Ring Packing	513029 Alt: B14-1, B14	CKH – 18	- 10 to + 120	Air, traces of oil & water vapour	CQA(HV)/NBR	N3
18	U A 632K – Washer	B14-1	CKH – 18	- 10 to + 100	Air, traces of oil & water vapour	CQA(HV)/NBR	N3
19	669309/A-K – Washer	B14 – 1	CKH – 18	- 10 to + 120	Air, traces of oil & water vapour	CQA(HV)/NBR	N3
20	U A 626-K – Diaphragm	14K-10	CKMC-10	- 10 to + 100	Compressed air, traces of water vapour	CQA(HV)/NBR	N2
21	54-38-132 – Collar	4326-1	CKH – 18	- 10 to + 100	Diesel fuel	CQA(HV)/NBR	N3

(P59) (B)

Sl No	Item Number / Description	Rubber Grade As per drawing	Raw rubber as per Russian specn.	Actual Working Environment		Recommendation	
				Temp (° C)	Medium	CQA(HV) Specification	Rubber grade
22	1-16 (EPV) – Sea.	TC-B14-1(TC -No foreign matter inclusion allowed)	CKH – 18	- 10 to + 120	Air, traces of oil & water vapour	CQA(HV)/NBR	N3
23	1-14 (EPV) – Sealing Ring	TC – 98-1	CKH – 18	- 10 to + 120	Air, traces of oil & water vapour	CQA(HV)/NBR	N1
24	1-16 (EPV) – Ring	TC – B14-1	CKH – 18	- 10 to + 120	Air, traces of oil & water vapour	CQA(HV)/NBR	N3
25	1-18 Packing. Servo valve	14K-22	CKMC – 18	- 10 to + 120	Air, traces of oil & water vapour	CQA(HV)/NBR	N4
26	1-22 Seal	B 14-1	CKH – 18	- 10 to + 120	Air, traces of oil & water vapour	CQA(HV)/NBR	N3
27	4-4 – Packing	TC 98-1	CKH – 18	- 10 to + 120	Air traces of oil	CQA(HV)/NBR	N1
28	520-15-001 – Ring Φ 8, Φ 20	253111 Alt 8075	CKH – 26 CKH – 18	- 10 to + 120	Oil, Air, Grease* & water vapour	CQA(HV)/NBR	N3
29	219-09-430- Ring	IRP 1316	CKΦ - 26	-10 to + 150	Air, traces of oil & water vapour	CQA(HV)/FKM	FKM

Grease* - SIATIN 201 (Styrene 1142. Lithium Hydroxide, Diphenylamine, Instrumen oil)

DETAILS OF RUBBER COMPONENTS USED COOLING SYSTEM (CODE 31)

Sl No	Item Number / Description	Rubber Grade as per drawing	Raw rubber as per Russian specn.	Actual Working Environment		Recommendation	
				Temp (° C)	Medium	CQA (HV) specification	Rubber grade
1	172-31-019 – Gasket	4326-1	NBR18	-10 to 100	Air, oil, lubricant	CQA(HV)/NBR	N3
2	172-31-129 – Gasket	CK 141 Alt 51-3082-1	CKMC30APK M15,CKD	-10 to-70	Air	*	*
3	172-31-146 & 147 – Gasket	CK 141 Alt 51-3082-1	CKMC30APK M15,CKD	-10 to-70	Air	*	*
4	172-31-162 - Gasket	CK 141 Alt 51-3082-1	CKMC30APK M15,HK	-10 to-70	Air	*	*
5	172-31-273 - Gasket	CK 141 Alt 4326-1	CKMC30APK M15,HK/ NBR18	-10 to-70/ -10 to 100	Air/diesel fuel	*	*
6	172-31-290 – Gasket	HO-68-1 Alt. 51-3029	NBR18+CR/ NBR26	-10 to 100	Air, water Oil, fuel	CQA(HV)/NBR+CR	BNC
7	172-31-327 – Gasket	HO-68-1	NBR18+CR/	-10 to 100	Air, Oil, fuel	CQA(HV)/NBR+CR	BNC
8	172-31-328 – Gasket	CK 141 C2JIA Alt 51-3082-1	CKMC30APK M15,CKD	-10 to 70	Air	*	*
9	172-31-329 – Gasket	P - 35 CIUI	CK	-10 to 70	Air	*	*
10	172-31-361 – Gasket	IRP1078 /1287	NBR 26/18	-10 to 100		CQA(HV)/NBR	N3
11	172-31-409 – Gasket	HO-68-1 Alt. 4326-1	NBR18+CR/ NBR18	-10 to 100	Air, Oil, fuel	CQA(HV)/NBR+CR	BNC

Sl No	Item Number / Description	Rubber Grade as per drawing	Raw rubber as per Russian specn.	Actual Working Environment		Recommendation	
				Temp (° C)	Medium	CQA (HV) specification	Rubber grade
12	172-31-411 – Ring	3211 Alt. 51-1562	NR/ IR	-10 to 80	Air, water	CQA(HV)/EPDM	EP
13	172-31-434 – Gasket	1847(1166) Alt.1847(Ty 38.005.838.70)	NR	-10 to 80	air	CQA(HV)/EPDM	EP
14	176-31-019 – Gasket	9831	NBR26	-10 to 150	Water, oil, low freezing liq.	CQA(HV)/NBR	N2
15	176-31-027 – Shock absorber	4326-1	NBR18	-10 to 80	Air, diesel fuel	CQA(HV)/NBR	N3
16	176-31-034 – Shock absorber	4326-1	NBR18	-10 to 70	Air, diesel fuel, petrol, oil	CQA(HV)/NBR	N3
17	175-31-032 – Gasket	4326-1	NBR18	-10 to 70	diesel fuel	CQA(HV)/NBR	N3
18	175-31-149 – Gasket	CK 141 Alt 51-3082-1	CKMC30APK M15,NR	-10 to-70	Air, water	*	*
19	175-31-150 – Gasket	CK 141 Alt 51-3082-1	CKMC30APK M15,NR	-10 to-70	Air, water	*	*
20	175-31-151-A – Gasket	1847 Alt.1847(Ty 38.005.838.70)	NR	-10 to 80	air	CQA(HV)/EPDM	EP
21	175-31-226 – Gasket	4326-1 Alt. HO-68-1 638	NBR18/ NBR18+CR	-10 to 100	Air, Oil, fuel, lub, gasoline	CQA(HV)/NBR	N3

Sl No	Item Number / Description	Rubber Grade as per drawing	Raw rubber as per Russian specn.	Actual Working Environment		Recommendation	
				Temp (° C)	Medium	CQA (HV) specification	Rubber grade
22	175-31-260 – Gasket	638 µ A-2 Alt. 4326-1 HO-68-1	NBR18/ NBR26+CR	-10 to 120	Air, oil, diesel, Petrol, benzene	CQA(HV)/NBR	N3
23	175-31-273 – Gasket	CK 141 Alt 4326-1	CKMC30APK M15,HK/ NBR18	-10 to-70/ -10 to 100	Air/diesel fuel	*	*
24	175-31-275 – Gasket	IRP1338	Silicone rubber	-10 to 250	Air with high O_3 conc., electrified	*	*
25	175-31-277 – Gasket	4326-1	NBR18	-10 to 100	Air, oil, lub	CQA(HV)/NBR	N3
26	175-31-285-A – Shock absorber	2317	NR	-10 to 60	Air, water	CQA(HV)/CR	CR1
27	432-31-104-2 – Gasket	IRP1078 (Ty38-105-12-64-72 Sec A)	NBR 18+26	-10 to 100		CQA(HV)/NBR	N3
28	520-10-003-01 – Gasket	HO-68-1	NBR26+CR	-10 to 70	Air, water, oil	CQA(HV)/NBR+CR	BNC
29	520-10-004-08 – Gasket	HO-68-1	NBR26+CR	-10 to 70	Air, water, oil	CQA(HV)/NBR+CR	BNC
30	520-10 009-01 Gasket	HO-68-1 Alt 4326-1	NBR26+CR/ NBR18	-10 to 70	Air, water, oil	CQA(HV)/NBR+CR	BNC
31	520-15-001-04 – Ring 20	51-3029 Alt. 3074	NBR26	-10 to 120	Air, water, oil	CQA(HV)/NBR	N3

Sl No	Item Number / Description	Rubber Grade as per drawing	Raw rubber as per Russian specn.	Actual Working Environment		Recommendation	
				Temp (° C)	Medium	CQA (HV) specification	Rubber grade
32	40Y 8-13 – Hose (Ty 005-6016-80)	HO-68-1 (cover) 129 (inner)	NBR26+CR NBR18+26	-10 to 70	Air, water, oil	CQA(HV)/NBR+CR	BNC
33	176-31-052 – Gasket	HO-68-1 Alt. 4326-1	NBR26+CR	-10 to 100	Air, fuel, oil	CQA(HV)/NBR+CR	BNC
34	176-31-057-1 – Packing	HO-68-1 44-1	NBR26+CR	-10 to 100	Air, benzene, oil	CQA(HV)/NBR+CR	BNC
35	175-31-104 – Gasket	HO-68-1 Alt. 4326-1	NBR26+CR	-10 to 100	Air, fuel, oil	CQA(HV)/NBR+CR	BNC
36	172-2M-31-076 – Shock absorber	HO-68-1	NBR26+CR	-10 to 125	Air, fuel, oil	CQA(HV)/NBR+CR	BNC
* Specification for Sponge rubber grades is yet to be prepared.							

DETAILS OF RUBBER COMPONENTS USED LUBRICATION SYSTEM (CODE 32)

Sl No	Item Number / Description	Rubber Grade as per drawing	Raw rubber as per Russian specn.	Actual Working Environment		Recommendation	
				Temp (°C)	Medium	CQA(HV) specification	Rubber grade
1	172-32-126 - Gasket	3826	NBR40	-10 to +100	Air, water, weak soln. of alkali & acid, oil- MK8, gasoline	CQA(HV)/NBR	N4
2	172-32-304 – Gasket	9831	NBR 26	-10 to +120	Water, low freezing liq. With oil penetration	CQA(HV)/NBR	N2
3	172 32-542 – Ring packing	9831 Alt. IRP1078	NBR 26	-10 to +120	Water, low freezing liq. With oil penetration, oil fuel lub	CQA(HV)/NBR	N2
4	172-32-545 – Ring packing	9831 Alt. IRP1078	NBR 26	-10 to +120	Water, low freezing liq. With oil penetration,	CQA(HV)/NBR	N2
5	172-32-552 – Gasket	9831 Alt. IRP1078	NBR 26	-10 to +120	Water, low freezing liq. With oil penetration,	CQA(HV)/NBR	N2

Sl No	Item Number / Description	Rubber Grade as per drawing	Raw rubber as per Russian specn.	Actual Working Environment		Recommendation	
				Temp (°C)	Medium	CQA(HV) specification	Rubber grade
6	172-32-568 – Ring packing	IRP1078 Alt 9831	NBR 26+18	-10 to +120	Water, low freezing liq. With oil penetration,	CQA(HV)/NBR	N3
7	172-32-647 – Ring, packing	9831 Alt. IRP1078	NBR 26	-10 to +70	Diesel fuel, oil	CQA(HV)/NBR	N2
8	176-32-006 – Gasket	98-1 Alt 51-3029	NBR18/ NBR18+26	-10 to +100	Air, oil	CQA(HV)/NBR	N1
9	175-32-146 – Collar	IRP1078	NBR18+26	-10 to +100	All type of oil, fuel, hyd./ water, low freezing liq	CQA(HV)/NBR	N3
10	175-32-206 – Gasket	HO 68-1 Alt 98-1	NBR18+CR/ NBR18	-10 to +100	Oil, air, fuel	CQA(HV)/NBR+CR	BNC
11	175-32-209 – Shock absorber	4326-1	NBR18	-10 to +70	Diesel fuel	CQA(HV)/NBR	N3
12	175-32-274 Shock absorber	HO 68-1	NBR18+CR	-10 to +100	Oil, air, fuel	CQA(HV)/NBR+CR	BNC
13	175-32-275 – Shock absorber	HO 68-1	NBR18+CR	-10 to +100	Oil, air, fuel	CQA(HV)/NBR+CR	BNC
14	175-32-285-A' – Shock absorber	3311	NR	-10 to +80	air, water	CQA(HV)/CR	CR1
15	175-32-347 & 348	4326-1	NBR18	-10 to +100	Air, fuel, oil	CQA(HV)/NBR	N3
16	432-32-247 – Ring, packing	98-1	NBR18	-10 to +100	Air, AMG10	CQA(HV)/NBR	N1

Sl No	Item Number / Description	Rubber Grade as per drawing	Raw rubber as per Russian specn.	Actual Working Environment		Recommendation	
				Temp (°C)	Medium	CQA(HV) specification	Rubber grade
17	432-32-248-1 – Ring, packing	9831	NBR 26	-10 to +120	Water, low freezing liq. With oil penetration	CQA(HV)/NBR	N2
18	432-32-573 – Gasket	4326-1	NBR18	-10 to +70	Diesel fuel	CQA(HV)/NBR	N3
19	54-05-696 – Gasket	3825	NBR40	-10 to +120	Air, water, petrol, kerosene, oil	CQA(HV)/NBR	N4
20	54-26-111-1A – Shock absorber	3311 SPCN	NR	-10 to +80	Air, water	CQA(HV)/CR	CR1
21	520-10-003-14	HO 68-1	NBR18+CR	-10 to +100	Oil, air, fuel	CQA(HV)/NBR+CR	BNC
22	520-10-004-07 – Gasket	HO 68-1	NBR18+CR	-10 to +100	Oil, air, fuel	CQA(HV)/NBR+CR	BNC
23	520-10-006-01 – Gasket	HO 68-1	NBR18+CR	-10 to +80	air	CQA(HV)/NBR+CR	BNC
24	520-10-007 – Gasket	4326-1	NBR18	-10 to +70	Air, oil, fuel	CQA(HV)/NBR	N3
25	520-10-008-03 – Gasket	4326-1	NBR18	-10 to +70	Air, oil, fuel	CQA(HV)/NBR	N3
26	40Y 15-7 – Hose (Ty 005-6016 -80)	HO 68-1 (Cover) 129-1 (inner liner)	NBR18+CR NBR18+26	-10 to +100	Air, oil, fuel	CQA(HV)/NBR+CR CQA(HV)/NBR	BNC N2

DETAILS OF RUBBER COMPONENTS USED FUEL SYSTEM (CODE 33)

Sl No	Item Number / Description	Rubber Grade as per drawing	Raw rubber as per Russian specn.	Actual Working Environment		Recommendation	
				Temp (°C)	Medium	CQA(HV) Specification	Rubber grade
1	172-33-169 - Gasket	4326-1	NBR18	-10 to +100	Air, fuel T1,TC1, oil AMG10	CQA(HV)/NBR	N3
2	172-33 612 – Gasket	4326-1 Alt. 583	NBR18	-10 to +90	Diesel, petrol, oil, air, gasoline	CQA(HV)/NBR	N3
3	172-33-646 – Gasket	HO 68-1 Alt.4326-1	NBR18+ CR	-10 to +100	Oil, MK22, MT16П, MC20, AMG10, benzene, diesel	CQA(HV)/NBR+CR	BNC
4	172-33-649 – Plug	3825	NBR40	-10 to +100	Air, water, petrol,T1, TC1, MK20,8, diesel	CQA(HV)/NBR	N4
5	175-33-177 – Gasket	3825 Alt. 51-3029	NBR40	-10 to +100	Air, water, fuels, gasoline	CQA(HV)/NBR	N4
6	175-33-240 – Gasket	4326-1	NBR 18	-10 to +70	Diesel fuel	CQA(HV)/NBR	N3
7	175-33-307-1 – Gasket	98-1	NBR 18	-10 to +70	Diesel fuel	CQA(HV)/NBR	N1
8	175-33-327 - Gasket	4326-1	NBR18	-10 to +70	Diesel fuel	CQA(HV)/NBR	N3
9	175-33-328 – Gasket	4326-1	NBR18	-10 to +70	Diesel fuel	CQA(HV)/NBR	N3
10	175-33-329 – Gasket	4326-1	NBR18	-10 to +70	Diesel fuel	CQA(HV)/NBR	N3
11	175-33-390-1 – Gasket	3825	NBR40	-10 to +100	Air, water, gasoline, fuel	CQA(HV)/NBR	N4
12	175-33-416 – Gasket	3825	NBR40	-10 to +100	Air, water, gasoline, fuel	CQA(HV)/NBR	N4

Sl No	Item Number / Description	Rubber Grade as per drawing	Raw rubber as per Russian specn.	Actual Working Environment		Recommendation	
				Temp (°C)	Medium	CQA(HV) Specification	Rubber grade
13	175-33-525-1 – Gasket	3825	NBR40	-10 to +100	Air, water, fuel, T-1, TC-1, oil MC8, MC20	CQA(HV)/NBR	N4
14	175-33-544 – Gasket	3825	NBR40	-10 to +100	Air, water, fuel, T-1, TC-1, oil MC8, MC20	CQA(HV)/NBR	N4
15	432-33-565 – Seal, oil	98-1	NBR 18	-10 to +100	Oil AMG10	CQA(HV)/NBR	N1
16	432-33-591 – Gasket	3825	NBR40	-10 to +120	Air, water, petrol, kerosene, oil	CQA(HV)/NBR	N4
17	432-91-282-1 – Gasket	632 Alt. HO 68-1	NBR18+CR	-10 to 170	Air, water, fuel	CQA(HV)/NBR+CR	BNC
18	155-05-708 Gasket	4326-1 Alt.4326-1(Ty38-005-838)	NBR18	-10 to +70 / -10 to +100	Diesel fuel/ Fuel T-1,TC-1, MC20	CQA(HV)/NBR	N3
19	155-05-887 – Diaphragm	4327 Alt. 4326-1	NBR18+26+ Poly sulphide	-10 to +100	Air, gasoline, fuel T1, TC1	CQA(HV)/NBR	N3
20	155-05-900 – Gasket	4327 Alt. 4326-1	NBR18+26+ Poly sulphide	-10 to +100	Air, gasoline, fuel T1,TC1, transformer oil	CQA(HV)/NBR	N3
21	155-26-1015 – Ring, packing	513029	NBR18+ NBR26	-10 to +100	Air, gasoline, fuel T1,TC1, transformer oil	CQA(HV)/NBR	N3

Sl No	Item Number / Description	Rubber Grade as per drawing	Raw rubber as per Russian specn.	Actual Working Environment		Recommendation	
				Temp (°C)	Medium	CQA(HV) Specification	Rubber grade
22	54-02-416-A – Seal, oil	98-1	NBR18	-10 to +100	Air, oil	CQA(HV)/NBR	N1
23	54-05-696 – Gasket	3825	NBR40	-10 to +120	Air, water, petrol, kerosene, oil	CQA(HV)/NBR	N4
24	150-31-2170 – Ring, buffer	120C Alt. 2842	CR	-10 to +100	Air, water, fuel	CQA(HV)/CR	CR1
25	2262A-17 – Ring, packing	IRP 1078	NBR18+ NBR26	-10 to +100	Air, water, fuel	CQA(HV)/NBR	N3
26	520-10-003-01 – Gasket	HO 68-1	NBR26+CR	-10 to +70	Air, water, fuel	CQA(HV)/NBR+CR	BNC
27	520-10-004-02 – Gasket	HO 68-1	NBR18+ CR	-10 to +70	Air, water, fuel	CQA(HV)/NBR+CR	BNC
28	520-10-007-04 – Gasket	4326-1	NBR18	-10 to +100	Air, water, fuel	CQA(HV)/NBR	N3
29	520-10-008-01 – Gasket	4326-1	NBR18	-10 to +100	Air, water, fuel	CQA(HV)/NBR	N3
30	520-15-001-04 – Ring	51-3029 Alt. 8075	NBR26	-10 to +100	Air, water, fuel	CQA(HV)/NBR	N3
31	40Y 8-13 – Hose (TY 005-6016-80)	HO 68-1 (cover) 129-1 (inner liner)	NBR18+ CR NBR18+26	-10 to +70	Air, water, fuel fuel	CQA(HV)/NBR+CR CQA(HV)/NBR	BNC N2

DETAILS OF RUBBER COMPONENTS USED IN HULL AND TURRET ASSEMBLIES

Sl No	Item Number / Description	Rubber Grade as per drawing	Raw rubber as per Russian specn.	Actual Working Environment		Recommendation	
				Temp (° C)	Medium	CQA(HV) Specification	Rubber grade
1	155-29 2375 – Ring	HO-68-1 Alt. 4326-1	NBR 18+CR NBR 18	-10 to +70	Air, water, oil	CQA(HV)NBR+CR	BNC
2	172-01-259-2 – Gasket	HO-68-1	NBR 18+CR	-10 to +70	Air, water, oil	CQA(HV)NBR+CR	BNC
3	172-11-002 – Cord	3311 Alt. IRP 1346	NR	-10 to +80	Air, water	CQA(HV)/EPDM	EP
4	172-03-012-1 – Spacer	HO-68-1	NBR 18+CR	-10 to +70	Air, water, oil	CQA(HV)NBR+CR	BNC
5	175-02-499 – Gasket	583 Alt. HO-68-1	NBR 18+CR	-10 to +80 -10 to +100	Petrol, oil, water, air	CQA(HV)NBR+CR	BNC
6	175-03-007-1 Gasket	4326-1 HO-68-1	NBR 18 NBR 18+CR	-10 to +80	Air, water, oil	CQA(HV)/NBR	N3
7	175-03-010-1 – Gasket	4326-1 HO-68-1	NBR 18 NBR 18+CR	-10 to +80	Air, water, oil	CQA(HV)/NBR	N3
8	175-03-036 – Gasket	4326-1 HO-68-1	NBR 18 NBR 18+CR	-10 to +80	Air, water, oil	CQA(HV)/NBR	N3
9	175-03-037 – Gasket	4326-1 HO-68-1	NBR 18 NBR 18+CR	-10 to +80	Air, water, oil	CQA(HV)/NBR	N3
10	432-11-062 – Cord	3311	NR	-10 to +80	Air, water	CQA(HV)/EPDM	EP

Sl No	Item Number / Description	Rubber Grade as per drawing	Raw rubber as per Russian specn.	Actual Working Environment		Recommendation	
				Temp (° C)	Medium	CQA(HV) Specification	Rubber grade
11	432-11-126 – Cord	3311	NR	-10 to +80	Air, water	CQA(HV)/EPDM	EP
12	432-11-168 – Cord	3311	NR	-10 to +80	Air, water	CQA(HV)/EPDM	EP
13	432-11-169 – Cord	3311	NR	-10 to +80	Air, water	CQA(HV)/EPDM	EP
14	176-01-034 – Gasket	HO-68-1	NBR 18+CR	-10 to +70	Air, water, oil	CQA(HV)NBR+CR	BNC
15	172-2M-01-067 – Gasket	HO-68-1	NBR 18+CR	-10 to +70	Air, water, oil	CQA(HV)NBR+CR	BNC
16	172-2M-01-073-1 – Gasket	HO-68-1	NBR 18+CR	-10 to +70	Air, water, oil	CQA(HV)NBR+CR	BNC
17	172-2M-01-077-1 – Gasket	HO-68-1	NBR 18+CR	-10 to +100	Air, water	CQA(HV)NBR+CR	BNC
18	434-01-229 – Gasket	HO-68-1	NBR 18+CR	-10 to +100		CQA(HV)NBR+CR	BNC
19	172-02-203-1 – Gasket	HO-68-1	NBR 18+CR	-10 to +100	Air, oil, fuel	CQA(HV)NBR+CR	BNC
20	175-02-495 Gasket	583 Alt. HO68-1		-10 to +100		CQA(HV)NBR+CR	BNC
21	52-02-415-A – Seal	98-1	NBR18	-10 to +100	Air, oil AMG10	CQA(HV)/NBR	NJ
22	172-03-084 – Collar	98-1	NBR18	-10 to +100	Air, water	CQA(HV)/NBR	NJ
23	175-03-38 – Cord	3311	NR	-10 to +80	Air, water	CQA(HV)/EPDM	EP
24	175-03-039 – Gasket	HO-68-1 Alt. 4326-1	NBR 18+CR NBR 18	-10 to +70	Air, water	CQA(HV)NBR+CR	BNC
25	432-03-187 – Grip, lever	98-1	NBR18	-10 to +100	Air, oil AMT 10	CQA(HV)/NBR	NJ
26	432-66-142 – Ring, sealing	IRP 1078	NBR18+26	-10 to +100	Air, water, oil	CQA(HV)/NBR	N3

Sl No	Item Number / Description	Rubber Grade as per drawing	Raw rubber as per Russian specn.	Actual Working Environment		Recommendation	
				Temp (° C)	Medium	CQA(HV) Specification	Rubber grade
27	54-29-2130 – Gasket	HO-68-1	NBR 18+CR	-10 to +100	Air, oil, fuel	CQA(HV)NBR+CR	BNC
28	172-11-064 – Ring, sealing	513029 Alt.9831 HC-68-1	NBR 26 NBR 18+CR	-10 to +100	Air, water, oil	CQA(HV)/NBR	N3
29	432-62-140 – Ring, packing	IRP 1078	NBR 18+26	-10 to +100	Air, water, oil	CQA(HV)/NBR	N3
30	172-11-094 – Gasket	HO-68-1	NBR 18+CR	-10 to +100	Air, oil, lubricants	CQA(HV)NBR+CR	BNC
31	172-11-099-2 – Collar	511452	NBR 26	-10 to +80	Oil MT,14П,16 П,8П	CQA(HV)NBR	N3
32	172-11-130-1 – Insulator	9-56 (for open system, with metal bonding)	NR	-10 to +70	Air, water	CQA(HV)/CR	CR1
33	172-11-130-1A – Insulator	9-56 (for open system, with metal bonding)	NR	-10 to +70	Air, water	CQA(HV)/CR	CR1
34	172-11-133 – Ring, packing	513029 Alt. 8075	NBR 26 NBR 18+26	-10 to +100	Air, water, oil	CQA(HV)/NBR	N3
35	434-11-035 – Collar	511452	NBR 26	-10 to +100	Air, water, oil, grease	CQA(HV)/NBR	N3
36	434-11-042-1 – Shock absorber	4326 -1 Alt. 513029	NBR 18 NBR 26	-10 to +100	Air, water	CQA(HV)/NBR	N3

Sl No	Item Number / Description	Rubber Grade as per drawing	Raw rubber as per Russian spccn.	Actual Working Environment		Recommendation	
				Temp (° C)	Medium	CQA(HV) Specification	Rubber grade
37	432-11-107-2 – Gasket	638 or 632	NBR 18+CR	-10 to +100	Air, oil, lubricants	CQA(HV)NBR+CR	BNC
38	432-62-140 – Ring, Packing	IRP 1078	NBR18+26	-10 to --120	Air, water, oil	CQA(HV)/NBR	N3
39	520-15-001-01 – Ring	513029 Alt. 8074	NBR 26 NBR	-10 to +100	Air, water, oil	CQA(HV)/NBR	N3
40	175-11-007eb – Buffer	HO-68-1	NBR 18+CR	-10 to +100	Air, petrol	CQA(HV)NBR+CR	BNC
41	175-11-012 -	HO-68-1	NBR 18+CR	-10 to +100	Air, petrol	CQA(HV)NBR+CR	BNC
42	172-12-013 – Ring, packing	IRP1005 Alt. HO 68-1	NDR18	-10 to +100	Air, oil, lub	CQA(HV)NBR+CR	BNC
43	432-12-040 – Bushing	98-1	N3R18	-10 to +100	Air, oil, lub	CQA(HV)/NBR	N1
44	432-23-113 – Washer	IRP1315 Alt. 120C	IR CR	-10 to +70	Air, oil, lub	CQA(HV)/CR	CR1
45	432-23-164 – Washer	120C IRP1315	CR IR	-10 to +70	Air, oil, lub	CQA(HV)/CR	CR1
46	434-17-014 – Gasket	632 Alt. HO 68-1	NBR 18+CR	-10 to +100	Air, petrol	CQA(HV)NBR+CR	BNC
47	434-17-017 – Bushing	120C Alt. IRP1315	CR IR	-10 to +70	Air, oil, lub	CQA(HV)/CR	CR1