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HIGH PRESSURE SPACE SUIT ASSEMBLY

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HIGH PRESSURE SPACE SUIT ASSEMBLY

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ABSTRACT

An effort is underway to incorporate advanced suit and LSS components into a functional suit in order to assess the performance of these components. A brief description of the suit configuration is presented in the following text.

SUIT SYSTEM

Figure 1 shows the space suit assembly (SSA) which is currently being developed. A detailed review of advanced suit configurations, component developments, and mobility exercises in the AiResearch AES, Ames AX-2 and Litton RX-4 suits provided the basis for selection of the configuration shown. The SSA can be considered as a hybrid suit in that it incorporates both hard and soft suit components.

The torso configuration employs hard structure both above and below the suit entry closure and in the briefs section between the waist and hip joint. The torso closure, currently under fabrication by Air Lock, Inc., is geometrically similar to the dual plane closure used on the RX-4 hard suit. This torso configuration provides maximum area on the back of the suit for mounting the LSS components and allows for easier entry into the suit as compared to the rotary bearing waist closure used in the Ames AX-2. An off-the-shelf hemispherical helmet and connector assembly will be utilized. Waist mobility will be provided by a single axis, "elliptical," dual opposed rolling convolute joint having a 56° forward flexion range.

Since maximum mobility, minimum leakage, long operational life, and ease of fabrication at low cost are of primary concern in this development, special attention has been given to the selection of extremity joints. The shoulder joint employs three sealed bearings with an internal linkage rolling convolute in the first element of the joint. The elbow incorporates a two-segment, dual-opposed soft rolling convolute with sizing ring attachments at both ends of the joint (all sizing segments shown shaded). The hip is similar to the AES configuration which consists of two sealed bearings and a two-axis, dual-opposed soft rolling convolute. The knee incorporates a two-segment soft toroidal joint with sizing ring attachments at both ends. A two-axis, dual-opposed soft rolling convolute is utilized at the ankle. A universal fit pressure boot similar to that used in the Ames AX-2 suit will be utilized.

The sealed bearing concept developed under contract NAS 2-8442 will be used at all rotary interfaces of the suit. Phase V gloves, which utilize the tucked fabric technique for the thumb and finger assembly, are currently being developed under contract NAS 2-8846.

All soft component hardware fabrication will consist of a multiple laminate structure of neoprene coated Kevlar fabric and rip stop materials.

Configuration drawings of the suit components are shown in the appendix.

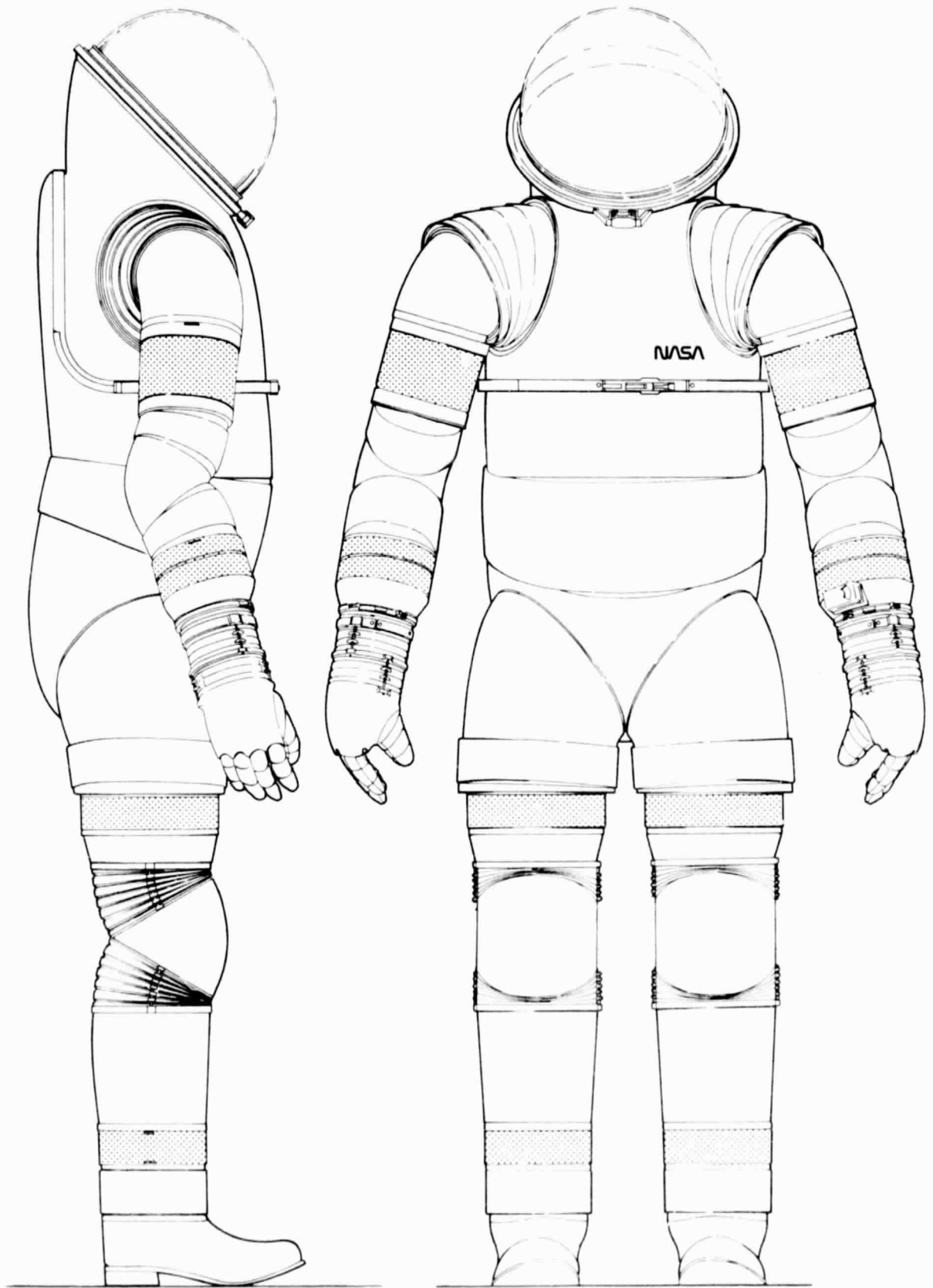


Figure 1.— Space suit assembly.

SUIT DUCT SCHEMATIC

The layout of the internal suit plumbing is shown in figure 2. A single suit pressure shell penetration provides the interface for all suit-LSS connections. The LCG feed and return lines and the vent garment feed line are then internally routed to a multiple connector at the front of the torso. This multiple connector, which is being built by Airlock, Inc., is the only plumbing connection that must be made in donning the system.

The gas distribution in the vent system is different than has been used on other suits. The entire gas flow to the suit enters a small plenum chamber built into the torso. Approximately 90 percent of the flow is ducted to the helmet to remove CO₂ and prevent visor fogging. This gas then flows back around the upper torso to an exhaust vent near the inlet plenum. The remaining 10 percent of the flow is fed through the multiple connector into the vent garment (fig. 3), which distributes the gas to the hands and feet. This dehumidified gas, which has been warmed by heat exchange through the vent ducts, flows back over the limbs to the exhaust vent. This arrangement should be very effective in evaporating any sweat on the extremities so that comfort will be improved. In addition, the total gas pressure drop through the suit will be reduced, since only a small part of the flow must be forced through the small ducts.

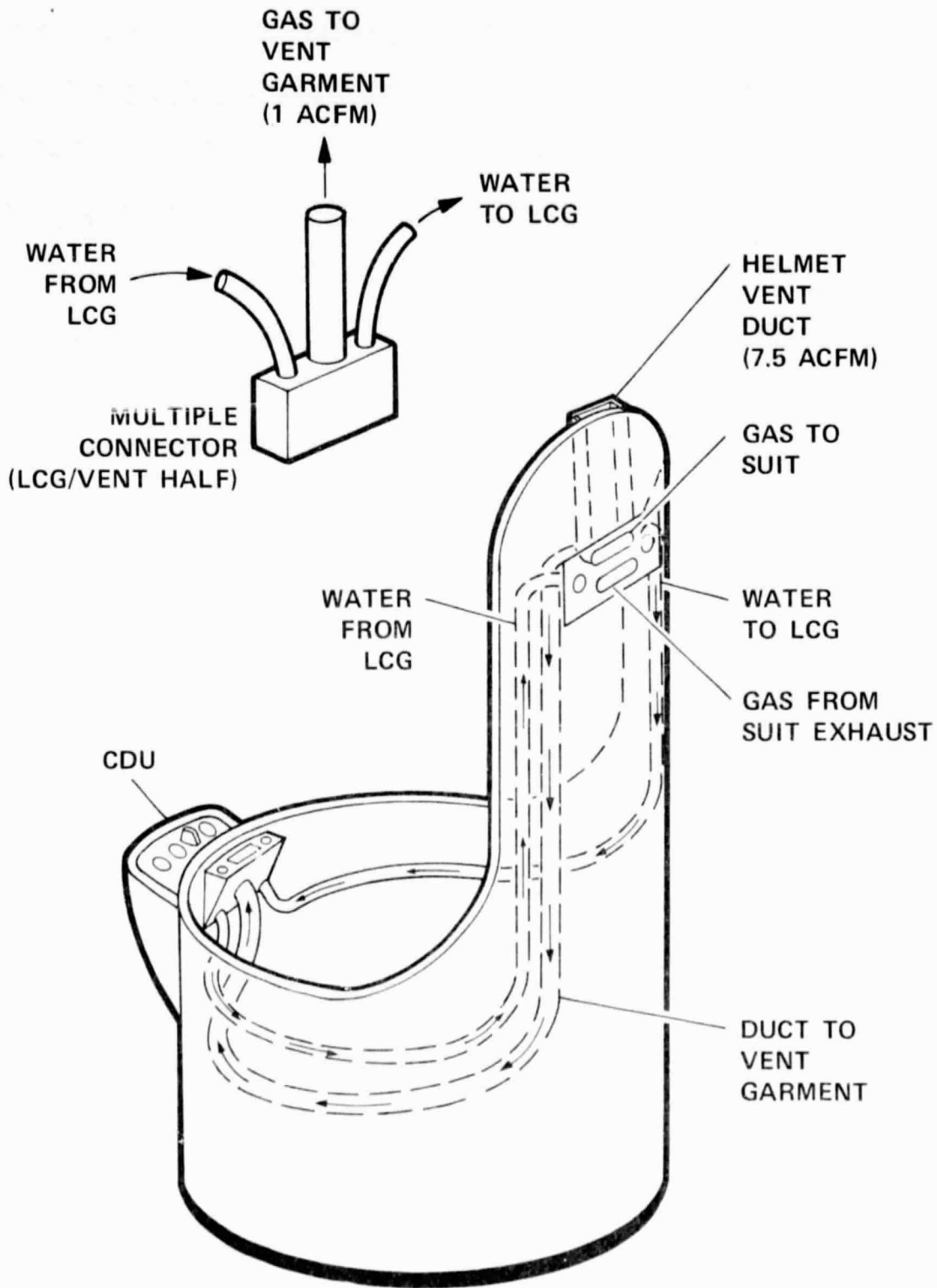


Figure 2.— Suit duct schematic.

LCG/VENT/COMMUNICATIONS ASSEMBLY

Figure 3 shows the integrated liquid cooling, gas distribution, and communications garment assembly. The gas vent ducts are attached to the garment rather than to the pressure suit assembly. This provides for a positive means of keeping the ducts in position as compared to tying them to rotary suit segments.

Liquid cooling, utilizing the highly effective patch approach developed for Ames under contract NAS 2-7485 is provided at the head and torso only. Preliminary testing at Ames has indicated that this approach will provide all of the cooling necessary for thermal comfort at the metabolic rates expected during orbital EVA's. Two garments are currently being fabricated for a more thorough evaluation at Ames.

A standard Apollo communications carrier assembly will be integrated with the head part of the garment.

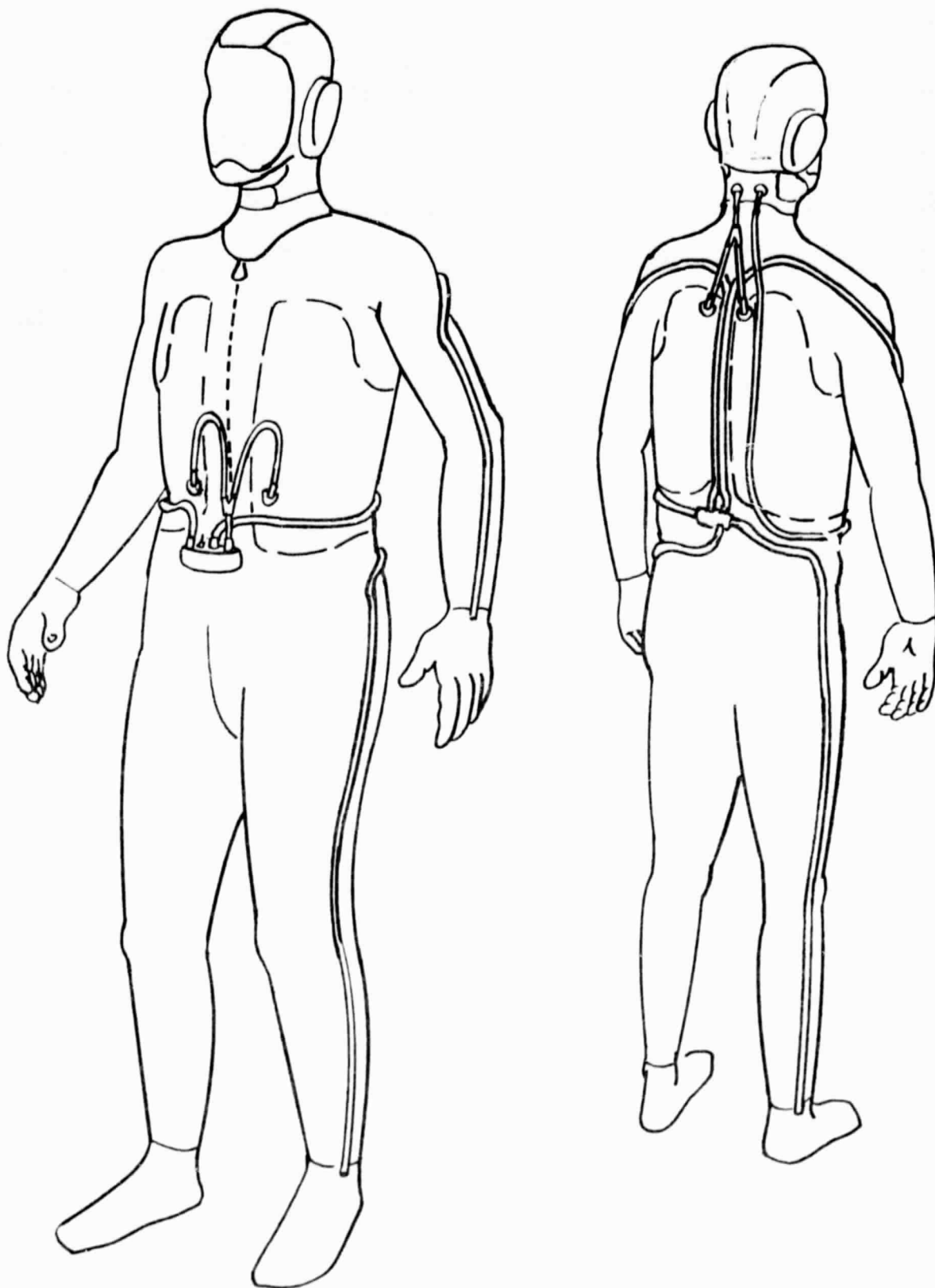


Figure 3.- LCG/Vent assembly.

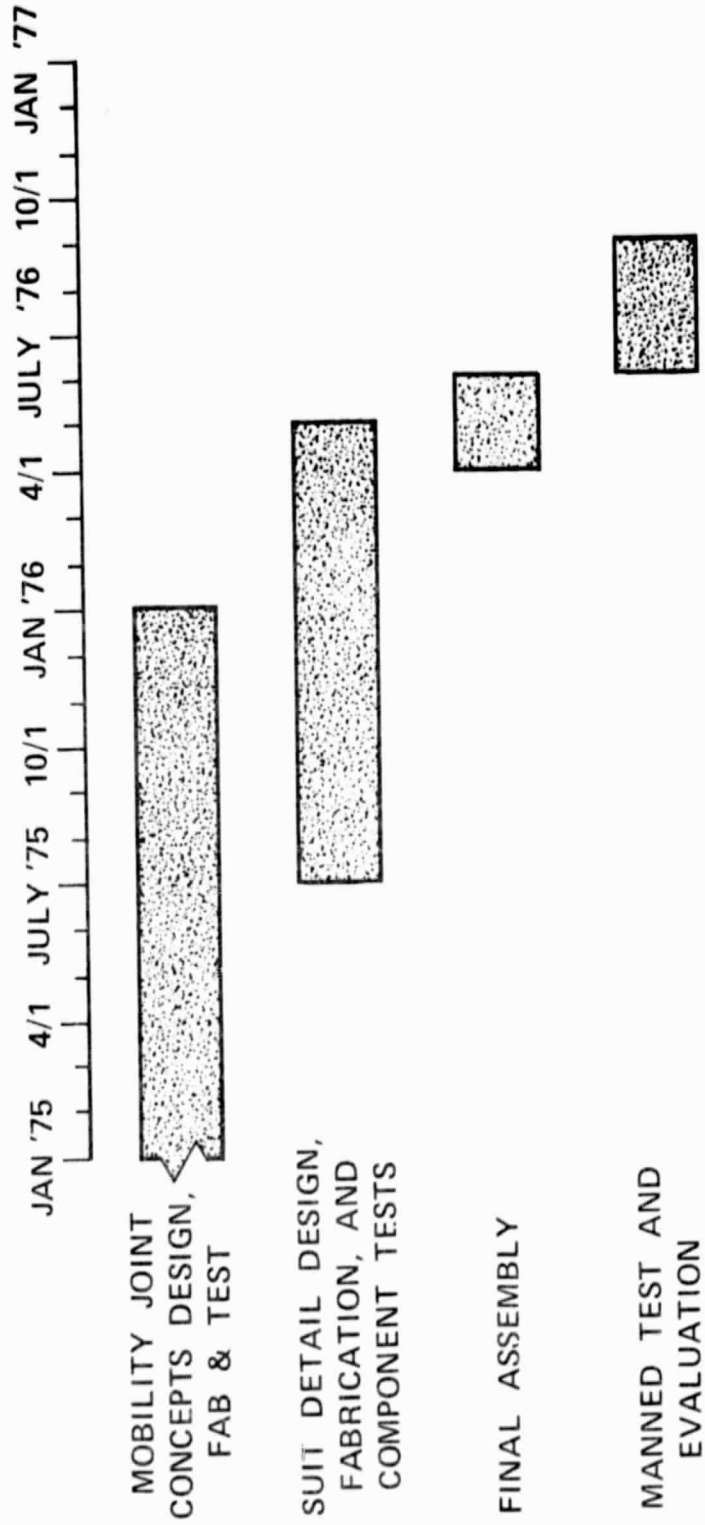
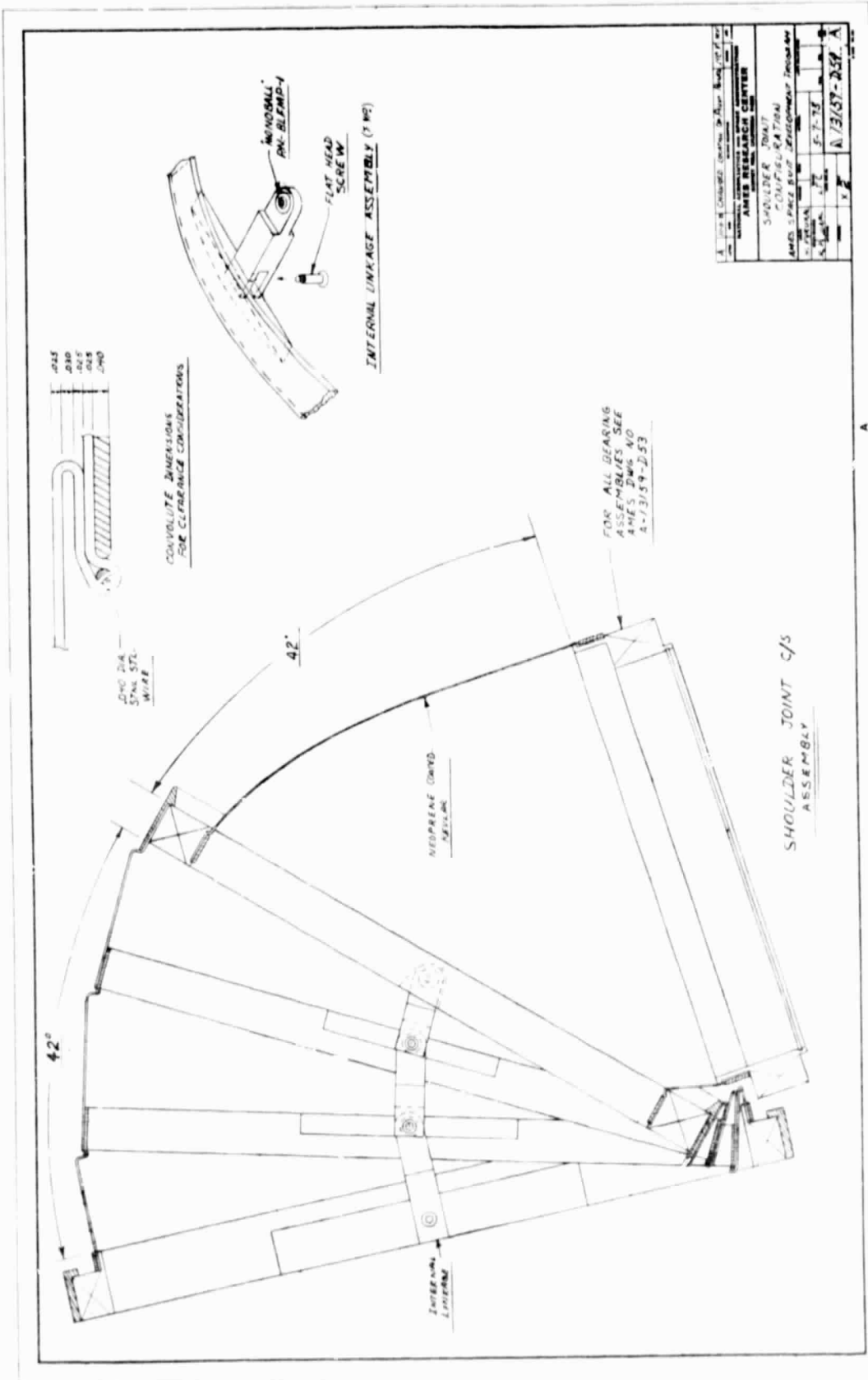


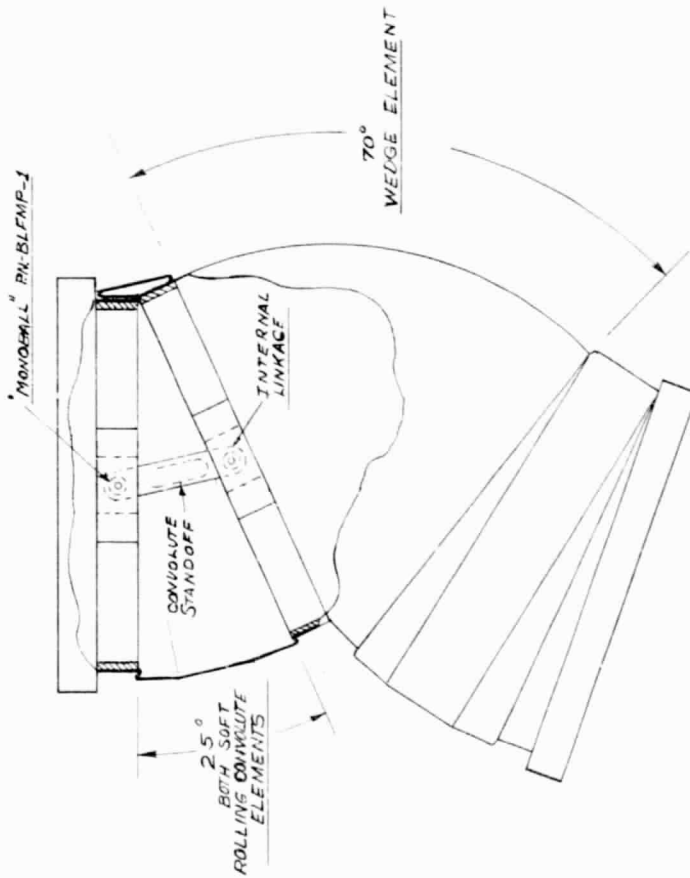
Figure 4.- High Pressure Suit Program Schedule.

APPENDIX

COMPONENT CONFIGURATION DRAWINGS

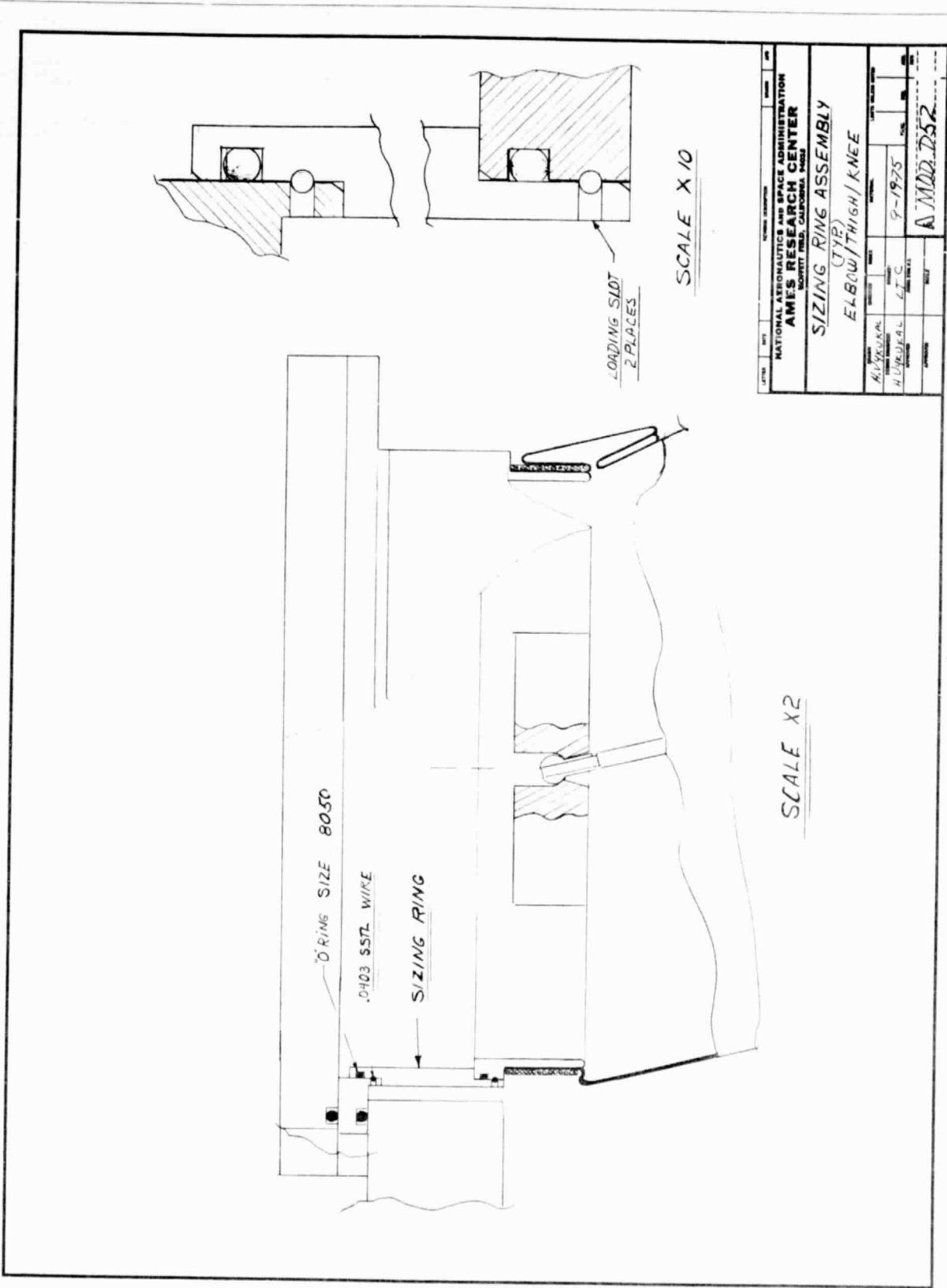


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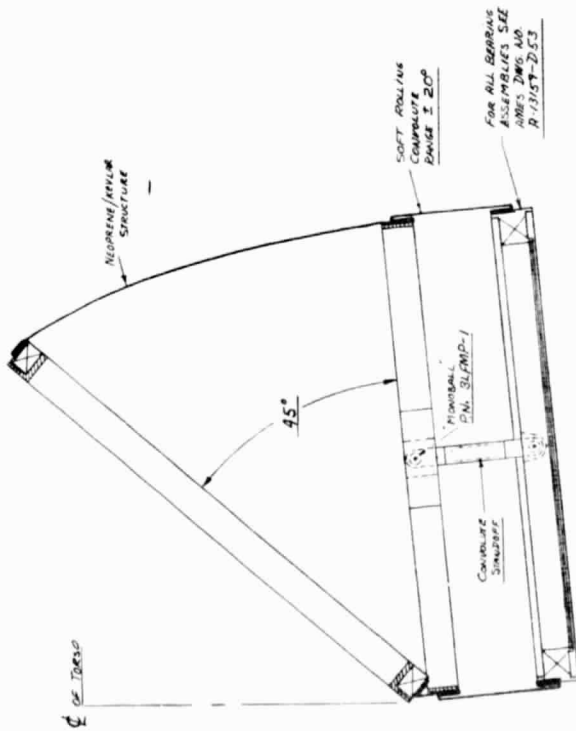
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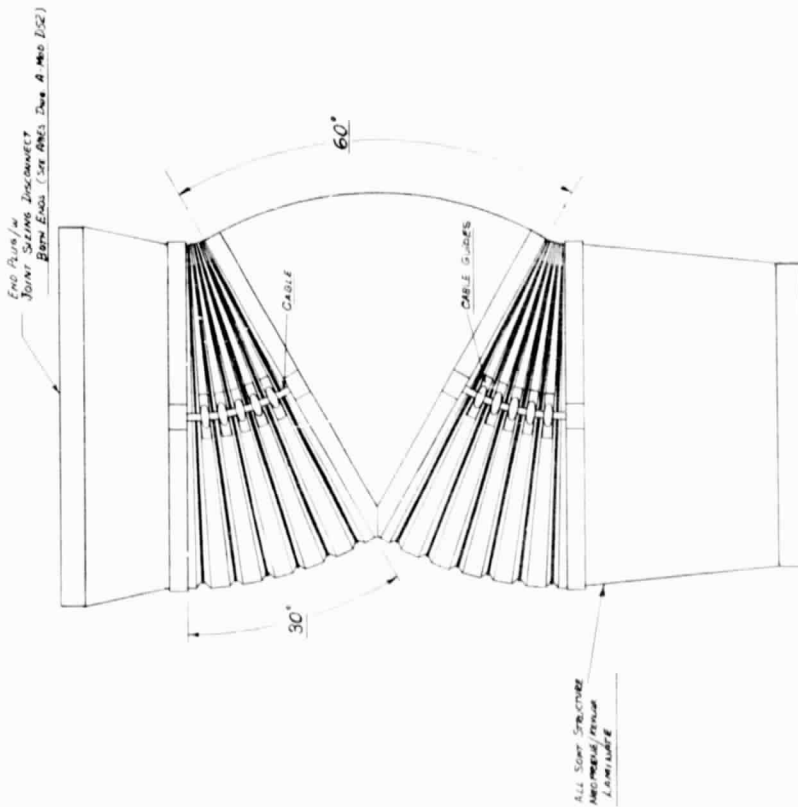
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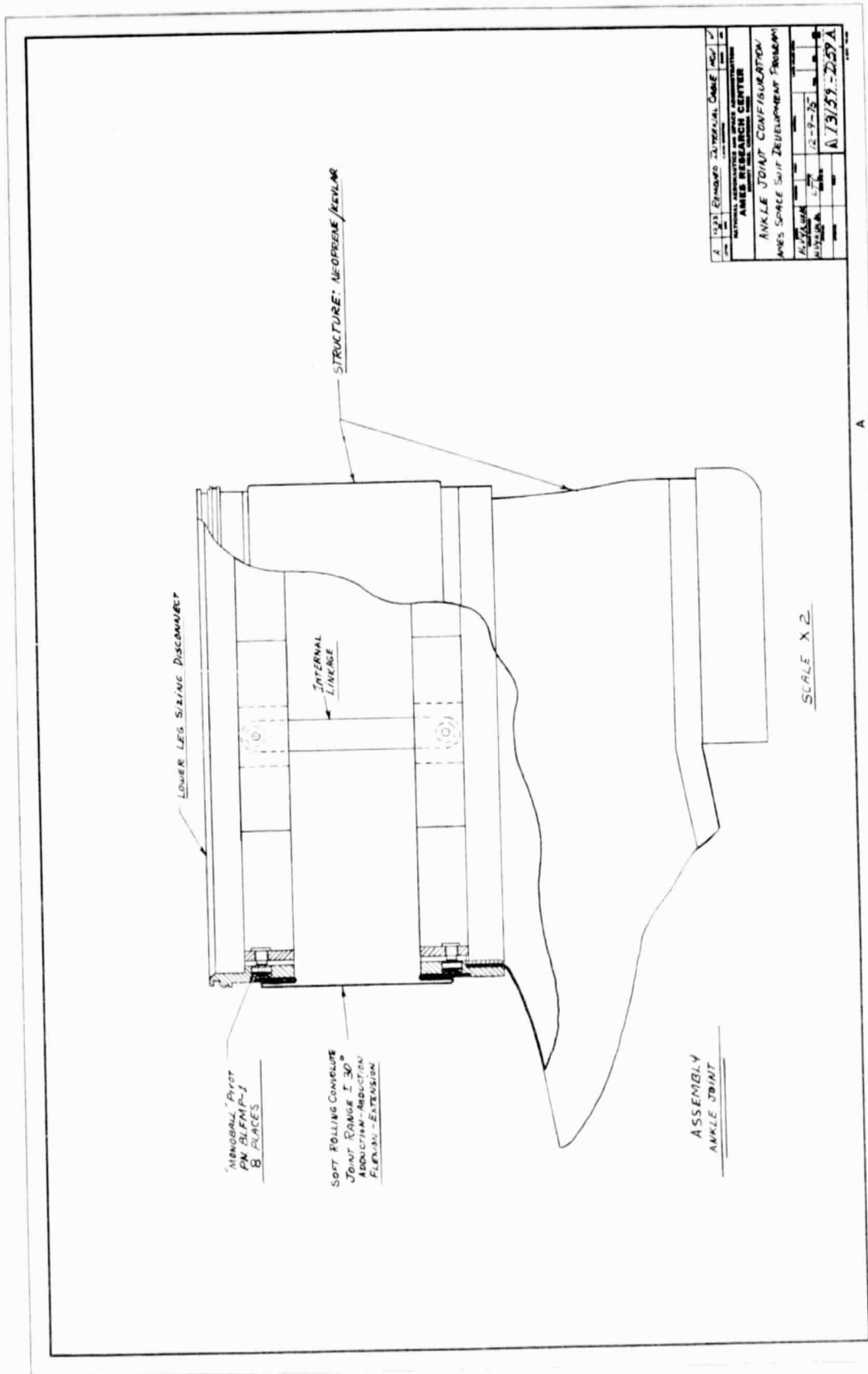
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Universal-fit boot.

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