LLNL Laser Beamlet Mechanical Parts

Kansas City Division

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LLNL LASER BEAMLET MECHANICAL PARTS

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Final Report
M. G. Chapman, Project Leader

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ABSTRACT

This report describes product manufactured to support the High Energy Laser Project of Lawrence Livermore National Laboratory. The project was also undertaken to maintain machining competency in the AlliedSignal Inc., Kansas City Division, Mechanical Departments.

SUMMARY

Lawrence Livermore National Laboratory (LLNL) has initiated a project to develop a high energy laser to provide an aboveground experimental capability for maintaining nuclear weapons competence. It also will provide a means of achieving fusion ignition utilizing solid state lasers as the energy driver. To complete this project, LLNL needed to procure hardware for evaluation purposes. This development endeavor included building the Beamlet Lens Positioner Assembly at AlliedSignal Inc., Kansas City Division (KCD). This assembly included piece parts from all KCD mechanical areas. Piece part assembly of the unit was completed at KCD, and the unit was shipped to LLNL.

DISCUSSION

Scope and Purpose

The project objective was to supply hardware to Lawrence Livermore National Laboratory (LLNL) for beamlet laser testing.

Prior Work

During FY92 AlliedSignal Inc., Kansas City Division (KCD), initiated a Production Capability Assurance Project (PCAP) to supply a switching mechanism to the LLNL Laser Group. This project supplied a metal housing and other hardware for evaluation purposes. This metal housing replaced a nonmetallic unit.

Activity

On May 4, 1995, the KCD completed a project for the Laser Group at Lawrence Livermore National Laboratory. This project was a Lens Positioner Assembly, which will be used in the current LLNL fusion reaction study. The unit's function of final laser positioning at the target would help LLNL engineers establish the final design of the new Petawatt LLNL Laser.

This new laser is projected to be at least ten times stronger than the NOVA laser. The assembly delivered weighed 700 lbs. Two of the major components specified use of 26-inch-diameter parts with a rectangular hole, outlined with a spherical radius ledge and O-ring groove. Starting point axis of this spherical radius was 20 feet from the part with a 10-inch offset. This requirement created numerous NC programming, engineering, and manufacturing challenges which were met and resolved. Medium- and small-size parts with complex features such as fine threaded details were produced with minimum fixturing. This reduced cost and delivery.

Purchase product such as O-rings were expedited by using off-the-shelf stock. The bellows assembly, one of the major components, required the selection process of finding a new supplier. The unit was then cost estimated by the supplier and reviewed by engineering (KCD and the supplier). Part material was purchased, complex end rings and bellows were manufactured, and the unit was assembled by welding end rings to the bellows before delivery to KCD.

Definition release for this bellows was on January 6, 1995. Delivery to KCD was on April 17, 1995. With the completion of the piece parts and subassemblies, final assembly was performed. A leak test requirement of 1×10^{-8} was required and met. The completed unit was accepted on May 4, 1995. Photographs of the piece parts and the final assembly unit appear following the text (Figures 1 through 6).

Accomplishments

1. The 26-inch-diameter parts with a rectangular hole, outlined with a spherical radius and O-ring groove presented an NC programming challenge. This spherical radius was 20 feet from the part with a 10-inch offset. NC programming of this size part with this large axis of rotation had not been developed in the past. Several iterations of NC tapes were produced to complete the project.
2. Delivery of the completed unit was made to LLNL with a successful leak test of 1×10^{-8} leak rate.

Figure 1. Lens Holder

Figure 2. Lens Simulator

Figure 3. Adjusting Bellows Assembly

Figure 4. Conical/V-Groove Seat

Figure 5. Adjuster Block Assembly Piece Parts

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BEAMLET INVENTORY
— 6 inches —

Figure 6. Adjuster Block Assembly