

MATERIALS AND STRUCTURES SYMPOSIUM (C2)
Space Structures I - Development and Verification (Space Vehicles and Components) (1)

Author: Mr. Thomas Kurian
Indian Space Research Organization (ISRO), India, thomas_kurian@vssc.gov.in

Mr. Yezhil Arasu
Vikram Sarabhai Space Centre (VSSC), India, yezhil_arasu@yahoo.com
Mr. B Kiran Kumar
Indian Space Research Organization (ISRO), India, kiran_bekkari@yahoo.com
Mr. Srinivasan Venkitaraman
Indian Space Research Organization (ISRO), India, v_srinivasan@vssc.gov.in

DESIGN, REALISATION AND TESTING OF A LARGE DIAMETER SOLID BOOSTER MOTOR
CASE

Abstract

Solid Motors are generally being used as boosters for heavier satellite launch vehicles. GSLV Mk II, ISRO's operational launch vehicle for geo-synchronous missions has payload capability of 2500 Kg. To meet the enhanced requirements on payload capability, ISRO has configured a three stage vehicle, which will have two Solid Boosters as Strap-on Motors, each of which will deliver a thrust of 6000 kN. The nominal diameter of this three segmented Motor is 3.2 m and case length is 19.5 m (approx.). Both the end segments are having torispherical domes and integral flanges for external connections. Tang and clevis joint with capture feature is used to connect the segments. Provisions are there for attaching the Motor to the core vehicle. Booster Motor Case is one of the costlier components of launch vehicle system. Its cost constitutes 65% of total Motor cost and 20% (approx.) of overall vehicle cost. Thus, it is imperative to make a choice for case material based on appropriate criteria pertaining to design, development and production of the Motor case. 250 Gr. Maraging steel is the material selected for the case on account of various factors. The basic thickness at various regions on the Motor Case were derived through conventional design approach and Elasto Plastic Fracture Mechanics criteria was used for confirming the adequacy of design margins on burst pressure in presence of cracks on welds.

Due to non-availability of flow forming technique for large diameter shells in India, the conventional roll and weld construction is adopted for the realisation of the Segment hardware. Very stringent design and quality requirements are there on fabrication and inspection of the hardware. Sophisticated fixtures and set ups are employed in the fabrication. Segment interchangeability is achieved through the master and slave concept for the drill jigs used for drilling the Segment joints at different work centres. The middle and nozzle end segments of this Motor case is the largest integral segments ever made for a launch vehicle program through the welding route.

As part of the mandatory requirement on acceptance of hardware, the Segments are proof pressure tested with necessary instrumentation. Suitable end closures are assembled to the open ends of the Segments and the assembly is tested in the vertical condition.

This paper outlines the salient information regarding the design, realisation and acceptance testing of this large diameter Solid Motor Case.