

Reference documents: -

- (i) FFV Specification: F1301-901620J
(ii) FFV Specification 00809783 issue 14
(iii) Drawing no: F1301-135341B, 304071978,304071835 & 304072211
(iv) CQA(Met) letter no. CQA(M)/QA-2/84mm/Amn/1/Vol-18 dated 09-01-2019

- 1. Applicable documents: -** In addition to this annexure:
(i) Method of Tensile test: - IS: 1608 / ISO: 6892-1
(ii) Method of Hardness Test: - IS: 1501-1 / ISO:6507-1
(iii) Ultrasonic inspection: - AMS-2630B
(iv) Methods and sampling: - IS: 2500-1 / ISO: 2859-1
- 2. Product description: -** The material is used for manufacture of cartridge case by drawing in cold condition. The cartridge case will be exposed to high temperature and high pressure and thus there are high requirements for the strength and homogeneity of the material.

3. Product requirements

- 3.1 Material: -** The basic material for manufacture of the sheet shall be according in material standard in item code description or corresponding alloy with the exception of some deviations regarding composition and strength.

3.1.1 Preferably Composition: -

	Al	Cr	Cu	Fe	Mg	Mn	Pb	Si	Sn	Ti	Zn	Zr	Others		
													Of each	Total	
Nom	97.50			0.40	0.80	0.70		1.00							
Min		0.00	0.00	0.00	0.70	0.60	-	0.90	-	0.005	0.00	0.001	-	-	
Max		0.04	0.09	0.48	0.85	0.80	0.05	1.10	0.0012	0.03	0.10	0.002	0.05	0.15	

Inspection in accordance with para 6.5.1 Defects not permissible.

- 3.1.2** The material shall comprise the following strength values in cold rolled condition:

Proof stress	Rp 0.2	Min. 140 N/mm ²
Tensile strength	Rm	Min. 170 N/mm ²
Elongation	A5	Min 11 %
Hardness		45-55 HV5

- 3.1.3** The material shall comprise the following strength values in solution treated and artificially aged condition:

Proof stress	Rp 0.2	Min. 250 N/mm ²
Tensile strength	Rm	Min. 290 N/mm ²
Elongation	A5	Min 12 %
Hardness		Min. 100 HV10

Inspection in accordance with para 6.5.2 & 6.5.3 Defects not permissible

- 3.1.4 Structure:** The material shall be free from cracks, lamination, streaks or inclusions of oxide and slag which may adversely affect the shaping, surface treatment (anodising) or strength of the finished cartridge case.

Inspection in accordance with para 6.5.5.

- 3.1.5 Formation of "ears"-** After deep drawing the height of "ears" shall not exceed 7 %, to be calculated as follows: -

$$\frac{H_{\max} - H_{\min}}{H_{\min}} \times 100$$

In this formula H_{\max} and H_{\min} represent the mean value of

Maximum and minimum cylinder heights as measured on one and the same item (cup or cartridge case).

- 3.1.6 Ultrasonic inspection:** - The manufacture shall be carried out Ultrasonic inspection of ingot / slab before cold rolling in accordance to AMS-2630B.
- 3.1.7 Delivery form and condition:** - The material shall be delivered in the form of cold rolled sheets as per dimension mentioned in item code description. The cold-rolling to be performed with a reduction of min. 30 %.
- 3.2 Dimensions:** - The sheets shall have the dimensions as per item code description.
- 3.3 Surface quality:** - The surface of the sheets shall be dull-rolled, clean and free from dents, flakes, blisters, rolled-in scale, streaks of oxide or contaminations which may adversely affect the subsequent shaping, surface treatment (anodising) or strength of the cartridge case.
- 4. Manufacture:** -
- 4.1** The different phases of the manufacture of the sheets shall be performed with thorough inspection in order to ensure an even, acceptable quality. Special attention shall be paid to properties which may adversely affect the shaping of the finished cartridge cases and the surface treatment (anodising) of the cartridge cases.
- 4.2** The manufacture shall be carried out in accordance with a programme laid down in writing. The purchaser shall be informed about major changes in the manufacture procedure for approval.
- 5. Delivery:**
- 5.1 Packing:** - The package of a lot shall protect the sheets against atmospheric action etc. and against damage during handling, transporting and storage. The layers of sheets are to be separated by suitable dividers so that the surfaces of sheets are not damaged.
- 5.2 Marking:** - Each packing unit (pallet or corresponding) shall be marked with item description, quantity and lot number.
- 5.3 Supply of Lot / Heat:** - Vendor has to preferably supply initially full quantity of one heat. Second / another heat quantity can be despatched after completion of previous heat to meet the supply order quantity. This is to reduce the repeat inspection for every part quantity received per heat.
- 6. Inspection:** -
- 6.1 Vendor's inspection:** -
- 6.1.1** The Vendor's inspection shall be performed in accordance with a laid down inspection plan, which shall be kept accessible to the inspection activity of the Purchaser. The Purchaser shall be informed about major changes to this plan.
- 6.1.2** During manufacture the vendor shall, at regular intervals, perform inspection to the extent necessary to verify that the stipulated requirements are met. Particular attention shall be paid to the requirements for structure and surface finish stated in paras 3.1.4 and 3.3.
- 6.1.3** When there is a deviation, a deviation routine agreed upon between the Vendor and the Purchaser shall be followed.
- 6.2 Purchaser's inspection:** -
- 6.2.1** The Purchaser shall perform acceptance inspection on each delivery lot to the extent which is judged to be necessary.
- 6.2.2** Representatives of the inspection activity of the Purchaser are entitled to be present at the Vendor's manufacture and inspection.
- 6.3 Inspection Lot:** - Each delivery lot is an inspection lot.
- 6.4 Certificate:** - For each delivery lot the Vendor shall accompany with a test certificate. The certificate shall contain information on valid product documents, delivery lot number, quantity and certificate number. The certificate shall account for the following inspection results:
- 6.4.1** The result of actual dimensions of samples taken at random from each lot.
- 6.4.2** The results of chemical analysis of the charge/charges used for the delivery lot with regard to the alloy components stated in para. 3.1.1.

6.4.3 Results from the determination of proof stress, tensile strength, elongation and Hardness of the sheets in cold rolled condition and also in solution treated and artificially aged condition of the sample sheet. Annealing temperature and duration time as well as solution treatment and artificial ageing temperature and time should be incorporated in the test certificate. A certificate that strips have been subjected to min. 30% cold rolling, has also to be given by the supplier of the sheets.

6.5 Test methods

6.5.1 The composition shall be inspected by using the analysis method normally used by the Vendor. The number of test specimens shall be minimum 1/charge.

6.5.2 The tensile test shall be performed in accordance with the test standard stated in para. 1. The longitudinal axis of the test piece shall be perpendicular to the last rolling direction and the test piece shall comprise both rolled surfaces. The number of tensile test specimens shall be minimum 5/delivery lot in each test when inspecting blanks in agreed delivery condition and in hardenability test.

6.5.3 The hardness test shall be performed in accordance with the test standards in para. 1. When testing material in agreed delivery condition, and in the test connection with the hardenability test, minimum 5/delivery lot.

6.5.4 The hardenability test shall be performed at the following temperatures and during the following times:

Solution heat treatment: - 525 - 535°C, exposure 1 h with subsequent rapid cooling in water.

Artificial ageing: - 165 - 170°C, exposure 8 h.

The subsequent testing shall comprise tensile test and hardness test to be performed in accordance with para 6.5.2 and 6.5.3.

6.5.5 Inspection of lamination to be performed at the front and the rear end of each hot-rolled blank. Test method, approved by the Purchaser, shall be in writing at the sub-contractor's and be available to the Inspection Department of the Purchaser.

6.6 **Inspection of ear formation at Purchaser end:** - From each delivery lot 5 blanks are sampled for inspection of formation. For calculation and requirement para 3.1.5 may be referred. On receipt of the acceptance of the purchaser, the lot will be cleared by inspection for production.

7. Other conditions: -

7.1 Pilot Production: -

7.1.1 Before starting series production, a manufacturer who has not earlier manufactured the sheets in question shall carry out pilot production.

7.1.2 Pilot production may be demanded before series production is taken up after a long interruption.

7.1.3 Pilot production may be demanded if essential alterations of the manufacturing processes are made. The purchaser shall be consulted in each particular case.

7.1.4 The pilot lot shall comprise 1000 kg of sheets.

7.1.5 The seriesproduction shall not start until the pilot lot has been approved.

7.1.6 Notwithstanding the test certificate produced by the Vendor, the purchaser shall have the right to test and inspect the material at their own premises.