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(NASA-CR-161565) SPACE TRANSPORTATION
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STRATOS DIVISION
DOCUMENT NUMBER ER 76300-5

FINAL REPORT

SPACE TRANSPORTATION SYSTEM DISCONNECT
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FINAL REPORT

SPACE TRANSPORTATION SYSTEM DISCONNECT

Prepared for:

George C. Marshall Space Flight Center
Marshall Space Flight Center
Huntsville, Alabama 35812

Contract Number NAS-3-32806

5 March 1980
ABSTRACT

Work described in this report demonstrates that the use of medium duty 300 psi fluid disconnects for orbital servicing is both practical and technically feasible. A prototype disconnect was designed and tested, based on criteria formulated from a survey of expected usage requirements for orbital servicing concepts. Testing involved the comparison of three seal materials (EPR, Neoprene and Teflon), and two test media (helium and Freon 21), and was conducted over a temperature range of -150°F to +225°F. Results indicated low helium leakage ($10^{-4}$ sccs) and extremely low engagement forces (56 lbf). Special testing was also performed on a new seal design. Design concepts for a cryogenic disconnect and a high pressure disconnect were investigated. Results of an industry survey for usable orbital servicing disconnects and areas needing attention in future studies are discussed.
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1.0 INTRODUCTION

The final report provides the history and status of the Space Transportation System Disconnect Program performed by Fairchild Stratos Division (FSD) under Contract Number NAS-8-32806 to George C. Marshall Space Flight Center.

1.1 Objectives

The objective of this program was to develop and qualify a fluid disconnect or family of disconnects capable of servicing a wide range of orbiting payloads. Servicing, in this context, implies mating of the Shuttle Orbiter with a satellite, followed by modular replacement and/or replenishment of satellite subsystems or experiments. The types of fluids generally include propellants, pressurants and coolants, as typically used in subsystems for attitude control, thermal conditioning, special experiments, etc. The use of fluid disconnects as part of an integrated orbital servicing concept provides the capability for replenishment, mixing, or exchange of on-board fluids to extend satellite orbital lifetime, increase payload, or vary experiments.

1.2 Program History

FSD received a contract in September 1976 from MSFC to design, develop, fabricate and test a fluid disconnect for Space Operation Systems. This original program was divided into two phases.

Phase I was to identify potential users and applications, formulate specific design criteria, survey available hardware and performance data, make hardware modifications if required and perform development testing on selected designs. Lacking available hardware, a disconnect was to be designed to meet the specified requirements, fabricated, and subjected to development testing.

Phase II was to update specification requirements formulated in Phase I and then update design, fabricate and perform qualification testing on two separate designs.

Funding for this program was $103,000 and the initial scheduled completion date was December 1976. In May 1977, it was determined that for lack of an available off-the-shelf disconnect, FSD would design, fabricate and test a new medium-duty disconnect (300 psig operating pressure). Conceptual designs for a cryogenic disconnect and a high pressure disconnect (3,000 psig operating pressure), were added to the program. FSD was also requested to support the Martin Marietta Module Exchange Mechanism (MEM) Demonstration.
1.2 Program History (continued)

In April 1978, FSR met with MSFC program personnel and redefined the effort. This change was a result of interest shown for a Freon 21 disconnect for use on the 25 kW Power Module. Consequently, the program was modified to fully support a Freon 21 disconnect. The program schedule was moved out to October 1979 but remained within the original budget constraints. Table I is a brief summary of the final Statement of Work (SOW).

1.3 Summary and Conclusions

Work performed by FSR has demonstrated that the use of fluid disconnects for orbital servicing is both practical and technically feasible. Contact with other companies involved in space activity has shown that much interest does exist for hardware that expands the scope of orbital servicing and that efforts in this field should continue.

FSR has designed and successfully tested a medium duty (300 psi) prototype disconnect following a thorough search of industry and government sources which failed to locate an existing off-the-shelf design suitable for the orbital servicing concept. Testing indicated low helium leakage (10^-4 sccs), low engagement forces (80 lb) and demonstrated the capability of fluid transfer between simulated spacecraft after installation on a Module Exchange Mechanism (MEM) designed and built by Martin Marietta, Denver. In addition, a previously qualified JPL disconnect was identified as being adaptable for possible use with Freon 21 on the 25 kW Power Module and design concepts for a high pressure disconnect and a cryogenic disconnect have been laid out.

Development testing of the NASA prototype disconnect has confirmed the ability to achieve low helium leakage and low engagement forces. Problems identified lie in seal design and measurement of leakage rates when using Freon 21. The program slippage was attributed to program changes and additional testing done to help resolve the seal problem. This program was completed within the original budget.
Table I. NASA Disconnect Statement of Work (April 1978)

- Determine Design Requirements
- Identification of Potential Users and Applications
- Survey of Available Hardware
- Design New Medium Duty (300 psi) Disconnect
- Fabricate Prototype Hardware
- Provide Prototype Hardware for Martin MEM Demonstration
- Development Test Program
- Design Hold:
  - Layout of Redundant Seal Medium Duty Disconnect
  - Layout of a Cryogenic Disconnect
  - Layout of a High Pressure (3000 psi) Disconnect
- 25 KW Power Module - Freon 21 Disconnect
  - Establish Requirements
  - Test Hardware - NASA and JPL Test
- Final Report
1.3 **Summary and Conclusions (continued)**

Future work will be needed to refine the concepts and designs developed under this contract. Major areas needing attention include:

- Seal compatibility and containment with Freon 21 and MMH.
- Seal redundancy for reliability.
- Pressure balancing of more complex design to minimize engagement loads.
- Internal swivel to simplify disconnect/vehicle interface.
- Minimize leakage and spillage volume.
- Scale up the existing 1/2" design to 1" design for the 25 KW Power Module.

2.0 **PROBLEM DEFINITION AND REQUIREMENTS**

Initial efforts of this program involved the definition of the potential requirements necessary to provide the best disconnect for use in a broad range of applications. After discussion with MSFC and a review of expected usages, a set of basic requirements was prepared (see Table II). Primary design goals were low leakage and minimum engagement, retention and separation forces.

The initial intent was to provide a disconnect design from existing industry hardware. FSD had contacted eleven potential suppliers requesting technical data and designs on their disconnect. In addition, FSD selected WESRAC (Western Research Application Center) to assist with a survey of available technology for disconnects.

WESRAC, a non-profit computer search firm operated by the University of Southern California with the cooperation of NASA, can access all the major data files and can extract abstracts of interest by means of a cross-coupling of key words, modifiers, and exclusions. FSD, with the technical assistance of WESRAC, searched five major data files (CLAIMS/GEN, NTIS, NASA, ISMEC, and COMPENDEX). These files cover patents, general engineering, private industry, and government sources of technical data. A total of 213 "hits" were recorded, based on the list of key words, modifiers and exclusions. The corresponding abstracts were ordered printed. FSD reviewed these abstracts and placed orders for documents and patents of interest.
Table II. Basic Requirements - NASA Space Transportation System Fluid Disconnects

1. Classification:  
   Class 1: Low pressure, self-sealing, automatic open/close  
   Class 2: High pressure, self-sealing, automatic open/close

2. Size:  
   1/4 inch to 1 inch

3. Fluids:  
   Class 1: Liquid Hydrogen  
   Class 2: Inert gases (He, N₂, etc.)

4. Pressure:  
   Class 1: 100 psia (maximum operating)  
   Class 2: 3000 psia (maximum operating)  
   Proof Factor: 1.5X  
   Burst Factor: 2.0X

5. Temperature:  
   Class 1: -423°F to +150°F  
   Class 2: -150°F to +250°F

6. Leak Rates:  
   Class 1 room temperature: 1 x 10⁻⁴ sccs GHe  
   -423°F: 0.1 sccs GHe  
   Class 2 room temperature: 0.1 sccs GHe

7. Spillage:  
   To be minimized (interface enclosed volume).

8. Separation Force:  
   Pressure effects on engage/disengage forces and on separation force while connected must be minimized.

9. Alignment:  
   Self-aligning within ±5° conical and 1/16-inch offset.

10. Life/Endurance:  
    10 years and 500 cycles.
2.0 PROBLEM DEFINITION AND REQUIREMENTS (continued)

The need for specific design criteria was also considered necessary. FSD contacted 8 potential satellite and payload contractors in an attempt to discuss anticipated fluid requirements by fluid type, operating pressures, mission life, leakage, etc.

Additional background information was obtained by review of orbital servicing studies and other related documents, and attendance at a UCLA short course on Space Shuttle Payload Design and Operation.

The results of all these investigations turned up no available hardware that was considered usable. Only one disconnect supplier responded formally but the unit did not appear to be applicable to the NASA disconnect program. The WESRAC search did not turn up any designs which were directly usable in the intended application, and no specific design requirements were identified by the satellite and payload contractors.

Consequently, during the program review held in November 1976, a decision was made to proceed with a new design utilizing the best features of all concepts investigated to meet a set of generalized fluid requirements. The program structure and schedule were revised to reflect this change in scope.

Appendix I contains a summary of the WESRAC input and output, including abstracts, and a summary of the reports reviewed.

Appendix II contains copies of the letters requesting support from the valve suppliers and payload contractors, with the name and address of those contacted.
3.0 DISCONNECT DESIGN

3.1 Medium Duty Disconnect (NASA Prototype)

Following layout work and design study tradeoffs, a 1/2", 300 psig, disconnect design was presented to MSFC at a preliminary design review held in April 1977. This design features an external swivel with semi-balanced sleeve/poppet which provides relatively low pressure induced separation forces (approximately 1/3 standard unbalanced design), only one close tolerance sealing diameter, relatively short engagement and reasonably low interface volume. Although designed for leakage of $1 \times 10^{-4}$ sccs helium, MSFC specifically requested that the leakage rates and spillage volume be improved. This request was adopted as a design goal.

This disconnect design is shown in Figure 1 and in Photograph 1. The design requirements are shown in Table III. Fabrication of two test disconnects was started in April 1977 and the first prototype disconnect was delivered for test in July 1977. Simultaneous with fabrication, a detailed development test procedure was prepared and test fixtures built.

The original intent was to use a proprietary TRW material, AF-E-411, for the vent, poppet and sleeve seals. This material is excellent for MMH and other common spacecraft propellants. However, due to the excessive cost for molded seals made of AF-E-411, ethylene propylene rubber (EPR) material was chosen for prototype testing. Neoprene and Teflon seals were also tested.

3.2 Medium Duty Disconnect (JPL)

Discussion with MSFC in April 1978 indicated the need for a medium duty Freon 21 disconnect for use on the 25 kW Power Module. Because considerable modification would be required with the NASA disconnect, another FSD designed disconnect was added to the program. This disconnect was flight qualified by the Jet Propulsion Laboratory (JPL disconnect) and used in the Mariner Space Vehicle. The design of this disconnect with internal swivel offers simplicity and a hard line installation which may make it compatible with the current power module design concept. Minor modification to the hardware and seals compatible with Freon 21 is considered necessary.

The JPL design is shown in Figure 2 and in Photograph 2. The design requirements are shown in Table III.
3.3 Additional Disconnects

In light of the program desire to provide a family of disconnects suitable for a full range of orbital servicing applications, FSD performed conceptual layouts of three additional disconnects. These include a 1/4-inch high pressure (3,000 psig operating pressure) gaseous helium or nitrogen unit and a 1/2-inch cryogenic unit based on the NASA prototype but using a bellows and low temperature seal for fluid containment. Also included was a modification of the NASA prototype designed to have redundant seals for improved reliability. See Figures 3, 4 and 5.

There is no intention at this time to pursue these units due to time and budget constraints. However, it is felt that the preliminary work done supports the concept of a family of simple, reliable, multi-purpose disconnects capable of supporting many varied space servicing applications.
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4.0 DEVELOPMENT TESTING

Testing of the first prototype NASA disconnect was started in July 1977 in accordance with Development Test Procedure FP 76300-2 (see Appendix III). The original test plan included the following:

- Examination of Product
- Proof
- Leakage
- Functional
- Flow and Pressure Drop
- Interface Volume
- Life Cycle
- Vibration
- Burst
- Post Test Examination

This test plan was modified as initial testing and program changes dictated. Vibration and burst testing were deleted in an effort to conserve funds and to ensure availability of the disconnects for additional testing, if required. The deletion of these two tests did not affect the overall test results of the units.

The test program was expanded to include Freon 21 testing using different seal materials and to include a leakage test of a new concept of seal that could be applicable to future modifications of the NASA and/or JPL disconnects.

A test fixture was designed and fabricated to allow for automatic or manual operation of the disconnects. This fixture provided a fixed installation for the Space Half Disconnect (SHD) and a two-position installation for the Mission Half Disconnect (MHD). The MHD could be installed so that the two disconnects would be in nominal alignment or with 0.06-inch offset and ±5° angulation misalignment. A 28 VDC motor and screw drive mechanism was used for engagement and disengagement. Two load cells were installed in the SHD mounting bracket to provide engagement force data.
4.0 DEVELOPMENT TESTING (continued)

A test stand was built to provide gaseous helium, a 28-volt power supply, and control switches. An environmental box was fabricated to permit testing at high and low temperatures. Figures 6 and 7, and Photographs 3, 4 and 5 depict the test setup.

The initial phases of testing disclosed some minor problems of leakage, seal blowout, seal contact on engaging, and seal rollover. These problems were solved by redesign of the interface seal groove, SHD guide, MHD sleeve, seal retainers, and a new SHD poppet spring.

Each test performed is described in detail in the following paragraphs. A summary of the NASA disconnect test results is compared with JPL disconnect test results in Table IV.

NOTE: The JPL disconnect was not tested under this program due to the cost of fabricating new seals compatible with Freon 21. The design is, however, considered usable for a wide variety of spacecraft servicing missions. The data presented in Table IV is from prior qualification tests.

4.1 Examination of Product

Prior to initiation of development testing, the disconnects were examined and weighed. No non-conformities with the applicable drawings were noted. The weight of the SHD was 1.03 pounds and the weight of the MHD was 1.21 pounds.

4.2 Proof Pressure

The disconnects were installed in the test fixture in the unmated condition and each unit was separately pressurized to 440 psig with GN₂ for a period of 5 minutes. Visual inspection showed no permanent deformation.

The disconnects were then fully engaged and pressurized to 440 psig with GN₂ for a period of 5 minutes. Visual inspection showed no permanent deformation.
<table>
<thead>
<tr>
<th>Description</th>
<th>NASA Disconnect</th>
<th>JPL Disconnect</th>
</tr>
</thead>
<tbody>
<tr>
<td>Test Status</td>
<td>In Development</td>
<td>Qualified</td>
</tr>
<tr>
<td>Proof</td>
<td>No distortion or failure</td>
<td>No distortion or failure</td>
</tr>
<tr>
<td>Leakage</td>
<td>See Table V</td>
<td>See Table VI</td>
</tr>
<tr>
<td>Flow/ P</td>
<td>See Figure 11</td>
<td>8.1 psid @ 1.1 lb/sec</td>
</tr>
<tr>
<td>Spillage Volume</td>
<td>0.26 cc/cycle</td>
<td>0.68 cc/cycle</td>
</tr>
<tr>
<td>Engagement Force</td>
<td>56 lbf @ 300 psig</td>
<td>375 lbf @ 465 psig</td>
</tr>
<tr>
<td>Vibration</td>
<td>N/A</td>
<td>11.4 G RMS</td>
</tr>
<tr>
<td>Pyrotechnic Shock</td>
<td>N/A</td>
<td>8500 G' Peak</td>
</tr>
<tr>
<td>Misalign</td>
<td>No sticking or binding</td>
<td>20 lbf max - no sticking or binding</td>
</tr>
<tr>
<td>Disengagement</td>
<td>N/A</td>
<td></td>
</tr>
<tr>
<td>Contamination</td>
<td>N/A</td>
<td>No failures or damage</td>
</tr>
<tr>
<td>Life Cycle</td>
<td>No problems during 200 cycles</td>
<td>No problems during 200 cycles @ +151°F and 200 cycles @ +9°F</td>
</tr>
<tr>
<td>Burst</td>
<td>N/A</td>
<td>No failures @ 1860 psig unmated and 3300 psig mated</td>
</tr>
<tr>
<td>Weight</td>
<td>1.03 lb (SHD)</td>
<td>0.65 lb (Propulsion Module)</td>
</tr>
<tr>
<td></td>
<td>1.21 lb (MHD)</td>
<td>0.46 lb (Mission Module)</td>
</tr>
</tbody>
</table>
4.3 Leakage

Individual disconnect half leakage rates were determined with the unit installed in the test fixture in the unmated condition. Special leakage collection test fixtures were used to isolate SHD poppet seal leakage, MHD sleeve seal leakage, and MHD interface seal leakage.

Various leakage measuring devices were used depending on the media and leakage rate and included a mass spectrometer, halogen leakage detector, water displacement, and flowmeters.

Figure 8 shows a typical setup for mass spectrometer leakage tests.

Mated leakage tests were conducted with the units installed in the test fixture and a rubber bladder installed over the mated disconnects to collect leakage.

In all cases, the test fixture was placed in an environmental box which allowed testing to be performed at temperatures between -50°F and +225°F. Following leakage tests conducted at ambient temperature, tests were performed at +125°F, +175°F, and +225°F. Low temperature tests were performed at +50°F, +25°F, 0°F, -25°F and -50°F. Leak test pressures were 50, 150 and 300 psig at high and low temperature, and 50 to 300 psig at 50 psig intervals at ambient temperature.

Using EPR seals, helium leakage results for the unmated SHD, the unmated MHD, and the mated SHD/MHD ranged from $2.4 \times 10^{-4}$ sccs to $2.6 \times 10^{-10}$ sccs over the entire pressure and temperature range. See Table V for a complete summary of leakage test results. Table VI provides leakage data for the JPL disconnect for comparison purposes.

4.4 Functional Testing

Functional testing was performed to determine any indication of jamming or binding of the disconnects during engagement or disengagement and to determine the engagement force required. This test was performed in both the aligned and misaligned position with internal pressures of 0 to 300 psig at ambient temperature.

There was no indication of binding or jamming during engagement and disengagement under either the aligned or misaligned condition. The maximum engagement force with the MHD pressurized to 300 psig was 56 pounds. See Figure 9.
### Table V. Leakage Characteristics - KARA Disconnect
Leakage in Sccs of Helium (EPR Seals)

#### Unmated - Module Half Disconnect

<table>
<thead>
<tr>
<th>Pressure (psig)</th>
<th>R.T.</th>
<th>+50°F</th>
<th>+25°F</th>
<th>0°F</th>
<th>-25°F</th>
<th>-50°F</th>
</tr>
</thead>
<tbody>
<tr>
<td>50</td>
<td>7.2x10^-6</td>
<td>1.0x10^-7</td>
<td>6x10^-8</td>
<td>2.6x10^-10</td>
<td>2.6x10^-7</td>
<td>1.3x10^-5</td>
</tr>
<tr>
<td>100</td>
<td>1.2x10^-6</td>
<td>1.2x10^-7</td>
<td>6x10^-8</td>
<td>2.6x10^-10</td>
<td>2.6x10^-7</td>
<td>1.3x10^-5</td>
</tr>
<tr>
<td>150</td>
<td>2.2x10^-6</td>
<td>2.7x10^-7</td>
<td>6x10^-8</td>
<td>2.6x10^-10</td>
<td>2.6x10^-7</td>
<td>1.3x10^-5</td>
</tr>
<tr>
<td>200</td>
<td>3.4x10^-6</td>
<td>9.0x10^-7</td>
<td>6x10^-8</td>
<td>2.6x10^-10</td>
<td>2.6x10^-7</td>
<td>1.3x10^-5</td>
</tr>
<tr>
<td>250</td>
<td>6.4x10^-6</td>
<td>9.0x10^-7</td>
<td>6x10^-8</td>
<td>2.6x10^-10</td>
<td>2.6x10^-7</td>
<td>1.3x10^-5</td>
</tr>
<tr>
<td>300</td>
<td>9.5x10^-6</td>
<td>1.1x10^-6</td>
<td>6x10^-8</td>
<td>2.6x10^-10</td>
<td>2.6x10^-7</td>
<td>1.3x10^-5</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th></th>
<th>R.T.</th>
<th>+125°F</th>
<th>+175°F</th>
</tr>
</thead>
<tbody>
<tr>
<td>50</td>
<td>3.3x10^-6</td>
<td>9.8x10^-6</td>
<td>3.2x10^-6</td>
</tr>
<tr>
<td>100</td>
<td>3.3x10^-6</td>
<td>9.8x10^-6</td>
<td>3.2x10^-6</td>
</tr>
<tr>
<td>150</td>
<td>3.3x10^-6</td>
<td>9.8x10^-6</td>
<td>3.2x10^-6</td>
</tr>
<tr>
<td>200</td>
<td>3.3x10^-6</td>
<td>9.8x10^-6</td>
<td>3.2x10^-6</td>
</tr>
<tr>
<td>250</td>
<td>3.3x10^-6</td>
<td>9.8x10^-6</td>
<td>3.2x10^-6</td>
</tr>
<tr>
<td>300</td>
<td>3.3x10^-6</td>
<td>9.8x10^-6</td>
<td>3.2x10^-6</td>
</tr>
</tbody>
</table>

#### Mated - Space Half Disconnect & Module Half Disconnect

<table>
<thead>
<tr>
<th>Pressure (psig)</th>
<th>R.T.</th>
<th>+50°F</th>
<th>+25°F</th>
<th>0°F</th>
<th>-25°F</th>
<th>-50°F</th>
</tr>
</thead>
<tbody>
<tr>
<td>50</td>
<td>1.6x10^-8</td>
<td>4x10^-7</td>
<td>0</td>
<td>2.0x10^-8</td>
<td>0</td>
<td>0</td>
</tr>
<tr>
<td>100</td>
<td>2.4x10^-8</td>
<td>4x10^-7</td>
<td>1.2x10^-8</td>
<td>2.0x10^-8</td>
<td>2.0x10^-8</td>
<td>0</td>
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<tr>
<td>150</td>
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<td>4x10^-7</td>
<td>8.0x10^-8</td>
<td>4.0x10^-8</td>
<td>4.0x10^-8</td>
<td>2.0x10^-8</td>
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<tr>
<td>200</td>
<td>4.8x10^-8</td>
<td>4x10^-7</td>
<td>1.2x10^-8</td>
<td>6.0x10^-8</td>
<td>6.0x10^-8</td>
<td>4.0x10^-8</td>
</tr>
<tr>
<td>250</td>
<td>8.0x10^-8</td>
<td>4x10^-7</td>
<td>1.2x10^-8</td>
<td>6.0x10^-8</td>
<td>8.0x10^-8</td>
<td>4.0x10^-8</td>
</tr>
<tr>
<td>300</td>
<td>1.1x10^-7</td>
<td>4x10^-7</td>
<td>1.6x10^-8</td>
<td>8.0x10^-8</td>
<td>8.0x10^-8</td>
<td>8.0x10^-8</td>
</tr>
</tbody>
</table>
### Table V. Leakage Characteristics - NASA Disconnect

#### Leakage in Scs of Helium (continued)

<table>
<thead>
<tr>
<th>Pressure (psig)</th>
<th>R.T.</th>
<th>+122°F</th>
<th>+175°F</th>
<th>+225°F</th>
<th>R.T.</th>
</tr>
</thead>
<tbody>
<tr>
<td>50</td>
<td>1.27x10^-7</td>
<td>1.7x10^-7</td>
<td>4x10^-7</td>
<td>6.4x10^-7</td>
<td>4.2x10^-7</td>
</tr>
<tr>
<td>100</td>
<td>1.27x10^-7</td>
<td>1.7x10^-7</td>
<td>4x10^-7</td>
<td>6.4x10^-7</td>
<td>4.2x10^-7</td>
</tr>
<tr>
<td>150</td>
<td>1.27x10^-7</td>
<td>1.7x10^-7</td>
<td>4x10^-7</td>
<td>6.4x10^-7</td>
<td>4.2x10^-7</td>
</tr>
<tr>
<td>200</td>
<td>1.27x10^-7</td>
<td>1.7x10^-7</td>
<td>4x10^-7</td>
<td>6.4x10^-7</td>
<td>4.2x10^-7</td>
</tr>
<tr>
<td>250</td>
<td>1.27x10^-7</td>
<td>1.7x10^-7</td>
<td>4x10^-7</td>
<td>6.4x10^-7</td>
<td>4.2x10^-7</td>
</tr>
<tr>
<td>300</td>
<td>1.27x10^-7</td>
<td>1.7x10^-7</td>
<td>4x10^-7</td>
<td>6.4x10^-7</td>
<td>4.2x10^-7</td>
</tr>
</tbody>
</table>

#### Unmated - Space Half Disconnect

<table>
<thead>
<tr>
<th>Pressure (psig)</th>
<th>R.T.</th>
<th>+50°F</th>
<th>+25°F</th>
<th>0°F</th>
<th>-25°F</th>
<th>-50°F</th>
</tr>
</thead>
<tbody>
<tr>
<td>50</td>
<td>0</td>
<td>1.1x10^-6</td>
<td>2.4x10^-7</td>
<td>4.6x10^-8</td>
<td>-</td>
<td>1.3x10^-6</td>
</tr>
<tr>
<td>100</td>
<td>2.3x10^-7</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>8.1x10^-5</td>
</tr>
<tr>
<td>150</td>
<td>4.6x10^-7</td>
<td>-</td>
<td>4.0x10^-7</td>
<td>2.5x10^-7</td>
<td>5.4x10^-7</td>
<td>8.1x10^-5</td>
</tr>
<tr>
<td>200</td>
<td>6.9x10^-7</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>8.1x10^-3</td>
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<td>250</td>
<td>1.6x10^-6</td>
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<td>-</td>
<td>8.1x10^-3</td>
</tr>
<tr>
<td>300</td>
<td>2.5x10^-6</td>
<td>-</td>
<td>1.0x10^-5</td>
<td>2.0x10^-7</td>
<td>1.9x10^-6</td>
<td>8.1x10^-3</td>
</tr>
</tbody>
</table>

#### LEAKAGE IN SCCS OF FREON 21

<table>
<thead>
<tr>
<th>Seal Material</th>
<th>EPR</th>
<th>Neoprene</th>
<th>Teflon</th>
</tr>
</thead>
<tbody>
<tr>
<td>Leal Pressure (psig)</td>
<td>50-300</td>
<td>50-300</td>
<td>50-300</td>
</tr>
<tr>
<td>Leakage (scs F-21)</td>
<td>2x10^-5 to 1x10^-7</td>
<td>1x10^-5 to 1x10^-7</td>
<td>1x10^-3 to 3x10^-5</td>
</tr>
</tbody>
</table>
Table VI. Leakage Characteristics (During Qual) - JPL Disconnect - Leakage in SCCs of Helium

<table>
<thead>
<tr>
<th>Mated (Out-to-In)</th>
<th>Post Vibration</th>
<th>Post Shock</th>
<th>Post 200 Cycles @+151°F</th>
<th>Post 200 Cycles @+9°F</th>
<th>Post Flow &amp; Contamination</th>
</tr>
</thead>
<tbody>
<tr>
<td>14.7 psia</td>
<td>3.6x10^-6</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>7.6x10^-7</td>
</tr>
</tbody>
</table>

Mated (In-to-Out)

<table>
<thead>
<tr>
<th>Pressure</th>
<th>Post Vibration</th>
<th>Post Shock</th>
<th>Post 200 Cycles @+151°F</th>
<th>Post 200 Cycles @+9°F</th>
<th>Post Flow &amp; Contamination</th>
</tr>
</thead>
<tbody>
<tr>
<td>5 psig</td>
<td>1.6x10^-5</td>
<td>4.8x10^-6</td>
<td>2.6x10^-6</td>
<td>1.9x10^-5</td>
<td>5.6x10^-6</td>
</tr>
<tr>
<td>40 psig</td>
<td>1.9x10^-5</td>
<td>4.1x10^-6</td>
<td>1.1x10^-5</td>
<td>1.1x10^-5</td>
<td>2.2x10^-6</td>
</tr>
<tr>
<td>465 psig</td>
<td>1.38x10^-4</td>
<td>1.8x10^-5</td>
<td>3x10^-5</td>
<td>1.1x10^-5</td>
<td>4.6x10^-7</td>
</tr>
</tbody>
</table>

Unmated (Worst Case)

<table>
<thead>
<tr>
<th>Propulsion Half</th>
<th>Pressure</th>
<th>Post Vibration</th>
<th>Post 200 Cycles @+151°F</th>
<th>Post 200 Cycles @+9°F</th>
<th>Post Flow &amp; Contamination</th>
</tr>
</thead>
<tbody>
<tr>
<td>5 psig</td>
<td>2.5x10^-4</td>
<td>1.7x10^-4</td>
<td>1.7x10^-5</td>
<td>2.9x10^-4</td>
<td>1.7x10^-4</td>
</tr>
<tr>
<td>40 psig</td>
<td>3.3x10^-4</td>
<td>1.7x10^-4</td>
<td>1.7x10^-5</td>
<td>3.3x10^-4</td>
<td>3.2x10^-5</td>
</tr>
<tr>
<td>465 psig</td>
<td>3.3x10^-5</td>
<td>3.3x10^-5</td>
<td>4.6x10^-4</td>
<td>1.6x10^-5</td>
<td>3.2x10^-5</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Mission Half</th>
<th>Pressure</th>
<th>Post Vibration</th>
<th>Post 200 Cycles @+151°F</th>
<th>Post 200 Cycles @+9°F</th>
<th>Post Flow &amp; Contamination</th>
</tr>
</thead>
<tbody>
<tr>
<td>5 psig</td>
<td>3.3x10^-5</td>
<td>1.7x10^-4</td>
<td>1.1x10^-6</td>
<td>3.3x10^-5</td>
<td>1.7x10^-4</td>
</tr>
<tr>
<td>40 psig</td>
<td>3.3x10^-5</td>
<td>1.7x10^-4</td>
<td>1.7x10^-6</td>
<td>3.3x10^-5</td>
<td>3.2x10^-5</td>
</tr>
<tr>
<td>465 psig</td>
<td>4.6x10^-5</td>
<td>3.3x10^-5</td>
<td>3.8x10^-5</td>
<td>7.4x10^-4</td>
<td>3.2x10^-5</td>
</tr>
</tbody>
</table>
4.5 Flow and Pressure Drop

The disconnects were installed in the test fixture in the mated condition and placed in the flow test facility as shown in Figure 10 and Photographs 6 and 7.

The water reservoir was pressurized to between 100 and 200 psig and flow through the mated disconnects was gradually increased over the flow range of 1 to 20 GPM. Pressure drop was measured across the disconnects and correlated with the flowrate as measured by a turbine flowmeter. The test was performed with the disconnects mated in both the minimum and maximum separation positions. In addition, a third run was made with the disconnects removed and a 1/2-inch diameter straight tube installed to obtain a system tare. The tare $\Delta P$ was subtracted from the disconnect $\Delta P$ to get the net $\Delta P$ induced by the disconnects for water. This data was then corrected to provide equivalent data for MMH and Freon 21. Figure 11 is a plot of $\Delta P$ vs flowrate for water, MMH and Freon 21.

4.6 Interface Volume

The disconnects were installed in the test fixture in the mated position and connected to a water supply as shown in Figure 12. All air was bled from the disconnects and the water supply pressurized to 300 psig. Using the automatic cycling mode, the units were disengaged and engaged 100 times. Water spilled from the interface and SHD vent port was collected and measured.

After 100 cycles, a total of 25.7 cc was collected from the interface, and 0.2 cc from the SHD vent port. This corresponds to a total of 0.26 cc/cycle.

4.7 Life Cycle

The disconnects were installed in the test fixture and subjected to 100 automatic cycles at ambient temperature with the MHD pressurized to 300 psig and the SHD pressurized to 0 psig. A second 100 automatic cycles were performed with the MHD pressurized to 300 psig and the SHD pressurized to 150 psig. Mated and unmated leakage tests were performed before and after each 100-cycle test.

During this phase of testing, two problems were noted; (1) the MHD poppet seal started to move forward and cause excessive interface leakage, and (2) excessive SHD vent leakage occurred during disengagement.
Life Cycle (continued)

The MHD poppet seal retainer was modified to increase the squeeze on the seal and the SHD poppet spring preload was increased.

The ambient life cycle test was repeated with no recurrence of leakage or excessive venting. All leakage test results were acceptable (much less than $1 \times 10^{-4}$ sccs helium).

Life cycle testing at high and low temperatures was not performed due to problems with the test fixture motor and screw drive mechanism. However, leakage tests were performed successfully at the high and low temperature conditions.

Freon 21 Testing

Following the decision to investigate the possible use of the NASA disconnect in Freon 21 systems, a review of possible seal materials was performed. Technical data indicated that the existing EPR seals were rated unsatisfactory and Neoprene was rated fair for use with Freon 21. Although both materials will exhibit swelling, EPR tends to disintegrate much sooner under long-term storage. Neoprene was therefore chosen as the most likely seal material to perform over the full temperature range, but Teflon was also chosen as a good candidate for the lower temperatures. Testing with Freon 21 was performed on all three seal materials.

The disconnects were placed connected to a Freon 21 supply as shown in Figure 13 and Photograph 8.

Freon 21 at ambient temperature was applied to the mated disconnects over a pressure range of 50 to 300 psig and allowed to sit over periods of time that varied from 2 to 72 hours.

Leakage was measured by water displacement and/or a halogen leak detector and leakage results for seals of Neoprene, EPR and Teflon are summarized in Table V.

Analysis of the test results for each of the three seal materials revealed the following:

a. O-rings of both Neoprene and EPR showed signs of swelling but neither showed evidence of damage or caused failure of proper disconnect operation.
4.8 Freon 21 Testing (continued)

b. Molded Neoprene seals swelled excessively, resulting in tearing of the seal and/or jamming of the poppets during engagement or disengagement. All molded seals (MHD poppet seal, MHP sleeve seal, and SHD poppet seal) were destroyed. Leakage rates ranged from $10^{-5}$ to $10^{-7}$ sccs, but are questionable due to swelling. See Photographs 9 through 13.

c. Molded EPR seals swelled but did not tear or cause jamming of the poppet. Test time in Freon 21 was not long enough to determine degradation of seal physical characteristics and no disintegration was noted. Leakage rates ranged from $10^{-5}$ to $10^{-7}$ sccs He, but are questionable due to swelling. See Photograph 14.

d. Teflon seals showed no evidence of swelling or degradation. Leakage rates ranged from $10^{-3}$ to $10^{-5}$ sccs He.

4.9 Special Seal Leakage Test

Molded seals of Neoprene may be used in Freon 21 systems if proper containment and volume for the expected swelling is considered. Since it was impractical to modify the NASA disconnect at this point in the development program, an effort was made to identify and perform preliminary testing on a new Freon 21 seal design.

Several modifications to the disconnects were considered after discussions with seal manufacturers and one promising design was chosen. Sample seals of a spring loaded, Teflon jacketed, pressure loaded seal (PLS) design were purchased and a simple test fixture designed and built.

The test fixture was installed in the test setup as shown in Figure 14 and Photograph 15. The PLS was subjected to helium leakage tests over the pressure range of 50 to 300 psig and temperatures ranging from $-150^\circ F$ to $+225^\circ F$.

Results indicated acceptable leakage rates under all conditions above $-50^\circ F$. Leakage rates below $-50^\circ F$ were in the range of $10^{-2}$ sccs of helium. See Table VII for a complete summary of test results. This seal should be considered a candidate for future development.

4.10 Post Test Inspection

The SHD, MHD and special seal test fixture were disassembled and visually inspected following completion of the development test program. No evidence of contamination, distortion, or abnormal wear was noted. See Photographs 16, 17 and 18.
<table>
<thead>
<tr>
<th>Temperature (°F)</th>
<th>Pressure (psig)</th>
<th>0</th>
<th>50</th>
<th>100</th>
<th>150</th>
<th>200</th>
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<td>-</td>
<td>ø</td>
<td>ø</td>
<td>ø</td>
<td>ø</td>
<td>ø</td>
<td>ø</td>
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<td>-</td>
</tr>
<tr>
<td>After 50 cycles @ 100 psig</td>
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<td>ø</td>
<td>ø</td>
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<td>1.8x10^{-5}</td>
<td>2x10^{-5}</td>
<td>2.2x10^{-5}</td>
<td>2x10^{-5}</td>
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<td>After 50 cycles @ 200 psig</td>
<td>-</td>
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<td>2x10^{-5}</td>
<td>3x10^{-5}</td>
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<td>After 50 cycles @ 300 psig</td>
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<td>ø</td>
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<td>ø</td>
<td>ø</td>
<td>4x10^{-6}</td>
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<tr>
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<td>ø</td>
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<td>ø</td>
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<td>ø</td>
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<td>2x10^{-5}</td>
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</tr>
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<td>6.6x10^{-5}</td>
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<td>1.9x10^{-4}</td>
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</tr>
<tr>
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<td>ø</td>
<td>2x10^{-5}</td>
<td>9x10^{-5}</td>
<td>2x10^{-4}</td>
<td>1.6x10^{-4}</td>
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<td>+125 (with 100 psig on part)</td>
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<td>6x10^{-6}</td>
<td>8x10^{-6}</td>
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<td>+175 (with 100 psig on part)</td>
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<tr>
<td>+225 (with 100 psig on part)</td>
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<td>-</td>
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<td>3.3x10^{-4}</td>
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<td>ø</td>
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<td>ø</td>
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### Table VII. NASA Special Seal Test (PLS) (continued)

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<td>5x10^{-5}</td>
<td>2x10^{-5}</td>
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<tr>
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**Part pressurized to 100 psig as temperature reduced**

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<td>1.8x10^{-2}</td>
<td>1.6x10^{-2}</td>
</tr>
</tbody>
</table>

* data erratic on all 10^{-2} scale.
5.0 MARTIN DEMONSTRATION

In February 1978, FSD installed the backup prototype NASA disconnect on the Martin Marietta (Denver) Module Exchange Mechanism (MEM) for demonstration to NASA headquarters personnel. Martin was performing studies on satellite servicing using a module exchange system. At the request of MSFC, FSD and Martin cooperated in adapting the NASA disconnect to the MEM to demonstrate the feasibility of fluid exchange. The disconnects were pressurized and instrumentation provided a visual indication of proper engagement when the MEM exchanged modules between a simulated spacecraft and on-orbit servicer. See Figure 15 and Photographs 19 through 23.

This demonstration successfully verified the self alignment capability and low engagement force necessary for remote spacecraft servicing operations and that fluid transfer between spacecraft is feasible.

FSD permanently installed the second NASA prototype disconnect on the Martin MEM following delivery of the mechanism to MSFC for future demonstration and evaluation.

6.0 FUTURE USAGE

As part of the NASA disconnect program, FSD agreed to assist MSFC in identification of potential users and applications for the NASA disconnect. Twenty-one potential users were contacted by letter explaining the program and soliciting help in defining potential uses and requirements. Responses led to several meetings where information was exchanged, although no specific environmental or design requirements were identified. Companies interested were Martin Marietta, Beach Boulder, Ball Brothers, Lockheed Sunnyvale, TRW, McDonnell Douglas, Vought, and the U.S. Navy.

7.0 NEW TECHNOLOGY UTILIZATION

There were no reportable items as defined under the New Technology Utilization Program discovered during this contract.
Figure 18. NASA Prototype Disconnect, Module Half Disconnect (MID), P/N 76300000-101
Figure 8. Mass Spectrometer Leak Test Setup Schematic
Figure 9. NASA Disconnect Engagement/Separation Forces
Figure 10. Flow/ΔP Test Setup Schematic
Figure 11. NASA Disconnect, Flow/ΔP
Figure 13. Freon 21 Leakage Test Setup Schematic
Figure 14. Special Seal Leakage Test Setup Schematic

(SHOWN IN ENERGIZED POSITION)
HARDWARE MOUNTED ON BASEPLATE (SIMULATED REPLACEABLE UNIT)

HARDWARE MOUNTED ON BASEPLATE RECEPTACLE (SIMULATED SPACECRAFT)

Figure 15. NASA Disconnect - Schematic for Martin Marietta MEM Demonstration
Photograph 6. Flow/ΔP Test Setup
Photograph 7. Flow/ΔP Instrumentation
Photograph 10. MHD Poppet Seal (Neoprene) After Freon 21 Test
Photograph 11. SHD Poppet Seal (Neoprene) After Freon 21 Test
Photograph 12. SHD Poppet Seal and Pieces of MHD Poppet Seal (Neoprene) After Freon 21 Test
Photograph 13. SHD Poppet Seal and MHD Poppet Seal (Neoprene) After Freon 21 Test
Photograph 14. MHD Poppet Seal (EPR) After Freon 21 Test
Photograph 15. Special Seal Leakage Test Setup
Photograph 16. Special Seal Leakage Test Fixture
Photograph 20. MEM Baseplate
Photograph 23. NASA Disconnect Mounted on MEM Assembly
APPENDIX I

WESRAC COMPUTER SEARCH SUMMARY
I. KEY WORDS (SINGULAR AND PLURAL FORMS USED)

Disconnect(s)  Quick Disconnect(s)  Coupling(s)  Fluid Coupling(s)  Fluid Hardware  Fluid Connector(s)  Mechanical Coupling(s)  Liquid Coupling(s)  Gaseous Coupling(s)  Coupling Devices

II. MODIFIERS

High Pressure  Moderate Pressure  Low Pressure  High Temperature  Low Temperature  Cryogenic  Hypergolic  Hazardous Fluid(s)  Liquid Hydrogen  3000 psi, psia, psig  100 psi, psia, psig  1/4 Inch  1/2 Inch  1 Inch  2 Inches

III. EXCLUSIONS

Electrical
## WESRAC COMPUTER SEARCH

<table>
<thead>
<tr>
<th>INDEX/DATA BASE</th>
<th>KEY WORD HITS</th>
<th>CROSS COUPLING (INTERSECT HITS)</th>
</tr>
</thead>
<tbody>
<tr>
<td>ISMEC (Mechanical Engineering)</td>
<td>120</td>
<td>3</td>
</tr>
<tr>
<td>CLAIMS/GEM (patents since 1975)</td>
<td>8</td>
<td>0</td>
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<tr>
<td>NTIS (U.S. Technical Information Service) (83 w/exclusion)</td>
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<td>3</td>
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<tr>
<td>NASA (Aerospace since 1963)</td>
<td>497</td>
<td>10</td>
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</table>

## ABSTRACTS ORDERED

1. All key word hits from ISMEC 120
2. None from CLAIMS/GEM 0
3. Key word hits with exclusion from NTIS 83
4. All intersect hits from NASA 213

The proceedings deal primarily with mechanically connected fluid joints, such as flanged, bolted, and B-nut types. There was one true disconnect described conceptually, a hermaphroditic type of self-latching unit. This design possesses some interesting features, but is not designed for connection while pressurized. Very high forces would be required to accomplish pressurized connection.

2. USAAVLABS Technical Report 68-37, "Development and Test of an Automatic Shutoff Closed Circuit Refueling System"

The fluid coupling discussed in this report is basically a closed circuit ground refueling system for helicopters. While both halves of this coupling incorporate the required self-sealing feature, they are designed strictly for manual operation, atmospheric receiver tank pressure, and low (<50 psi) fill pressures.

3. AFAPL Technical Report 68-19, "Variable Flexibility Tether System"

This system was investigated to determine what advantage might be taken of the innovative latching and interlock devices designed for use with the tether. These devices were basically unproven and relatively complex in our application where very high reliability is desired.

4. NASA Technical Memorandum X-64849, "An Assessment of Separable Fluid Connector System Parameters"

This report of an optimization study deals exclusively with flanged and bolted fluid connections of various configurations utilizing a variety of static sealing techniques.

5. NASA Case No. MFS 20395, "Duct Coupling for Single-Handed Operation"

As the title indicates, this patented design provides a simplified connection method for the manual coupling of duct sections. It is intended to be suitable for use by a suited astronaut during EVA (Extra Vehicular Activity).

Over 400 pages long, with more than 250 illustrations, this report discusses and depicts a variety of mechanical coupling devices used for remote and semi-remote retention and release of equipment. While very few, if any, of the devices illustrated have direct application to our specific case, some of the concepts may be useful further along.

7. **NASA Technical Brief 67-10256 (Moderate Side Loading Quick Disconnect)**

The brief describes a ball lock and spring steel tongue arrangement which disconnects with the application of a 15 lbf side load when line pressure is 100 psig. This concept is not applicable to our case.


This double butterfly design includes large unbalanced bellows pressure areas. The separation loads associated with the low pressure, high flow rate disconnect must be carried by the attach structures. This design is thus not appropriate for our applications.
ID NO.-E1760851442 651442
WORKING FLUID OF HIGH FLASH-POINT IN FLUID COUPLINGS.
Sebestyen, Gyula; Vargha, Laszlo; Svirteczky, Ferenc; Katona, Lajos
Tech Univ Budapest, Hung
DESCRIPTORS- (+COUPLINGS, *Hydraulic, HYDRAULIC FLUIDS.
CARD ALERT- 632, 632
SOURCE- Conf on Fluid Mach. 5th, Proc Budapest, Hung. 1975 v
2 p 979-986. Publ by Akad Kiado, Budapest, Hung. 1975
Authors publish the results of comparing tests of torque
transmission of fluid couplings filled with hydrogen-base
and with high flash-point silicon oils. Conclusions regarding
the influence of viscosity on the torque transmission are also
presented. 7 refs.

ID NO.-E1760851441 651441
MODEL INVESTIGATIONS OF HIGH POWER FLUID COUPLINGS WITH
REGULATED AMOUNT OF FILLING.
Dabrowski, Stanislaw
Inst of Fluid-Flow Mach. Gdansk, Pol
DESCRIPTORS- (+COUPLINGS, *Hydraulic, (FLOW OF FLUIDS.
Mathematical Models),
CARD ALERT- 631, 632
SOURCE- Conf on Fluid Mach. 5th, Proc Budapest, Hung. 1975 v
1 p 197-209. Publ by Akad Kiado, Budapest, Hung. 1975
The impossibility of preserving all conditions of
hydrodynamic flow similarity in model investigations of high
power fluid couplings with regulated amount of filling has been
proved by the authors. The model investigations carried out
showed that equality of Reynolds numbers and determination of
quantities 0/2, which express the feeding fluid flow rate,
according to the formula 0/2 $\approx$ $\pi R^4$ n/10,13, where n/1 is
the rotational speed of the coupling imeller and d is the
imeller diameter, are the essential requirements to be met in
order to achieve an approximate hydromechanical flow similarity
in two geometrically similar couplings. The parameter 0/2, neglected
until now in investigations, has the essential influence on the shapes of axial thrust curves of a coupling.
4 refs.

ID NO.-E1760850484 650484
FOURIER TRANSFORM APPLIED TO VEHICLE EXTERIOR NOISE SOURCE
IDENTIFICATION.
Daniels, V. A.; Veres, F. E.
Ford Motor Co.
DESCRIPTORS- (-AUTOMOBILES, *Noise Abatement, (*Mathematical
Transformations, Fourier Transforms),
CARD ALERT- 662, 751, 921
CODEN- SEPPAB SOURCE- SAE Prepr n 760151 for Meet Feb
22-27 1976. 8 p
This paper discusses a motor vehicle noise source
identification technique designed for use during the SAE J986a
or similar driveby test procedure. It provides, by
application of the Fourier Transform, the capability to obtain
a narrow band (9-8 Hz) frequency resolution over an extended
frequency range (10-10,000 Hz) at the peak vehicle noise level,
a particular RPM or a particular vehicle location in the test
zone. Other features include corrections for the Doppler
shift, averaging of noise tests, and subtraction of spectra of two
separate noise tests from a component disconnect/reconnect
procedure. The above analysis, in conjunction with the noise
source isolation resulting directly from the disconnect
procedure, identifies the major vehicle noise contributors in
terms of their respective amplitudes and frequencies.
Application of this technique to several vehicles has
also demonstrated its ability to accurately identify the dB(A)
levels and problem frequencies of the major vehicle noise
contributors in the vehicle environment.

ID NO.-E1760850321 650321
MECHANICAL RESPONSE AND THERMAL COUPLING OF METALLIC TARGETS
TO HIGH-INTENSITY 1. 06- $\mu$m LASER RADIATION.
Hetche, L. R.; Tucker, T. R.; Schriempf, J. T.; Stegmann, R. R.
NRL, Washington, DC
DESCRIPTORS- (+ALUMINUM AND ALLOYS. *Irradiation, LASER
BEAMS, Effects, TITANIUM AND ALLOYS, CARD ALERT- 541, 542, 744
CODEN- JAPBU SOURCE- J Appl Phys v 47 n 4 Apr 1976 p
1415-1421
Mechanical response and thermal coupling measurements are
reported for aluminum and titanium targets exposed to
high-intensity 1. 06- $\mu$m laser radiation. Measurements are
made in air and vacuum for pulse lengths from 1 to 100 $\mu$m sec,
providing incident fluences of between 10$^6$ and 10$^8$
W/cm$^2$-sec. The observed behavior is consistent with the presence
of an optically absorbing plasma at the target surface. The
decrease in the thermal coupling coefficient is attributed to an
increase in the plasma propagation velocity with intensity.
29 refs.
A graph of the process of blood clotting as a function of time (thromboelastogram) is shown and characterized. It is concluded that to obtain sufficiently full characteristics of the state of the blood-clotting system the digital thromboelastometer must contain computer units for measuring and calculating indices determining the parameters of coagulation: r, a/m, V/m, and S. Parameter r is the latent coagulation reaction; a/m is the maximum ordinate of the thromboelastogram; V/m is the maximum velocity of the coagulation process; S is the integral assessment (area under the curve). A significant increase in the accuracy of calculation of the integral assessment S, which is already used in diagnosis, can be achieved by introducing a device into the circuit of the digital thromboelastometer to disconnect the measuring circuit when the blood-clotting process has reached its maximum.

References.

A technique is described for fluid coupling acoustic surface waves onto an arbitrary piezoelectric material to allow the study of its surface properties. In these surface studies the relevant experimental information is contained in an induced phase change of the acoustic wave. For this reason, the primary concern was to develop a reliable technique by which this phase could be transmitted through the fluid interface. A simple physical model of the coupling mechanism is given, followed by a detailed description of the apparatus and procedure. Experimental studies of the phase change using the fluid-coupling technique are compared with results obtained by direct surface-wave excitation with interdigital transducers. An example of the application of this technique to alkali-halide surface absorption of CO/2 laser radiation is presented.

References.
ID NO.- E1760213837 613937
MECHANICAL RESPONSE AND THERMAL COUPLING OF METALLIC TARGETS TO HIGH-INTENSITY 5-60 J MUZ LASER RADIATION.
Wettche, L. R.; Stegman, R. L.; Turner, T. R.; Metz, S. A.; Schriempf, J. T.
NRL, Washington, DC
DESCRIPTORS- [TITANIUM AND ALLOYS], [IRRADIATION], [ALUMINUM AND ALLOYS], [IRRADIATION], [LASER BEAM, EFFECTS].
CARD ALERT- 541, 542, 744
CODEN- ASHAS4 SOURCE- ASME Pap n 75-NA/HT-40 for Meet Nov 30-Dec 4 1975, 11 p
Mechanical response and thermal coupling measurements are reported for aluminum and titanium targets exposed to high-intensity 1. 06 J MUS laser radiation. Measurements are made in air and vacuum for pulse lengths of 1 to 100 microseconds, providing incident fluences of between 10+6 and 10+18 watts/sq cm. Total momentum delivered to the target and time-resolved pressure developed over the target surface were measured at irradiances spanning the threshold for laser-supported detonation (LSD) wave ignition. The slope of the impulse/energy ratio shows a marked discontinuity at LSD threshold intensity. Peak target surface pressure is found to increase as 2/3 power of the beam intensity in agreement with the hydrodynamic model of LSD wave propagation. 29 refs.

ID NO.- E1760102900 602900
HYDRODYNAMIC INSTABILITY IN A POROUS LAYER SATURATED WITH A HEAT GENERATING FLUID.
Kulacki, F. A.; Ramachandran, R.
Ohio State Univ, Columbus
DESCRIPTORS- [HEAT TRANSFER], [POROUS MATERIALS].
CARD ALERT- 641
CODEN- W588W SOURCE- Waerme Stoffubertrag Thermo Fluid Dyn v 3 n 3 1975 p 179-185
Critical Rayleigh numbers determined by linear stability theory are presented for porous-fluid layers of infinite height excited internally by a uniform volumetric energy source in the fluid. The thermal coupling between the layer and its environment is represented by a general mixed boundary condition for both the conduction state and the disturbance temperature. Rigid–rigid, rigid-constant pressure, and constant pressure-rigid boundaries are considered in the computations. 12 refs.

ID NO.- E1760100143 600143
COUPLING LAYERS FOR EFFICIENT WEDGE TRANSDUCERS.
Bertoni, Henry L.
Polytech Inst of New York, Brooklyn, NY
DESCRIPTORS- [ACOUSTIC TRANSDUCERS], [ACOUSTIC WAVES], [IDENTIFIERS], [ACOUSTIC SURFACE WAVES].
CARD ALERT- 751, 752
CODEN- IE6UAI SOURCE- IEEE Trans Sonics Ultrason v SU-22 n
6 Nov 1975 p 421-730
Two methods of controlling the perturbation by limiting the mechanical coupling between the wedge and substrate are discussed for the case of Rayleigh waves. One method employs a layer of a compliant material, such as plastic, epoxy, or indium between the wedge and substrate and is found to be effective for a wide range of substrates. These layer materials have the additional advantage of serving to bond the wedge to the substrate. The second method for controlling the coupling employs a layer in which the fields are evanescent. This method is limited to relatively dense substrates and involves a more difficult fabrication, although it offers the advantage of extremely wide band performance. The characteristics of both types of layer materials are illustrated by computing the leaky-wave characteristics, as well as the design and performance of wedge transducers, for various combinations of wedge, layer, and substrate materials. 11 refs.

ID NO.- E1751281534 581534
BRITISH EXPERIENCE WITH FIRE RESISTANT FLUIDS IN THE MINING INDUSTRY.
Hall, J. B.; Knight, G. C.; Kenny, P.
Natl Coal Board, Min Dep Headquarters, Doncaster, Yorkshire, Engl
DESCRIPTORS- [HYDRAULIC FLUIDS], [FIAMMABILITY].
CARD ALERT- 632
The application of fire-resistant fluids is often limited by the lubricating characteristics of the fluids and progress has been made in assessing these properties. Performance testing of machines has established the useful range of applications in many practical situations and has allowed operational problems to be anticipated and overcome. Recommendations made from the results of laboratory testing have allowed steady progress in increasing the utilisation of fire-resistant fluids underground. The success in the implementation of the Board's policy may be judged by the fact that all 726 powered roof support installations in the industry are operating on dilute emulsion; 12186 of 12476 fluid couplings are working on either non–toxic phosphate ester or water and 3237 of 3459 hydrostatic transmissions underground are working on inert emulsion. 15 refs.
A technique for splicing optical fibers has been developed that uses a self-aligning square cross-section tube, with inner dimensions slightly larger than the optical fiber. A total loss of 0.58 dB was obtained for eight splices connected in series using a graded-index fiber with a 60-μm core diameter. The splices were made one at a time without the use of microscoops or micromanipulators; however, the fabrication process could be mechanized and extended to groups of fibers. A holding fixture could be added to adapt this technique to a connect/disconnect type splice. The size of the splice is presently 0.012 in. square, making it suitable for use within cables. Measurement set refinements that were needed to measure individual splice losses as low as 0.05 dB include an improved detector and means for better control of launching conditions.

Torque converters, like any fluid coupling, inherently involve slippage. Moreover, any converter multiplies torque efficiently over only a certain usable speed range. For optimum fuel economy under all conditions, a four-speed automatic transmission with positive converter lockup in second, third, and fourth speeds would be ideal. Developmental work on this type of converter for automotive applications is presently in progress.

A general theory is developed for the properties of a vibrational sensor that acts as an acoustic resonator when driven remotely by a wire line carrying bursts of longitudinal plane waves of strain. The theory applies to an extended object having an arbitrary pattern of resonant frequencies, internal energy losses, and mechanical couplings to the line. The theory is used to relate experimental expressions of the spectra of isotropic disks of a variety of materials to recent theoretical studies. Accurate values of elastic constants and their temperature coefficients are obtained.
HISTORIC SYNOPSIS OF FLUIDIC AND FLUID LOGIC HARDWARE,
Gru, L. P.
Chrysler Corp
DESCRIPTORS- FLUIDIC DEVICES, FLUIDIC LOGIC DEVICES, FLUIDIC ELEMENTS

CARD ALERT- 632, 721
CODEN- FLQAI2 SOURCE- Fluid Q v 6 n 4 Oct 1974 p 17-23
Examples of fluidic devices developed by various organizations around the world are given. Comments about the development of fluidics and fluid logic are given together with a listing of some of the active companies in the field. 19 refs.

QUICK-CONNECT PIPE CUTS INSTALLATION COSTS AT BARNES & TUCKER MINES.
Anon
DESCRIPTORS- (COAL MINES AND MINING), (PIPING SYSTEMS), PIPE, PLASTIC
CARD ALERT- 503, 619, 817
CODEN- COOAK SOURCE- Coal Age v 80 n 7 Jun 1975 p 102-104
A lightweight but extremely rugged fiberglass/epoxy pipe with a quick-connect feature is used in both the drainage system and the fresh water supply system at four Pennsylvania coal mines. The quick-connect feature gives strong, leakproof connections in pipe sections in as little as 30 sec. thus substantially reducing installation time and costs. The system is also quick to disconnect, making repairs or re-routing simple. The epoxy resin-rich interior of each pipe is a special corrosion-resistant formulation.

EQUIPMENT FOR HANDLING THE ULTRA DEEP WATER SPREAD MOORING SYSTEM:
Childers, Mark A.
ODECO, Inc, New Orleans, La
DESCRIPTORS- (SHIP'S, SPREADING)
CARD ALERT- 671
CODEN- PENGAR SOURCE- Pet Eng v 47 n 5 May 1975, 9 p between p 114 and 133
This article focuses on two distinct types of combination wirerope/chain system (CWS): the disconnect system and the non-disconnect system. The former uses off-the-shelf deck machinery and requires considerably less structural support than the non-disconnect system. The non-disconnect system allows all operations to be completed without disconnecting any portion of the entire mooring line length. A unique feature of the non-disconnect system is the use of a chain locker sheave and an interconnection assembly which can be passed over the wildcat without damage to any of the components. The non-disconnect system requires synchronization and orientation of chain in the wildcat in the haul-in mode while under high tensions.

PARALLEL THINKING OF BINARY PICTURES
Ancell, C.; Cordella, R.; Levialdi, S.
Cons Naz. delle RIC, Naples, Italy
DESCRIPTORS- (PATTERN RECOGNITION SYSTEMS)
CARD ALERT- 723
CODEN- ELELAA SOURCE- Electron Lett v 11 n 7 Apr 3 1975 p 148-149
Sticklike figures can be obtained through the sequential application of a set of eight masks, of which each is applied in parallel. During the process, components neither disconnect nor vanish. Particular emphasis is given to the simplicity and speed of the algorithm when implemented on a parallel machine. 5 refs.

CONSIDER HOLLOW-ROTOR MOTORS
Mauroklicz, John
Hone, 111., Freeport, Ill
DESCRIPTORS- (ELECTRIC MOTORS, DC)
IDENTIFIERS- HOLLOW ROTOR MOTORS
CARD ALERT- 705
CODEN- ELELAA SOURCE- Electron Des v 23 n 11 May 24 1975 p 76-79
Hollow-rotor designs, the armature-coil wire is wound to form a cylindrical shell, which is then reinforced with glass yarn, coated with an epoxy resin and cured. The hollow or basket, rotor now rotates about the iron core. It is the resulting hollow-rotor design, that achieves acceleration at least tenfold compared to conventional electric motors constructed with copper windings set into slots of an iron core. With low-inertia rotors, the motor by itself, can quickly accelerate or decelerate loads, such as in tape transports, printers and other servo applications; therefore, no longer are clutches and brakes needed to disconnect or connect the load to a continuously running motor. Hollow-rotor designs are limited to motors with less than about 0.5 hp.
ID NO.- E1750743819 543819
NEW STARTING FLUID FLYWHEEL.
Bennet, V. M.
DESIGNERS- (COUPLINGS, HYDRAULIC, MACHINERY, ELECTRIC
Drive).
CARD ALERT- 602, 632, 601, 705
CODEN- RENJAT SOURCE- Russ Eng J v 54 n 8 1974 p 34-35
The drives of certain machines, belt and plate conveyors,
textile machinery etc. I are required to start smoothly so as
to control the acceleration within certain limits or to ensure
the required length of time to speed-up the driven part of a
machine. With these requirements in mind, a new starting fluid
flywheel has been developed. The flow passage of the fluid
coupling is a chamber formed by the symmetrical impellers of
pump and turbine which have an enlarged inside radius.
Research has shown that the enlargement of the inside radius R
of the working chamber to R/2a = 0.629/a (where R/2a is the
active radius of the working chamber), with a simultaneous
increase of the number of blades, while only slightly lessening
the energy capacity of the fluid flywheel under working
conditions (a slip of 3-4%), will substantially reduce its
overload capacity at higher slips. Apart from this, there is a
greater stability of the circulating flow in such a chamber.
The possible appearance of internal hydraulic oscillations, and
therefore of fluctuations in torque and speed, which are
characteristic for conventional fluid couplings controlled by
filling and emptying, is eliminated. It is found that when the
typical oscillogram that the acceleration of the powered machine
under load starts, in fact, after the drive motor has reached a
speed close to nominal. 3 refs.

ID NO.- E1750642065 542065
HYDRAULIC STARTING GEAR FOR PUMP/TURBINES.
Wolff, Norbert
Siemens, Erlangen, Ger
DESIGNERS- (TURBOMACHINERY, STARTING).
CARD ALERT- 617, 632
CODEN- SFIVER SOURCE- Siemens Rev v 42 n 2 Feb 1975 p
74-77
This article deals with the suitability of impulse and
Francis turbines for starting pumps/turbines in pumping
operations. The question of whether upstream-side guide valves
are suitable for controlling the starting torque of Francis
turbines with fixed guide vanes is discussed and reference is
made to the more convenient control of the pump/turbine
counter-torque by varying the guide vane position. By
reference to an electrohydraulic starting method employed in
the 1960s, the author then points out the advantages of a fluid
coupling used in conjunction with an electric motor for
starting a pump/turbine set under the more exacting conditions
of pumping. 2 refs.

ID NO.- E1750641805 541805
PUSH-BUTTON TELEPHONES.
Card, S. E.; Littlemore, D. I.
DESIGNERS- (TELEPHONE, PUSH-BUTTON SYSTEMS, TELEPHONE
EXCHANGES).
CARD ALERT- 718
CODEN- POEJAJ SOURCE- Post Off Electr Eng J v 67 pt 4 Jan
1975 p 223-231
A range of push-button telephone instruments, known
commercially as Keyphones, has been developed to function with
3 different local signaling systems: multi-frequency, dc code C
and loop-disconnect. The use of multi-frequency and dc code C
signaling instruments is, at present, confined to those PABX's
which are equipped with the appropriate signaling capability.
Loop-disconnect signaling instruments, of which certain types
are on trial, enable push-button signaling facilities to be
offered to customers on public exchanges. 4 refs.

ID NO.- E1750531604 531604
DESIGN SYNTHESIS OF SAFETY DEVICES ON A LOGGING TRAILER SEM
DANS 1.
Bhushan, Bharat; Feden, K. R.
Automot Spec, Denver, Colo
DESIGNERS- (LOGGING, TRAILERS, Accident Prevention),
TRIANGLES, Safety Devices).
IDENTIFIERS- LOGGING TRAILER, DECcouPLING DEVICES
CARD ALERT- 663, 821
CODEN- ASWSA SOURCE- ASME Pap n 75-DE-54 for Weet Apr
21-24 1975, 9 p
A safety device is proposed which enables the driver to
dump the loaded trailer in case of the emergency. The proposed
device is supposed to perform the following operations in
sequence. It will disconnect the coupler and saucer assembly. It
will apply the emergency brakes to stop the decoupled trailer.
It will drop the safety catch block skid-plates in front of the dual
axle of the trailer in order to avoid skidding on a slippery
road. The device is imperative at speeds over 45 mph (72
km/hr) to insure that the driver cannot use it on highways. A
thermodynamic analysis for the propulsion of a real gas from a high
pressure gas tank to two variable volume cylinders with
movable pistons, is proposed to calculate the time required to
perform these operations. 6 refs.
ID NO.: E1750423329 523329
SURGE-SUPPRESSING RESISTORS APPLIED TO EHV DISCONNECT SWITCHES
Lott, Donald J.
DESCRIPTORS- ($ELECTRIC SWITCHGEAR, ($Surge Protection), ($RESISTORS, Testing).
CARD ALERT- 704, 706, 942
CODEN- ACERBK SOURCE- Allis-Chalmers Eng Rev v 40 n 1 1975 p 24-27
As transmission voltages have increased, surge resistors have been added to circuit breakers and disconnect switches to limit switching transients. The most common applications of surge resistors to disconnect switches have been for deenergizing bus and short line sections at 345 and 500 kV. Without resistors, severe stresses can be imposed on lightning arresters and terminal equipment by line-to-neutral crest voltages ranging from 2, 0 to 2, 5 per unit (pu), where the base for the pu value is nominal crest line to ground voltage. Multiple sparkovers exceeding arrester ratings have been recorded. Surge voltages can also be induced in adjacent low-voltage power and control circuits with the possibility of causing equipment failure. Usually, the value of resistance is selected to limit the switching surge voltage to less than 1.0 pu. Resistance values three to five times the system surge impedance have become somewhat of an industry standard. A typical surge resistor consists of a 500- 5000GAS thick-film resistor element wound on an epoxy core mandrel and silver brazed to bronze end inserts. This assembly is encapsulated in the same epoxy, then put in a porcelain housing for environmental protection. The top end cap is sealed to the mounting flange and the bottom cap is relieved to permit breathing action. This construction provides a totally encapsulated resistor and permits reaming...

ID NO.: E1750317603 517603
IN SITU GROWN EUTECTIC MAGNETOELECTRIC COMPOSITE MATERIAL.
Van Run, A. M. J. G.; Terrell, D. R.; Scholing, J. H.
PHILIPS RES LAB, EINDHOVEN, NETH.
DESCRIPTORS- ($MAGNETOELECTRIC EFFECTS, ($PIEZOELECTRIC MATERIALS).
CARD ALERT- 701, 708, 712
A eutectic composite material with the mixed spinel cobalt ferrite-cobalt titanate and the perovskite barium titanate as co-existing phases has been prepared, which shows a magneto-electric effect due to the mechanical coupling of the piezomagnetic spinel and the piezoelectric perovskite. The maximum value of the magneto-electric effect $\delta \Delta E / \delta \Delta S$, obtained up to now is $5.0 \times 10^{-7}$, $\Delta E$ multiplied by $10^{-8}$ $\Delta S$, $V \text{ cm}^{-1}$ $\text{m}^{-1}$ $\text{deg}^{-1}$ $\text{K}^{-1}$ at room temperature. 10 refs.
GAS SHRUDING OF STRAND CAST STEEL AT JONES & LAUGHLIN STEEL CORPORATION.

Samways, N. L.; Pollard, B. R.; Federko, D. J.

Jones & Laughlin Steel Corp. Aliquippa Works, Pa.

DESCRIPTORS- (STEELMAKING., QUALITY, CONTROL.

CARD ALERT- 545, 913

CODE- JUMTAA SOURCE- J Met v 26 n 10 Oct 1974 p 20-34

A considerable improvement in steel cleanliness was realized by protecting the strand stream from atmospheric oxidation with refractory tube shrouds. Advantages include the ability to establish good casting conditions on all strands prior to the start of shrouding. This permits the use of unstoppered metering nozzles with the capability both of clearing initially frozen nozzles and dressing the nozzle to improve stream characteristics. Shrouds can be removed and reintroduced following temporary strand stoppage for minor equipment problems such as slow dummy bar disconnect, straightener and cut-off operation. The metal stream and mold metal level are visible at all times to the caster and permits corrective action if required. Product quality is fully comparable to ingot steel.

ID NO.- E1750106175 506175

SECONDARY SUBJ: A GROWING ROLE.

Anon

DESCRIPTORS- ELECTRIC SUBSTATIONS, TRANSFORMERS.

CARD ALERT- 706

CODE- PDAW SOURCE- Power v 118 n 11 Nov 1974 p 21-23

The secondary substation is the point where in-plant distribution voltage is brought to utilization values. The ever-widening choice of variables from incoming disconnect and transformer to low-voltage breakers are highlighted in this article.

ID NO.- E1750102133 502133

DUAL HYDRAULIC SYSTEM POWERS BLAST HOLE DRILL.

Devo, Bruce

Minion Power Shovel Co, Ohio

DESCRIPTORS- (DRILLING, HYDRAULIC DRIVE.

IDENTIFIERS- DRILL PIPE.

CARD ALERT- 405, 502, 632

CODE- HYDPA2 SOURCE- Hydraul Pneum v 26 n 7 Jul 1973 p 71-74

Hydraulic system described provides drill with high force necessary for drilling, plus provides power to stabilize the drill and to handle, connect, and disconnect lengths of drill pipe. Diversion valve in closed-loop circuit connects fluid motors in series or parallel.

ID NO.- E1741276631 476631

SOME SPECIAL DESIGN CONSIDERATIONS FOR A MECHANICAL FILTER CHANNEL BANK.

Albsmeier, Hans; Guenther, Alfradi E.; Volejnik, Wilhelm Siemens, Ger.

DESCRIPTORS- ELECTRIC FILTERS, ELECTROMECHANICAL, TELEPHONE CIRCUITS.

IDENTIFIERS- CHANNEL FILTERS.

CARD ALERT- 706


The technical concept realized by the channel bank is optimum with respect to a variety of requirements. Considerations of size and fabrication technology recommend a frequency of 50 kHz for the mechanical filter. The general concept of the modulator suggests a filter design with tuned conventional transformers. Since subsequent adjustment of the assembled mechanical part of the filter is undesirable, the provision of finite attenuation poles has been abandoned at the expense of adding two extra resonators. The design imposes only modest demands as to the reproducibility of the mechanical couplings. By tuning the transformers it is possible to correct minor production tolerances. A special design of the channel and associated signal filter results in a very low temperature dependence and permits the connection of both filters directly in parallel.

ID NO.- E1741279741 479741

MECHANICAL AND OPTICAL COUPLING OF A THOMSON SCATTERING LASER.

Culver, J. S.; Murakami, M.

Oak Ridge Natl Lab, Tenn.

DESCRIPTORS- (PLASMAS, DIAGNOSTICS, LASER BEAMS, APPLICATIONS, NUCLEAR REACTORS, FUSION, FLIGHT, SCATTERING).

IDENTIFIERS- ORPAX FUSION DEVICES.

CARD ALERT- 621, 744.


A combination laser, spectrometer device has been constructed to observe the electron density and temperature of the ORPAX plasma by Thomson scattering in the range of 50 eV-2 kev. The apparatus can observe the plasma at six radial positions and fire four 30 nanosecond pulses of Q switched ruby laser light during an ORPAX shot. The apparatus and some of its optical components are described. 1 ref.
Electrical to acoustical energy conversion in transducers consisting of a piezoelectric ceramic and metal front plate is considered when the lateral dimensions of the transducer is of the order of a few wavelengths. Experiments were carried out with transducers radiating into water. It was found that the pulsed radiation resistance can be substantially adjusted by adjusting the dimensions of the front plate. The results are also considered for the new piezoelectric materials which are characterized by a high-mechanical coupling factor. 9 refs.

ID NO.: E1741172267 472267
REPAIR OF OFFSHORE PIPELINES IN WATER DEPTHS TO 3,000 FEET.
Shell Dev Co
DESCRIPTIONS- (PIPERINES, OHOSE). SUBMERSIBLES.
IDENTIFIERS- REPAIR/CONNECTION SYSTEMS
CARO- ALERT- 472, 512, 610, 614

Describes a new concept for the repair or connection of large diameter submarine pipelines beyond the practical working depth of divers. A repair/connexion tool system is incorporated into an unmanned controlled buoyancy vehicle, powered through an umbilical cable from a surface vessel selected for local sea conditions. The need for heavy lift capability is eliminated since the vehicle rests on bottom while working. Repair is accomplished by replacing a section of pipeline with a new section, including articulating bearings. For accommodating misalignment of the damaged pipe cut ends, and mechanical couplings having longitudinal adjustment capacity. 2 refs.

ID NO.: E1741566816 466816
PIEZOELLECTRIC TRANSUDERS WITH A FACE PLATE.
Pacak, W.
Inst. of Energet Technol Res. Warsaw, Pol
DESCRIPTIONS- ULTRASONIC TRANSUDERS.
PIEZOELLECTRIC TRANSUDERS.
CARO- ALERT- 753. 764

The influence of the composition of the emitting tablet of a pressurized nickel oxide cathode on the emission capacity in the mode of electrode reaction was investigated. The resistances to contamination by argon in the pressure range 2x10⁻⁴ to 10⁻⁶ Torr and on the investment of helium in the pressure range 2x10⁻⁴ to 10⁻⁶ Torr were investigated. The construction of cathodes having a diameter of 5 to 10 mm for electron accelerators are described, which have good mechanical and electrical coupling between the emitting tablet and the cathode core, a constant shape of the emitting surface in both the sintering and operating processes of the cathode: this facilitates stability of electron-beam focusing. 9 refs.
the system and discusses the electrical design and the packaging concepts. Typical performance characteristics are listed.

ID NO.- EI740537397 437397
INELASTIC STRAINS FROM THERMAL SHOCK.
Houtman, J. L. Westinghouse Electric Corp., Pittsburgh, PA
DESCRIPTIONS- (STAINLESS STEEL, THERMAL EFFECTS, NICKEL AND ALLOYS, THERMAL EFFECTS, GRAPHIC METHODS), IDENTIFIERS- THERMAL SHOCK, INELASTIC STRAINS
CARD ALERT- 546, 491, 902, 421, 531
CODEN- MADAEP SOURCE- Mach Des v 48 n 7 Mar 21 1974 p 196-198

Pumps, valves, piping, and heat exchangers $5M DASH$ among other components $5M DASH$ are often subjected to thermal shock so severe that strains move into the plastic range. Because stress is no longer linearly proportional to strain in this region, conventional stress equations are not valid. A stress analysis in the inelastic range usually requires costly time-consuming methods. A new graphical approach is presented which provides a simple way to predict inelastic stresses and strains for cylinders and plates. Two structural shapes commonly encountered in fluid-transfer hardware. The method, developed initially to deal with thermal shock in nuclear reactors, has application far beyond reactor design and can be applied to any high-temperature component. The curves can be used to evaluate all annealed austenitic stainless steels, medium carbon steels in the normalized condition, as well as some of the high nickel alloys (Inconel). In the annealed condition, this approach is valid for cylinders exposed to thermal shock on one surface and insulated on the other, and also for any section with a through-thickness thermal gradient if the section is restrained fully against rotation at its boundaries. $5M DASH$ for example, a circular plate with edges clamped against rotation. An example is worked out for a type 304 stainless steel cylinder. 2 refs.
The article deals with the suitability of impulse and Francis turbines for starting pump/turbinines in pumping operation. The question of whether upstream-side globe valves are suitable for controlling the starting torque of Francis turbines with fixed guide vanes is discussed, and reference is made to the more convenient control of the pump/turbine counter-torque by varying the guide vanes position. By reference to an electrohydraulic starting method employed in the 1950s, the author then points out the advantages of a fluid-coupling used in conjunction with an electric motor for starting a pump/turbine set under the more exacting conditions of pumping.

In German with English abstract.

Clutch and brake motors combine a clutch and/or brake with a motor to which the clutch and brake are matched by the manufacturer, or individually selected and assembled into a drive unit by the user. Clutch-brake motors are generally used where load engagement, disengagement, or braking are frequent. They are used less often when steps and starts are infrequent, except where they must be very fast or where high-inertia loads must be started. The clutch permits the motor to be started before the load is engaged to avoid the high starting current that would be needed to simultaneously start both motor and high-inertia load. Brakes and clutches may be considered to have identical characteristics because the brake is merely a clutch with one of the engaging elements anchored. Positive clutches (for low-inertia applications) and the more generally applicable friction, electric, and fluid clutches are described. Friction clutches may be actuated centrifugally, electrically, pneumatically or hydraulically. Electric clutches may be of the hysteresis or eddy-current type. Fluid clutches are of the preset, fixed-torque fluid-coupling type, and of course provide some shock-absorbing action between the load and the motor. Speed, power and duty-cycle requirements are discussed.
ID NO.- E17400526160 426160
AMERICAN POWER CONFERENCE. PROCEEDINGS, VOLUME 25, 1973
Gross, Eric T. R.; Boulét, Lionel; Cloutier, Gilles G.;
Dupont, André; Wagnier, Maurice; Pugard, Michel; Lagman, B.;
Heberlein, Gustave E.; Carter, William A.; Huber, R. F.;
Humphreys, David A.; Young, James B.; Campbell, Harold E.;
Cameron, F. L.; Smith, D. P.
DESCRIPTORS- ELECTRIC POWER GENERATION, ELECTRIC POWER DISTRIBUTION, ELECTRIC POWER TRANSMISSION.
CARD ALERT- 615, 706

ID NO.- E17400420973 420973
TIME-DOMAIN MEASUREMENTS OF MICROWAVE COMPONENTS.
Cronson, Harry W.; Mitchell, Peter G.
Sperry Res Cent. Sudbury, Mass.
DESCRIPTORS- ELECTRIC MEASUREMENTS, ELECTRIC ATTENUATORS, TESTING.
IDENTIFIERS- ELECTRIC MEASUREMENTS, INSERTION LOSS MEASUREMENTS.
CARD ALERT- 714, 942
Recent advances in microwave component measurements using time-domain techniques are described. After reviewing the basic elements of a time-domain system, a substitution procedure is applied to determine the insertion loss of wide-band attenuators. Comparison of these measurements with frequency calibrations shows agreement to within 0.1 db in 10 db for attenuators between 10-50 db, over the frequency range 0-4-GHz. Error sources are resolved by experiments designed to isolate and evaluate various contributions including: random errors due to noise and drifts; systematic errors caused by substitution attenuator inaccuracies, line mismatch, reflection nonlinearities, and inaccurate time-window widths; time-to-frequency translation errors of aliasing and truncation; and mechanical errors due to connect-disconnect cycles. Results show that random processes are responsible for most of the observed error. The reported measurements establish the calibration capabilities and the expected magnitude of individual system errors for the particular system tested.

ID NO.- E17400419365 419365
PHYSICAL DESIGN AND PACKAGING SEM DASH 3. AVOIDING THE NUT & BOLTS.
Brooks, Phil
DESCRIPTORS- ELECTRONICS PACKAGING.
CARD ALERT- 715, 716
CODEN- EDN1SH SOURCE- EDN v 18 n 19 Oct 5 1973 p 70-75
The use of metal spring clips, plastic snap-in devices, adhesive tapes, shrink tubing, and other fastening devices and materials for providing insulation, weatherproofing, quick disconnects and other multifunction or unusual tasks is discussed.

ID NO.- E17400418268 418268
SIMULATION OF THE NEUTRON DIFFUSION EQUATIONS OVER MANY DECADES.
Morse, Nye F., Jr.; Carter, Joseph C.; Bryant, Lawrence T.
Argonne Natl Lab, III
DESCRIPTORS- COMPUTER PROGRAMMING (NEUTRONS, SCATTERING), NUCLEAR REACTORS.
IDENTIFIERS- NEUTRON DIFFUSION.
CARD ALERT- 621, 723, 932
CODEN- SIMN2 SOURCE- Simulation v 20 n 1 Jan 1973 p 9-16
The simulation of a nuclear reactor system is described using the neutron diffusion equations coupled to the thermodynamic and mechanical equations. In this coupling, representation of the diffusion equation presents considerable difficulty when large power excursions are being simulated. In this article a transformation of the diffusion equations is developed which permits coupling them to mechanical and thermodynamic equations of much slower response times, thus eliminating the difficulties previously encountered in simulating these coupled sets of equations. 2 refs.
A study was conducted to discover if the long-term effect of the lap belt reminder system on 1972 cars would be to increase belt-use frequency. Automobile Club of Southern California employees driving fleet vehicles equipped with specially designed hardware were used to perform the study. Driver lap belt use was compared with the buzzer and light reminder system disconnected (to determine use rates under normal conditions) and then with operating (to determine use rates in response to the reminder system). Approximately one third of the individuals who did not use lap belts will become users for the majority of vehicle trips when the reminder system is operative. The reminder system will also increase usage of lap belts by individuals who used them only on occasion. This study could not establish a significant relationship between lap belt use (with and without reminder system) and miles per vehicle trip, trips per day, and test subject demographics. Approximately one half of the individuals will circumvent the reminder system. The majority will manipulate the lap belts, not increasing lap belt use. The minority will disconnect the electrical system. Their subsequent behavior in terms of an increase, no change, or decrease in lap belt use may vary. 12 refs.

A method for the determination of the efficiency of mechanisms and mechanical systems with mixed coupling of elements (kinematic pairs or mechanisms) is considered. A general equation of energy balance is derived in relative coefficients. An analytical dependence is given for the determination of the efficiency of a system. The essence of the method presented consists in that any branching off of the flow of energy is evaluated by a relative coefficient. Relative coefficients for the power flow distribution, for the losses, and for efficiency are introduced. In Russian.
ID NO.- E1731153978  353978
PROPAGATION VELOCITIES AND AMPLITUDES OF THERMO-AcouSTICAL WAVES IN THERMO-PLASTIC MATERIALS.
Tokumka, Tatsuo
Kyoto Univ., Jpn
DESCRIPTORS- (1) MATERIALS, (2) Thermal Effects), THERMO-DYNAMICS.
CARD ALERT- 661
CODEN- TGASA
There are, in general, four propagation velocities and they have the temperature rate discontinuity as well as the acceleration discontinuity. The principal waves are separated into two kinds. One is two transverse waves, which have same propagation velocity and are purely mechanical, and the other is two coupling waves with mechanical longitudinal and thermal components. The wave velocities and the ratios of thermal and mechanical amplitudes of the coupling waves are studied. 16 refs.

ID NO.- E1731051419  351419
DON'T STARVE AIR TOOLS.
Lamb, ind
Parker Hannifin Corp., Minneapolis, Minn
DESCRIPTORS- (1) TOOLS, (2) JIGS AND FIXTURES, (3) Pneumatic.
PNEUMATIC DRIVE.
CARD ALERT- 603, 632
CODEN- PLNAB
SOURCE- Plant Eng (Barrington, Ill.) v 27 n 16 Aug 9 1973 p 78-81
Recommended air hose diameters, based on length and air flow (cfm) are listed in chart form for impact wrenches, screw and nut drive tools, drills, hammers and abrasive tools. A troubleshooting checklist summarizes possible causes and solutions for leaks and disconnect problems.

diagnose the bond quality of the experimental transducers. 12 refs.
In digital systems, switching transients occur most often when there is a transition from logic 0 to logic 1 or from logic 1 to logic 0. These transients can introduce errors if their amplitude is large enough to exceed the logic 0 maximum voltage or the logic 1 minimum voltage. Errors are particularly likely to occur at mechanical-to-electrical couplings, as in switches and relays. The article presents a simple digital circuit which can prevent both positive-going and negative-going logic transients from causing output errors.

The experimental observations presented suggest that plastic deformation of austenite decreases the autocatalytic generation of preferred nucleation sites for martensite; the mechanical coupling of the plates shape-strain helps the transformation by adding to the reaction driving force; small amounts of plastic deformation enhance the mechanical coupling of the plates formed in a burst. 8 refs.

Wiring devices, as the term is used in this article, are devices used to control, connect, and disconnect electrical power at its point of use; examples are wall switches, receptacles, attachment plugs, and connectors. Government legislation regarding the manufacture of safe products and their use in safe ways is reviewed. A few examples of wiring devices are discussed which illustrate the main areas in which design, construction, standardization, and material selection have been coordinated to produce devices that are inherently safe and give dependable service.

The function of an automatic transmission valve body and governor system is to regulate pressure and direct fluid flow to and from transmission components such as the torque converter, fluid coupling, band servos, clutch cylinders, cooler circuits, and lubrication systems. The scope of this paper includes the following: Discussion of the factors affecting the design of the hydraulic control systems; function of basic types of hydraulic valves and the accompanying circuits. Description of typical designs of automatic transmission hydraulic systems. Synthesis of a hydraulic control system for a hypothetical transmission by combining various valve and circuits to meet specific functional requirements. Calculations of valve areas by solution of simultaneous equations.
ID NO.- E1730943637  343637
DESIGN OF SINGLE-STAGE, THREE-ELEMENT TORQUE CONVERTER.
Jandasek, V. J.
Ford Motor Co
DESCRIPTORS- (AUTOMOBILE TRANSMISSIONS. *Design). TORQUE
CONVERTERS, HYDRAULIC.
IDENTIFIERS- HYDRAULIC DRIVE
CARD ALERT- 602, 632, 661
SOURCE- Des Prac: Passenger Car Autom Transm. SAE Transm
Workshop Meet. 2nd Ed p 201-226. Publ by SAE. New York. (Adv
in Eng, Vol 5) 1973
This torque converter consists of three members, each with
only one element or row of flow directing blades. It is a
single stage unit that is two phase in operation with the first
phase encompassing operation as a torque converter and the
second involving a fluid coupling range. A rotating housing
and torus with a disposition of impeller, turbine, and reactor.
Axial thrust can be formidable in converters, but in the type
of unit discussed here, it is not a serious problem, this is
due, to some extent, to the fact that the majority of operation
occurs at high-speed ratios where the thrust is reduced
considerably. The impeller thrust is substantially equal and
opposite in direction to the sum of the thrusts of the turbine
and reactor.

ID NO.- E1730943636  343636
NEW TYPE OF THREE-MEMBER HYDRAULIC UNIT.
Qualman. J. W.; Egbert. E. L.
DESCRIPTORS- (AUTOMOBILE TRANSMISSIONS. *Design).
IDENTIFIERS- HYDRAULIC DRIVE
CARD ALERT- 602, 661
SOURCE- Des Prac: Passenger Car Autom Transm. SAE Transm
Workshop Meet. 2nd Ed p 198-220. Publ by SAE. New York. (Adv
in Eng, Vol 5) 1973
The three-member hydraulic unit described is somewhat of a
hybrid, having some characteristics of both the fluid coupling
and the torque converter. It affords supplementation of the
gear ratio in a step-gear transmission with good extension of
this torque-multiplying range. This gives greater overall
ratio coverage with the same number of gear steps or the same
overall ratio coverage with fewer gear steps. It compares very
closely in efficiency with a two-member drive coupling when
functioning as one. The third member (reactor) is simple,
 inexpensive, and does not require a one-way clutch. The
impeller and turbine members are similar to coupling members
and thus adaptable to the same relatively low-cost
manufacturing and assembly methods.

ID NO.- E1730943635  343635
FLUID COUPLINGS.
Qualman. J. W.; Egbert. E. L.
EXPERIMENTAL URBAN VEHICLE.

Seal, Michael R.
Western Wash State Coll, Bellingham

DESCRIPTORS- (AUTOMOBILES, Design), (AIR POLLUTION, Control).
IDENTIFIERS- EXPERIMENTAL URBAN VEHICLES

CARD ALERT- 451. 661. 662

CODEN- IEPSAA SOURCE- SAE Prepr n 730509 for Weel May 14-18 1973 13 p

An experimental car with mid-engine rear drive chassis and pyramid link suspension is the subject of this paper. Extreme Ackerman steering allows a 9 ft turning radius. The chassis quick disconnects into three major sections to facilitate servicing. A bias beam brake linkage allows easy adjustment of front-rear brake bias. The low emission engine runs on propane and is equipped with a thermal reactor and an EGR system. The body chassis center unit is made from excoy fiberglass surface aluminum honeycomb. Passive restraint seat belts are attached to semigull wing doors. Five mph bumpers are fitted to each end. The front uses extrusion belts: the rear uses beverage cans in compression.

INSTRUMENTATION TECHNIQUES IN HIGH VOLTAGE SUBSTATIONS SEMI- DASHED LINES, TRIGGERING AND INTERFERENCE REDUCTION.

Rogers, Eldon J.
Bonavilla Power Administration, Portland, Ore

DESCRIPTORS- *(ELECTRIC SUBSTATIONS, *Control). ELEETROMAGNETIC COMPATIBILITY.

CARD ALERT- 706

CODEN- IEPSAA SOURCE- IEEE Trans Power Appar Syst v PAS-92 n 1 Jan-Feb 1973 p 127-131

Measurement of transient potentials in substation yards on control circuits. CTS, CPT, 115 vac receptacles, hoisters, yard telephones, heaters, flood lights and cable lead sheaths during disconnect switch arcing requires more stringent instrumentation techniques than comparable measurements made in the control house. Methods and equipment have been devised to trigger oscilloscopes independent of recorded transient and reduce measuring circuit interference voltages. 10 refs.

PROCEEDINGS OF THE SECOND SYMPOSIUM ON FUNDAMENTALS OF TRANSPORT PHENOMENA IN POROUS MEDIA.


DESCRIPTORS- *(SOILS, MOISTURE). FLOW OF WATER, FLOW OF FLUIDS, (GRANULAR MATERIALS, Permeability), (POROUS MATERIALS, IDENTIFIERS- INFILTRATION, SATURATED FLOW, UNSATURATED FLOW

CRITICAL MAGNETIC FLUID OF STRONG COUPLING SUPERCONDUCTORS.

Vashishta, P.; Carbotte, J. P.
Argonne National Lab, III

DESCRIPTORS- *(SUPERCONDUCTING MATERIALS, *Magnetic Properties). MAGNETIC PROPERTIES.

CARD ALERT- 701


New results for the temperature variation of the thermodynamic critical magnetic field of four strong coupling superconductors are presented. Amorphous Ga for which the calculated temperature variation of the reduced gap shows largest deviations from the BCS predictions exhibits the smallest deviations in D(T) among the four materials. The strongest deviations are found to occur in the alloy Pb/0.7// 9 B1/0.7// 71, where they are nearly one and a half times as large as the ones calculated in Pb. 13 refs.
ID NO.- E1730102460 302460
GEOMETRIC OPTICS OF THERMAL BLOOMING IN GASES #EM DASH# 1.
Kirtland Air Force Base, Albuquerque, NMw
DESCRIPTORS- LASER BEAMS, (LIGHT, Propagation),
IDENTIFIERS- THERMAL BLOOMING, THERMOPHOTIC EFFECTS
CABINET card 741, 744
CODEN- AFOPAI SOURCE- Appl Opt v 11 n 3 Mar 1972 p 554-564
Thermal blooming is considered for cases with and without wind.
transverse to the beam propagation from the point of view of
fluid dynamics of a compressible gaseous system and the
coupling of this with geometric optics using eikonal formalism.
A general time dependent model for the interaction of a laser
beam with a compressible absorbing medium in the presence of
wind is developed, and certain time dependent analytical
solutions are obtained. These solutions reduce to the plain
thermal blooming case with no wind and for long time periods to
steady state wind case that has been previously reported by
others to various degrees of correctness. 20 refs.

ID NO.- E1721319615 297612
WHY ANOTHER LIGHT TWIN JET: THE SN 601- CORVETTE.
Briot, Robert
Socitee Nationale Industrielle Aerospatiale, Fr
DESCRIPTORS- (AIRCRAFT, PERSONAL, Design),
IDENTIFIERS- LIGHT TWIN JET AIRCRAFT
CARD ALERT- 652
SOURCE- SAE Pp n 720335 for Weet Mar 15-17 1972, B p
in the SN-601 Corvette. Aerospatiale has produced a light
twin having large cabin volume, cruise speed above 400 kts with
only limited thrust, and a short-field capability using simple
high-lift devices. Spoliers are of the retractable type and are
interconnected to the ailerons so as to automatically
disconnect should the spoilers jam in any position.

ID NO.- E1721411067 289066
1100-kV DISCONNECT SWITCH DESIGN, TESTS, AND APPLICATION AT
THE KALTZ MILL 1100-KV STATION.
Ahrons, C. J.; McKinney, J. F.
Southern States, Inc, Hampton, Ga
DESCRIPTORS- (ELECTRIC Switchgear, Testing), ELECTRIC
SUBSTATIONS.
CARD ALERT- 704, 706
CODEN- IEP549 SOURCE- IEEE Trans Power Appar Syst v PAS-91
n 4 Jul-Aug 1972 p 1606-1613
The Kaltz Mill Project, performing accelerated life testing
of prototype samples of 115-kv to 750-kv, is part of the
Electric Research Council's underground transmission system
research program. Kaltz Mill also serves as a prototype of
1100-kv overhead type substations. This paper describes the
design and testing of 1100-kv disconnect switches for
application at Kaltz Mill and on future systems. 11 refs.

ID NO.- E1721000340 278350
A MOTORIZED DRIVE FOR THE DOUBLE-TILTING SPECIMEN HOLDER OF AN
ELECTRON MICROSCOPE.
Krätzinger, S. J.; Marais, D. J.; Monaci, T.
Univ of Stellenbosch, S Afr
DESCRIPTORS- MICROSCOPES, ELECTRON, ELECTRIC MOTORS,
IDENTIFIERS- MOTORIZED DRIVE, SPECIMEN HOLDER
CARD ALERT- 422, 705, 715
CODEN- BRSNAX SOURCE- Rev Sci Instrum v 43 n 6 Jun 1972 p
866-871
A detailed description is given of a very compact motorized
drive for the double-tilting specimen stage of an electron
microscope. Tilting is effected by foot controls at a speed
which is continuously variable between wide limits. Manual
tilting is possible by simply turning a lever to disconnect the
motorized drive. No alterations to the microscope column are
necessary to receive the motorized unit.

ID NO.- E172x054649 254649
Minimal k-arc connected graphs
FULMERSON DR
Rand Corp, Santa Monica, Calif.
DESCRIPTORS- ELECTRIC COMMUNICATION, MATHEMATICS,
IDENTIFIERS- COMMUNICATION NETWORKS, GRAPH THEORY,
CARD ALERT- 716, 716
CODEN- rasatw SOURCE- Rev Sci Instrum v 41 n 1 1971 p 91-8
A graph is k-arc connected if it is necessary to remove at least k arcs in order to
disconnect the graph. This paper solves the problem of
determining the least number of arcs required in a k-arc
connected graph on n nodes by describing constructions that
produce such graphs having kn/2 arcs (for kn even) or (kn plus
1)/2 arcs (for kn odd). These results have application to the
practical problem of synthesizing minimum cost, %k-reliable% communication networks.
The coupling in a system with a drive containing elastic mechanical couplings is analyzed for its amplitude-frequency characteristics. For this purpose, an electromechanical coupling is proposed, representing the relation of the motor armature current oscillation amplitudes to the amplitude of the elastic moment fluctuation when on the motor wall mechanical oscillations arise having the frequency equal to the frequency of undamped free oscillations of the mechanical part of the drive. The areas of weak, considerable, and rigid electromechanical oscillations are delineated. The possibility is shown to vary the oscillations' elasticity by feedback. In Russian.

ID NO.- E172X043781 243781
Magneto- mechanical coupling factor in magnetostrictive ferrites. (Factorul de cuple magneto- mecanic la ferite magnetostrictive)
VANIAKE 5
Institutul de fizica, Bucuresti, Romania
DESCRIPTORS- -MAGNETIC DEVICES, TRANSDUCERS. (MAGNETIC MATERIALS. Ferrites).
CARD ALERT- 701, 704
CODEN- ELTHA SOURCE- Electrotehnica v 19 n 11 Nov 1971 p 412-15
The problems are discussed concerning magneto- mechanical coupling in magnetostrictive ferrites, widely applied in ultrasonics and particularly in magnetostrictive transducers.
14 refs. In Romanian.

ID NO.- E172X041984 241984
Demand controllers disconnect some loads during peak periods
UZHNY T EJ. DONSET S G
DESCRIPTORS- -APARTMENT HOUSES, *Power Supply)., WAIT-HOUR METERS.
IDENTIFIERS- DEMAND METERS
CARD ALERT- 602, 704, 942
CODEN- TMTRI SOURCE- Trans Distrib v 23 n 7 July 1971 p 48-53
The load control of water heating, space heating and air conditioning in a hypothetical all- electric 25- story apartment complex is discussed. A significant reduction in the average demand yields a substantial decrease in an annual electric bill. However, this is only feasible if the demand control system assures that the total heating and cooling energy requirements are met along with the demand control.
Flexible etched circuitry is a packaging engineer's tool. It came into being as a direct replacement for wire harnesses and has gradually broadened in usage to include all types of package-military, commercial, large, small, complex, simple. This article points up current thinking in design and application from the packaging point of view.
A method for determining the delay of many electrical signals with respect to a common trigger (e.g., in capacitor banks) is described. Using the principle of time-to-pulse-height conversion, a low-leakage polystyrene capacitor is charged to a voltage proportional to the delay. A reed relay is used to disconnect the capacitor from the charging circuit, which permits the charge to be maintained on the capacitor for many seconds. Another reed relay is employed to connect each capacitor to an ADC when it is desired to digitize the charge on the capacitor.

Wake induced flutter of circular cylinders. Mechanical aspects

SIMPSON A
Univ of Bristol, England

DESCRIPTIONS- Flow of Fluids. Cylinders. Aerodynamics. Flutter

CARD ALERT- 631. 651

CODEN- AERD AERON QUART 22 1 2 May 1971 p 101-18

In this paper, the class of cases wherein the mechanical support system for the heavey cylinder exhibits static coupling is studied using "undamped flutter theory". It is demonstrated that the appearance of static coupling terms can lead to quite dramatic changes in the flutter characteristics, and that considerable care must be exercised in the design and operation of wind-tunnel dynamic models if meaningful results are to be obtained. An appendix deals with the general problem of mechanical coupling, using the normal coordinates approach, and aspects of the problem which bear on the subconductor oscillation phenomena experienced in "bundled" overhead power transmission lines are highlighted.

Application of load break switches for switching high-voltage AC shunt capacitor banks

SOLORZANO EF. RUSH PD
Dept of Water and Power, Los Angeles, Calif

DESCRIPTIONS- Lightning. Electric Capacitors Switching, Electric Transmission, Direct Current, Electric Switchgear

CARD ALERT- 20302

In this work, load break switches for switching high-voltage AC shunt capacitor banks are described. The switches are designed for use in power systems and are capable of switching large currents with minimal arcing. The design considerations and performance characteristics are discussed in detail.
Degrees of freedom of cochlear patterns

RINK R

Univ of Alberta, Edmonton

DESCRIPTORS- •AUDITION.
IDENTIFIERS- COCHLEA, DEGREES OF FREEDOM
CARD ALERT- 751
CODEN- JASA4

Nondestructive testing of welded tubing in C-5 Aircraft

ERMAN EO; JENKINS TC

Consultants Inc, Pasadena, Calif

DESCRIPTORS- •TUBES, •Welding, (MATERIALS TESTING,
Nondestructive).
CARD ALERT- 022
CODEN- P000

The use of tubing welded in place is increasing tremendously,
particularly as airplanes get larger. Reliability is also
enhanced by the reduction in the number of mechanical
connections. This paper describes an ultrasonic method of flow
detection in the confined areas. The introduction of this
method and the design and fabrication of a unit has proven that a
satisfactory ultrasonic inspection of tube welds can be
accomplished within the areas required for the fabrication of
such welds.

Influence of dislocations in CdS crystal on its electro
mechanical coupling factors

CHUBACHI N; INUMA K; KIKUCHI Y

Tohoku Univ, Sendai, Japan

DESCRIPTORS- •SUPERCONDUCTORS, •Cadmium (Compounds),
IDENTIFIERS- DISLOCATIONS, CADMIUM SULFIDE, ELECTROMECHANICAL
COUPLING FACTORS
CARD ALERT- 712
CODEN- JAP74

The electromechanical coupling factors are measured in the
frequency range from 100 kHz to 260 MHz forCdS single crystals
with various dislocation densities. These measurements show that
each of the electromechanical coupling factors begins to
decrease in a steep slope as the density of dislocation which
terminates at the surface of the crystal exceeds an amount around
10/6 cm^- 1/2. However, these coupling factors come back
toward the normal values when the density of dislocation is
decreased by means of the annealing of the crystals in a sulfur
vapor. No appreciable change of the elastic constants and the
dielectric constants is observed. Therefore, the observed
variation of the electromechanical coupling factors is
attributable to the dependence of the corresponding
piezoelectric constants on the dislocation density.
Iran's Saam. First of Vosper's Mk 5 destroyers/frigates

**DESCRIPTORS:** +WARSHIPS. +Iran. (GAS TURBINES. Marine). (SHIPS PROPULSION. Gas Turbine).

CARD ALERT- 612. 671. 672


The Mk 5 destroyer/frigate Saam's main machinery is comprised of two Rolls-Royce CRM 16 marine Diesels, turbines, rated at 24,000 bhp each driving into separate David Brown double-reduction gear boxes, and two Paxman Ventura 16 ACM diesels driving into the same gear boxes in a CODUG arrangement. The gas turbines are not enclosed in the standard modules which have been developed since this ship design began, but have acoustic booms integral with the structure to absorb the noise radiated from the gas generator and to provide the necessary housing to carry a supply of cooling air to the external surfaces of the gas generator. The air intakes pass 1/2 tons of air/min when at full power. The power turbines are connected to the gear boxes through flexible couplings and torque tubes at 5600 rpm maximum power. The gear boxes have a reduction of 14 to 1 on the gas turbine drive and 8 to 1 on the diesel drive. The gas turbine drive is toted double-reduction dual-tandem locked-train with single-helical, hardened and ground gears. Synchro self-shifting clutches (1551) are fitted in both inboard shafts and interlocked to prevent simultaneous drive by both power units. Fluid couplings are fitted between the diesel engines and the main gear boxes to enable the relatively small diesel engines to overcome the large gear box and propeller shafting inertia without stalling.

**ID NO.- E171X09923 123923**

Ali- electrostatic finishing at Ford's Kansas City plant

**HOWARD DC**


**CARD ALERT-** 662. 701. 813

**CODEN-** IFIIA SOURCE- Ind FinISH (Wheaton. Ill) n 46 n 10	Oct 1970 p 44-6

Mavericks are finished in one of four exotic or eleven standard exterior colors. The plant also produces commercial trucks at a rate up to 22 per finished in one of the 11 standard colors. The use of quick-disconnect fittings with the electrostatic guns permits color changes in as short a time as 5 sec. and savings of more than 10% were obtained where electrostatic replaced conventional spray guns. The operations performed on two separate lines for finishing passenger cars are described.

**ID NO.- E171X032554 132554**

**All- electrostatic finishing at Ford's Kansas City plant**

**HOWARD DC**


**CARD ALERT-** 662. 701. 813

**CODEN-** IFIIA SOURCE- Ind Finish (Wheaton. Ill) n 46 n 10	Oct 1970 p 44-6

Mavericks are finished in one of four exotic or eleven standard exterior colors. The plant also produces commercial trucks at a rate up to 22 per finished in one of the 11 standard colors. The use of quick-disconnect fittings with the electrostatic guns permits color changes in as short a time as 5 sec. and savings of more than 10% were obtained where electrostatic replaced conventional spray guns. The operations performed on two separate lines for finishing passenger cars are described.

**ID NO.- E171X020009 120009**

**Insertion loss repeatability versus life of some coaxial connectors**

**BERGRIED D. FISCHER H**

**Descriptro-** +RADIO EQUIPMENT. +Connectors.

**CARD ALERT-** 714. 716

**CODEN-** IEEE SOURCE- IEEE Trans Instrum Meas v IM-19 n 4

**Nov 1970 p 349-53**

One of the important characteristics of coaxial connectors in measurement applications is their insertion loss repeatability. Measurements up to 18 GHz have been made of the performance of various precision and general-purpose connectors over many connect-disconnect cycles.
Tests are reported to evaluate the effectiveness of shielding control cables that are laid in concrete trenches located in an electric power environment. Particular attention is given to the effectiveness of shielding against HF transients generated by the opening and closing of 500 kV disconnect switches. Transients or spurious signals caused by induction from 60 Hz fault currents, or by the energization or de-energization of d-c contactor coils, or relay coils, has already been documented. Because of this, the main attention is given to the subject of high frequency transients generated by multiple switches in an arc or in a corona. The conclusions pertain particularly to control cables laid in concrete trenches. To protect the shield and obtain further protection against transients, a heavy current carrying conductor properly grounded should be run along the same path as the shielded control cable. 14 refs. Paper 69 TP 665 - PWR.
The capability of maintaining and automatic editing of case data has been provided. Phase I of the system automatically generates matrices for joining, symmetric antisymmetric disconnect, vibration, and stability analyses. Modules for converting continuous- to discrete loads, analytic to discrete geometry, and a master case data file editor are provided to reduce input data requirements. Phase II of the system provides for the manipulation of matrices. The matrix operations include most of the basic matrix operations (e.g., add, multiply, etc.), several special matrix operations (e.g., adjoint), and several control operations (e.g., save matrices, conditional IF test, etc.). Phase III of the system provides for self-explanatory report form printing of matrices and a nominal graphical display capability, including a geometric display.

Characterization of piezoelectric transducers used in ultrasonic devices operating above 0.1 GHz

Mason's equivalent circuit is used to critically appraise the validity of methods used to evaluate transducer performance from loss and admittance measurements made under conditions where performance of the transducers cannot be evaluated separately from the device. Computed families of curves are presented, spanning the practically important range of mechanical impedances and coupling factors. Experimental data from a ZnO film and a LiCDO3 thin-plate transducer on fused quartz substrates are presented to demonstrate the application of equivalent circuit descriptions to obtain the coupling factors.
ID NO.- E170X024511 024511
Direct buried transformers. Present and future
DECKER RM
Cleveland Electric Illuminating Co. Ohio
DESCRIPTORS- ELECTRIC TRANSFORMERS. (ELECTRIC DISTRIBUTION. Underground). (METAL CORROSION. Cathodic Protection).
CARD ALERT- 704, 706
Experience of Cleveland Electric Illuminating Co with underground distribution transformers, including those for city of Chicago, Ill. It is concluded that present day transformers in metal tanks can be direct buried and have the same load capability as pole mounted transformers. For the best corrosion protection it is necessary to have a good quality tank coating, disconnect the tank from the system neutral, and use either a magnesium or zinc anode for protection. Supplemental cooling is needed for the larger sizes of transformers.

ID NO.- E170X020544 020544
PROC
DESCRIPTORS- *POWER TRANSMISSION. CLUTCHES. BRAKES. BELTS.
CARD ALERT- 602
Proceedings include 1w papers relating to couplings, clutches, fluid couplings, brakes, gears, chain drives, bearings, v. and wedge belt drives, flat belts and other forms of variable speed drives.

ID NO.- E170X017150 017150
Thickness measurements of nonmetal products by natural decay of electromagnetic field
ERMakov AN; BRANDORF VG
DESCRIPTORS- *THICKNESS MEASUREMENT. (MATERIALS TESTING. Nondestructive). (MAGNETIC FIELDS. Measurement). ELECTRIC COILS
CARD ALERT- 422, 701
SOURCE- Soviet J of Nondestructive Testing (English translation of Defektoskopya) 9, 1 Jan-Feb 1969 p 21-5
A method for measuring the thickness of nonmetal products in terms of the natural decay of the electromagnetic field is described. A theoretical investigation of the pattern of the magnetic field established by the ring current is reported. The feasibility of taking measurements in the absence of any mechanical coupling between emitter and receiver at the physical point is demonstrated. The possibility of achieving a low level of measurement error is reported.

ID NO.- E170X015822 015822
Development of reduction gear with fluid coupling at Tsurumi shipyard
ETO H; SATO T; ARAI M
DESCRIPTORS- *LINGS. GEARs. SHIP PROPULSION-DIESEL.
CARD ALERT- 162, 295
Design and manufacture of reduction gear with fluid coupling have been completed, but many points are still left for future study, as to dynamic transitional phenomena; it is planned to make efforts to achieve lighter gears at lower cost minimizing margins, through accumulation of data, simultaneously with study of above problems. In English.

ID NO.- E170X008856 008856
Resonant charging technique simplifies ignition systems
CARLSTRODE MD
Sanders Associates, Inc. Nashua, NH
CARD ALERT- 913, 150, 160
SOURCE- Electronic Design v 17 n 7 Apr 1 1969 p 82, 84
Many capacitor discharge ignition systems suffer from spikes on n- v power supply; in units employing SCRs, these spikes can spoil the di/dt rating of SCR and breakdown occurs. transistor circuit can be used to disconnect SCR from power supply when SCR is OFF, but such circuits can be complex as well as expensive; simpler solution is to use resonant charging circuit, which provides high speed at low cost: output voltage of 55,000 v is obtained.

ID NO.- E170X004272 004272
Influence of magnetic annealing on magnetomechanical coupling coefficient of Ni-Co ferrites as function of cobalt concentration
PRESNOVA LA; PISKAEVA RI; FOMENKO LA
DESCRIPTORS- *MAGNETIC MATERIALS. *Ferrites). NICKEL AND ALLOYS.
CARD ALERT- 057, 135, 140
Effect of variation of concentration of Co ions in Ni-Co ferrites with small excess of iron ions on efficiency of thermomagnetic annealing is discussed; it is shown that influence of latter on magnetomechanical coupling coefficient of typical cores is determined by variation in rectangularity of hysteresis loop and by variation of anisotropy constant of ferrite. In Russian.
A PRELIMINARY EVALUATION OF SILANE COUPLING AGENTS AS PRIMERS AND ADDITIVES IN POLYURETHANE BONDING PROCEDURES
(SILANE COUPLING AGENTS USED AS PRIMERS AND ADDITIVES FOR POLYURETHANE BONDING)
A/HILL, H. E.; D/THOMPSON, L. W.
NATIONAL AERONAUTICS AND SPACE ADMINISTRATION, MARSHALL SPACE FLIGHT CENTER, HUNTSVILLE, ALA. AVAILABLE:
METAL BONDING/POLYURETHANE RESINS/PRIMERS (COATINGS)/RESIN BONDING/SILANES/ ADDITIVES/ AMBIENT TEMPERATURE/ COUPLINGS/
CRYOGENICS/ FIBER STRENGTH/ LINKAGES

DEVICE ENABLES CALIBRATION OF MICROPHONES AT HIGH SOUND PRESSURE LEVELS
COUPLING DEVICE ACCURATELY CALIBRATES MICROPHONES AT HIGH SOUND PRESSURE INTENSITIES. THE SYSTEM WHICH USES A LIQUID AS THE COUPLING MEDIUM CAN OPERATE IN AN AUTOMATIC MODE BY USING A STANDARD MICROPHONE AS A CONTROL SENSOR. FEEDBACK FROM THE STANDARD MICROPHONE CONTROLS THE CALIBRATION SIGNAL LEVEL.
A/GILLEN, A.
AUTOMATIC CONTROL/CALIBRATING/CAVITIES/CIRCULAR PLATES/COUPLINGS/DETECTORS/DISPLACEMENT/FEEDBACK/FRUSTUMS/HIGH PRESSURE/LIQUIDS/MICROP HONES/NEEDLES/NONLINEARITY/PISTONS/PRESSURE GAGES/PRISMS/SAFETY DEVICES/SOUND INTENSITY/VIBRATION

LINE ADAPTER PROVIDES QUICK DISCONNECT UNDER MODERATE SIDE LOADING
LINE ADAPTER ACTS AS QUICK AND SIMPLE DISCONNECT SYSTEM. IT QUICKLY SEPARATES UPON THE APPLICATION OF A SIDE LOAD OF 15 POUNDS WITH STANDING LINE PRESSURE AT 100 PSIG.
A/OWRAM, E. A.
ADAPTERS/BALL BEARINGS/CONNECTORS/DISCONNECT DEVICES/FLUID TRANSMISSION LINES/HIGH PRESSURE/LOCKS (FASTENERS)/O RING SEALS/RING STRUCTURES/SPRINGS (ELASTIC)

HIGHPRESSURE TUBE COUPLING REQUIRES NC THREADS OR FLARES
(high pressure tube coupling connects to any straight, unthreaded, and unflared tubing end without deforming or damaging the tubing. The coupling grips the tube wall tightly between an external compression sleeve and an internal hollow mandrel. It is adaptable to standard screw fittings for test stand attachment.)
A/STEIN, J. A.
COMPRESSING/COUPLINGS/DAMAGE/DEFORMATION/FLARED BODIES/HIGH PRESSURE/MANDBELS/METAL JOINTS/O RING SEALS/PIPES (TUBES)/RING STRUCTURES/SLEEVES/TEST STANDS/THREADS
REMOTE CONTROL, AIR-MOTOR DRIVEN, CHAIN-DRIVE SYSTEM ENGAGES AND DISENGAGES A FLANGE COUPLING FROM LARGE-DIAMETER, HIGH PRESSURE FLUID LINES.

A/GRiffin, P. A.

*CHAINS/CONNECTORS/COUPLINGS/DISCONNECT DEVICES/FLANGES/FLUID TRANSMISSION LINES/HIGH PRESSURE/MECHANICAL DRIVES/PIPES ITUBES)/REMOTE CONTROL

O-RING TUBE FITTINGS FORM LEAKPROOF SEAL IN HYDRAULIC SYSTEMS

*LEAKPROOF FITTINGS FOR HYDRAULIC SYSTEMS ARE DESIGNED TO BE WELDED TO THE ENDS OF THE TUBING TO BE JOINED AND MATED TO FORM A SEAL WITH ONE O-RING AT THE JOINT. SINCE THE FITTINGS ARE COUPLED AT ONLY ONE JOINT, THEY TEND TO BE MORE RELIABLE THAN STANDARD FITTINGS COUPLED AT TWO JOINTS.*

*BOLTS/COUPLINGS/CRYOGENIC EQUIPMENT/FITTINGS/FLANGES/FLANGED BODIES/HYDRAULIC EQUIPMENT/LEAKAGE/O-RING SEALS/PIPES ITUBES)/WELDED JOINTS

EVALUATION OF AN O-RING HYDRAULIC PIPE COUPLING

A/COOK, A. /B/FISHER, M. J.

BRITISH HYDROMECHANICS RESEARCH ASSOCIATION, HARPWELL (ENGLAND).

NATIONAL ENGINEERING LAB., EAST KILBRIDE (SCOTLAND).

PREPARED JOINTLY BY BHRA/NEL

*COUPLINGS/HYDRAULIC EQUIPMENT/PIPES ITUBES)/HIGH PRESSURE/O-RING SEALS/FLANGES/STATIC TESTS/TABLES (DATA)

UMBILICAL CONNECT SYSTEMS

(SPACE SHUTTLE UMBILICAL SYSTEMS FOR MATING, CONNECTION AND CHECKOUT OF CARRIER ASSEMBLIES AND COUPLINGS FOR CRYOGENIC, ELECTRICAL, PNEUMATIC AND HYDRAULIC SERVICES)

A/VALKEMA, D. /A/GENERAL DYNAMICS CORP., ST. LOUIS, MO.

AMERICAN INSTITUTE OF AERONAUTICS AND ASTRONAUTICS AND NASA, SPACE SHUTTLE OPERATIONS, MAINTENANCE, AND SAFETY TECHNOLOGY CONFERENCE, COCOA BEACH, FLA., MAR. 29, 1972. PAPER. 15 P.

*CRYOGENIC EQUIPMENT/ELECTRIC EQUIPMENT/HYDRAULIC
ABSTRACT

ABS UMBILICAL CONNECT SYSTEMS WERE STUDIED FOR THE PURPOSE OF DEVELOPING TECHNIQUES, SPECIFICATIONS, AND HARDWARE DESIGN CONCEPTS FOR PROTOTYPE SYSTEMS TO BE USED IN THE SPACE SHUTTLE PROGRAM. NEW TECHNIQUES ARE DESCRIBED WHICH PERMIT RAPID AND RELIABLE MATING, CHECKOUT, AND CHECKOUT OF UMBILICAL CARRIER ASSEMBLIES AND COUPLINGS FOR VEHICLE SERVICES (OXYGENIC, ELECTRICAL, PNEUMATIC, AND HYDRAULIC SYSTEMS).

EVALUATION OF A OIL HYDRAULIC PIPE COUPLING (PERFORMANCE OF OIL HYDRAULIC PIPE COUPLINGS UNDER MAXIMUM AND MINIMUM TOLERANCE CONDITIONS)

A/CROOK, A.
BRITISH HYDRODYNAMICS RESEARCH ASSOCIATION, CRANFIELD (ENGLAND).

AVAILABILITY: COPYRIGHT. AVAILABLE.
GLASGOW NATL. ENG. LAB. PREPARED JOINTLY WITH NATL. ENG. LAB.
GLASGOW.
APPENDIX II

CORRESPONDENCE
October 7, 1976
1.610WPR82

Various - List Attached

Attention:

Subject: Fluid Disconnects for Space Transportation Systems

Gentlemen:

Fairchild Stratos Division (FSD) has been selected by the NASA to conduct a study to develop and qualify a fluid disconnect for Space Transportation Systems. The intent of this program, (Contract NAS 8-32806) is to provide a disconnect design from existing industry hardware, capable of servicing a wide range of orbiting payloads.

Because the intended scope of potential applications is very broad, a family of disconnects, similar in design but adapted for specific media, temperature, etc. may emerge. In all cases, low leakage and minimum engagement, retention, and separation forces will be primary design drivers.

Fairchild Stratos has been directed by the subject contract to survey leading suppliers of aerospace disconnect hardware in search of applicable concepts and components. The modification of existing hardware to meet Space Transportation Systems requirements will be strongly considered. Any contribution, whether conceptual, test data, or hardware will be fully credited in the final report. Disclosures will be brought to the attention of interested NASA personnel. Contributors will be listed in, and given copies of, the final report.

If you wish to participate in this long range program, which Fairchild Stratos feels has great potential, please submit appropriate test data, assembly drawings, conceptual sketches, etc. A summary of basic requirements is attached to assist you in selecting items for submittal. Designs or concepts useful in satisfying all or part of these requirements will be of interest. To be of the most use, your reply should be received not later than December 1st, 1976. You may wish to submit an existing disconnect which can be used directly or modified to meet the enclosed criteria. Fairchild Stratos would, of course, expect to write a Purchase Order for the procurement of actual hardware.
In the event that you plan not to respond affirmatively, we would appreciate a reply confirming that intent.

If you have any questions, or wish to discuss technical aspects and implications of the program, please call Jere Vandewalle, Project Engineer, at (213) 675-9111, ext. 317, or the undersigned at Ext. 450.

Very truly yours,

FAIRCHILD STRATOS DIVISION

W. P. Rigsby
Program Manager

WPR:hb
Enclosure
BASIC REQUIREMENTS

NASA SPACE TRANSPORTATION SYSTEMS FLUID DISCONNECTS

1. Classification: Class 1 — Low Pressure, self-sealing, automatic open/close
   Class 2 — High Pressure, self-sealing, automatic open/close

2. Size: 1/4 Inch to 1-Inch

3. Fluids: Class 1 — Liquid Hydrogen
   Class 2 — Inert gases (He, N₂, etc.)

4. Pressure: Class 1 — 100 psia (maximum operating)
   Class 2 — 3000 psia (maximum operating)
   Proof factor: 1.5x  Burst factor: 2.0x

5. Temperature: Class 1 — -423° F to +50° F.
   Class 2 — -150° F to +250° F.

6. Leak Rates: Class 1 Room Temperature: 1 x 10⁻⁴ sccs GHe
   (mated & Unmated)
   -423° F: 0.1 sccs GHe
   Class 2 Room Temperature: 0.1 sccs GHe

7. Spillage: To be minimized (interface enclosed volume)

8. Separation Force: Pressure effects on engage/disengage forces and
   on separation force while connected must be minimized.

9. Alignment: Self aligning within ± 5° conical and 1/6 inch offset

10. Life/Endurance: 10 years and 500 cycles
LETTER MAILED TO THE FOLLOWING ADDRESSEES ON 10-7-76:

1. J. C. Carter Company
   671 W. 17th Street
   Costa Mesa, Calif. 92626
   ATTN: Nelson A. May
   Marketing Manager

2. Royal Industries, Inc.
   2040 Dyer Road
   Santa Ana, Calif. 92705
   ATTN: H. J. Patrick
   V.P., Marketing

3. Consolidated Controls Corp.
   15 Durant Avenue
   Bethel, Conn. 06801
   ATTN: Marketing Manager

4. Consolidated Controls Corp.
   2338 Alaska Avenue
   El Segundo, Calif. 90245
   ATTN: H. A. Waller
   Marketing Manager

5. AMETEC - Calmec Division
   8401 E. Slauson Avenue
   Pico Rivera, Calif. 90660
   ATTN: Keith Rogers
   Marketing Manager

   770 Boonton Avenue
   Boonton, New Jersey 07005
   ATTN: William T. Browne
   Sales Manager

7. Hamilton Standard
   United Aircraft Corporation
   Windsor Locks, Conn. 06096
   ATTN: Robert E. Breeding
   Manager, Space Systems

8. Val Cor Engineering Corp.
   365 Carnegie Avenue
   Kenilworth, New Jersey
   ATTN: Marketing Manager

   18321 Jamboree Road
   Irvine, Calif. 92644
   ATTN: W. G. Webster
   V.P., Marketing
   Aerospace Group

10. Lear Siegler, Inc.
    Romec Division
    241 So. Abbe Road
    Elyria, Ohio 44035
    ATTN: D. J. Webster
    Marketing Manager

11. Purolator California
    950 Rancho Conejo Blvd.
    Newbury Park, Calif. 92320
    ATTN: Barry B. Willis
    President
Subject: Requirements for Payload Fluid Disconnects

Sir:

Fairchild Stratos Division (FSD) is conducting a program under NASA Contract NAS 8-32806 to develop and qualify fluid disconnects in support of Space Transportation Systems (STS). The intent of this program is to provide a unit, or family of units, capable of servicing a wide range of orbiting payloads. Servicing, in this context, implies orbital mating of the Shuttle Orbiter with a satellite, followed by modular replacement and/or replenishment of satellite subsystems or experiments. The fluid disconnect as such becomes a key element in the success of orbital servicing operations.

The types of fluids generally include propellants, pressurants, and coolants, as typically used in subsystems for attitude control, thermal conditioning, special experiments, etc. The use of fluid disconnects as part of an integrated orbital servicing concept provides capability for replenishment, mixing, or even exchange of onboard fluids. This additional flexibility can be utilized to extend satellite orbital lifetime, increase payload, vary experiments, etc.

To provide the most useful disconnects for such a broad range of applications, full understanding of potential requirements is necessary. Accordingly, Fairchild Stratus has been advised by the contracting agency (NASA-MSFC) to contact potential satellite and payload contractors to discuss anticipated fluid requirements. These include all significant parameters, such as fluid type, operating pressure, mission life, allowable leakage, etc.

Any assistance you might provide in terms of definition of fluid requirements would be appreciated, and would be fully credited in the final report. We would welcome an opportunity for a face-to-face meeting and discussion of anticipated requirements at your convenience. In any event, we request that your reply be received not later than 15 December 1976. If you wish to contact us by phone, or if you have any questions regarding the technical aspects of the program, please contact the undersigned at (213) 675-9111, extension 317, or Mr. M. Baniadam at extension 217.

Very truly yours,

FAIRCHILD STRATOS DIVISION

J. M. Vandewalle
Project Engineer
PAYLOAD CONTRACTORS

1. Fritz Runge  
   Program Manager, Space Shuttle Payloads  
   Dept. 833 MS 13-2  
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   The Aerospace Corporation  
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   Bell Aerospace Textron  
   Box 1  
   Buffalo, New York 14240

4. H. K. Burbridge  
   Lockheed Missiles and Space Co., Inc.  
   Box 504  
   Sunnyvale, California 94088

5. A. L. Lang  
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   Dallas, Texas 75222

6. D. A. Heald  
   General Dynamics Corporation  
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   Box 80847  
   San Diego, California 92138

7. Elmer Frey  
   Sherman Fairchild Technology Center  
   Century Blvd.  
   Germantown, Maryland 20767

8. Gary D. Gordon, Project Manager  
   Communications Satellite Corporation  
   COMSTAT Laboratories  
   Clarksburg, Maryland 20734
APPENDIX III

DEVELOPMENT TEST PROCEDURE ER 76300-2
DEVELOPMENT TEST PROCEDURE
SPACE TRANSPORTATION SYSTEMS DISCONNECT
FOR
NASA GEORGE C. MARSHALL SPACE FLIGHT CENTER
PART NOS. 76300101-501 AND 76300001-501

Prepared by: J. M. Vandewalle 25 May '77
J. M. Vandewalle, Project Engineer

Approved by: D. Mu 5/26/77
S. Mu, Sr. Project Engineer

16 May 1977

FAIRCHILD
I800 ROSECRAWS AVENUE MANHATTAN BLACH CALIF 90260
1.0 SCOPE

This document describes the development test procedure applicable to the subject disconnects, FSD Part Nos. 76300101-501 and 76300001-501.

1.1 Test Specimens

Two prototype test specimens as follows will be used for the development test program:

<table>
<thead>
<tr>
<th>Description</th>
<th>FSD Part Number</th>
</tr>
</thead>
<tbody>
<tr>
<td>1/2 Inch Orbital Servicing Module Ass'y</td>
<td>76300001-501</td>
</tr>
<tr>
<td>1/2 Inch Orbital Servicing Spacecraft Ass'y</td>
<td>76300101-501</td>
</tr>
</tbody>
</table>

1.2 Objectives

Testing shall be performed to provide the necessary confidence that the disconnects will meet all specification requirements, and to explore the limits of the design capability.

2.0 APPLICABLE DOCUMENTS

The following documents of the exact issue shown, form a part of this plan to the extent referenced. Contents of the plan shall take precedence over any conflicting portions of these documents.

Military

- MIL-C-45662A 9 February 1967: Calibration System Requirements
- MIL-P-27401B 19 September 1962: Propellant, Pressurizing Agent Nitrogen
- MIL-P-27407 8 January 1965: Propellant, Pressurizing Agent Helium
- MIL-P-27201B 30 June 1971: Propellant Hydrogen
3.0 GENERAL REQUIREMENTS

3.1 Test Facilities

All testing shall be accomplished at Stratos Division, except where local safety requirements, specialized environmental testing, or equipment capacity demand the use of an approved outside laboratory source.

3.1.1 Test Data Documentation

All test data results obtained during tests at Stratos Division shall be recorded on data sheets provided in Appendix I of this procedure. One complete set is included. Additional copies can be made as required to perform complete development testing of all test specimens. All original test data sheets shall be kept in one book or file and be immediately available. All data sheets are to be signed by the data taker and another engineer for accuracy and reasonableness. All testing reports from approved outside source and Stratos shall include all pertinent data and photographs of both setups and specimen duly annotated.

3.1.2 Test Deviations

Any deviations in test or performance from allowable limits shall be immediately reported. No adjustments, repairs or maintenance shall be made to the specimen without prior approval of the Project Engineer.
3.1.3 Test Equipment Certification

All equipment shall be certified in accordance with MIL-C-45662A. A record of equipment used shall be maintained to include the following:

- Name of equipment
- Model number
- Serial number
- Manufacturer
- Certification and accuracy
- Frequency of calibration
- Range

3.1.4 Test Media

- GN₂: Propellant, Pressurizing Agent Nitrogen per MIL-P-27401B
- GHe: Helium, Bureau of Mines, Grade A-Oil Free or MIL-P-27407, Propellant Pressurizing Agent Helium
- LH₂: MIL-P-27201B, Propellant Hydrogen
- LN₂: MIL-P-27401C, Type I, Grade A

3.1.5 Test Tolerances - (Unless Otherwise Specified)

- Pressure: 1%
- Temperature: 5%
- Time: 5%
- Flow: 2%
- Vibration Frequency Bandwidth: 2%
- Spectral Density: 2db

3.1.6 Cleanliness

The cleanliness of the test equipment and fixtures shall be maintained in accordance with Stratos Specification SWP-209.
3.1.7 Safety Procedure

Safety procedures shall be observed at all times without exception. All normal laboratory practices applicable to pressure vessels and cryogenic testing shall be observed.

3.1.8 Test System Leak Check

All test system fittings shall be bubble-tight, using leak check solution per AMS 3159. The leak test shall be performed with GHe at specimen operating pressures as follows:

Operating pressure 300 ± 10 psig

3.1.9 Low Temperature Testing

Whenever the test specimen is being chilled or being warmed from a chilled condition, the test unit shall be pressurized or purged at 5 psig minimum pressure.

3.1.10 Units

Pounds per square inch gage psig
Pounds per square inch absolute psia
Standard cubic centimeters per second scs
4.0 DETAIL REQUIREMENTS

The prototypes will be subjected to development tests as outlined in Table I. Necessary deviations from the indicated sequence may be made at the discretion of the Project Engineer.

4.1 Examination of Product

Examine the disconnect halves carefully prior to initiation of development testing and record on the data sheets provided their weights and any non-conformances to applicable drawings.

4.2 Proof Pressure

4.2.1 Unmated Proof - Module Half Disconnect (MHD)

Place the unmated MHD in a proof test chamber connected by its flex hose to a pressure source of GN₂ or GHe. Apply 440 ± 10 psig through the flex hose to the MDH for a minimum period of five minutes. Remove the pressure and visually inspect the unit for permanent deformation. No permanent deformation is permitted.

4.2.2 Unmated Proof - Spacecraft Half Disconnect (SHD)

Repeat 4.2.1 using the SHD.

4.2.3 Mated Proof - Disconnect

Install the SHD and the MHD in the 78300901 test fixture as shown in Figure 1. Connect to the test control panel. Using the fixture drive, mate the halves of the disconnect. At a maximum rate of 100 psig per minute, apply 440 ± 10 psig to the mated disconnect. Observe the test fixture for deformation and/or any slippage of the ball screw drive. If either occurs, terminate the test, immediately reduce pressure to zero, and make appropriate modifications before proceeding. When the required 440 ± 10 psig is reached, maintain pressure for a minimum period of five minutes. Remove the pressure and visually inspect the disconnect for permanent deformation. None is permitted.
<table>
<thead>
<tr>
<th>Description of Test</th>
<th>Paragraph</th>
</tr>
</thead>
<tbody>
<tr>
<td>Examination of Product</td>
<td>4.1</td>
</tr>
<tr>
<td>Proof Pressure</td>
<td>4.2</td>
</tr>
<tr>
<td>Leakage</td>
<td>4.3</td>
</tr>
<tr>
<td>Functional</td>
<td>4.4</td>
</tr>
<tr>
<td>Flow and Pressure Drop</td>
<td>4.5</td>
</tr>
<tr>
<td>Interface Volume</td>
<td>4.6</td>
</tr>
<tr>
<td>Life Cycle</td>
<td>4.7</td>
</tr>
<tr>
<td>Vibration</td>
<td>4.8</td>
</tr>
<tr>
<td>Burst</td>
<td>4.9</td>
</tr>
<tr>
<td>Post Test Inspection</td>
<td>4.10</td>
</tr>
</tbody>
</table>
4.3 Leakage

4.3.1 Ambient Temperature Leakage

Perform the ambient temperature leak tests at 75 ± 20 °F.

4.3.1.1 Ambient Temp Leakage - SHD

Install the SHD and its leak test fixture (76300904) as shown in Figure 2. Connect leak test fixture port to leakage test carousel. Cap the 1/8" NPT vent port and apply 50 psig to the SHD 1/2" flow port. If there is no indication (on the smallest flowrator tube) of leakage, disconnect the carousel, and connect the test fixture port to a Nordquist Mark II or to a mass spectrometer. Maximum allowable leak rate is $1 \times 10^{-4}$ scs. If there is an indication of leakage on the carousel, stop the test, disassemble the unit, inspect the sealing surfaces and examine the seals. Determine the cause of the excessive leak rate before proceeding. Measure leak rates at 50 ± 5 psig increments from 50 to 300 ± 10 psig and record the data. Uncap the 1/8" vent port and remove the SHD and its leak test fixture.

4.3.1.2 Ambient Temp Leakage - MHD

Install the MHD and its leak test fixture (76300902) as shown in Figure 3. Connect the sleeve seal leak port on the test fixture to the leakage test carousel. Apply 50 ± 5 psig to the MHD 1/2" flow port. Repeat 4.3.1.1 using the MHD and its leak test fixture with the carousel, Nordquist Mark II, or mass spectrometer.

4.3.1.3 Ambient Temp Leakage - Interface

Remove the 76300902 leak test fixture and install the 76300903 spacer on it. Reinstall the assembly of the 76300902/76300903 leak test fixture and spacer and repressurize the MHD. Connect the interface seal leak port on the test fixture to the leakage test carousel. Apply 50 ± 5 psig to the MHD 1/2" flow port. If there is no indication of leakage on the smallest flowrator tube, disconnect the carousel, and connect the leak port to a Nordquist Mark II or to a mass spectrometer. Maximum allowable leak rate is $1 \times 10^{-4}$ scs. Determine cause of excessive leakage, if any, before proceeding. Measure and record leak rates at 50 ± 5 psig increments up to 300 ± 10 psig.
4.3.2 High Temperature Leakage

Place the 76300901 fixture in an environmental chamber or insulated box as shown in Figure 4. Apply heat input to the interior of the chamber where the fixture and the prototypes are located. Perform the High Temp Leakage tests at 75, 125, 175, and 225 ± 25°F.

4.3.2.1 High Temp Leakage - SHD

Repeat 4.3.1.1 at each temperature level except check only three pressure levels: 50 ± 5, 150 ± 5, and 300 ± 10 psig. Do not proceed beyond a level where 1.0 sccs leak rate is reached. Conclude the test by rechecking and recording ambient leakage at 50 ± 5, 150 ± 5, and 300 ± 10 psig.

4.3.2.2 High Temp Leakage - NHLD

Repeat 4.3.1.2 at each temperature level except check only three pressure levels: 50 ± 5, 150 ± 5 and 300 ± 10 psig. Do not proceed beyond a level where 1.0 sccs leak rate is reached. Conclude the test by rechecking and recording ambient leakage at 50 ± 5, 150 ± 5, and 300 ± 10 psig.

4.3.2.3 High Temp Leakage - Interface

Repeat 4.3.1.3 at each temperature level except check only three pressure levels: 50 ± 5, 150 ± 5 and 300 ± 10 psig. Do not proceed beyond a level where 1.0 sccs leak rate is reached. Conclude the test by rechecking and recording ambient leakage at 50 ± 5, 150 ± 5, and 300 ± 10 psig.
4.3.3 Low Temperature Leakage

Cool the environmental chamber interior where the fixture and prototypes are located. Perform the Low Temp Leakage tests at 75, 50, 25, 0, -25, and -50 ± 5°F.

4.3.3.1 Low Temp Leakage - SHD

Repeat 4.3.1.1 at each temperature level except check only three pressure levels: 50 ± 5, 150 ± 5, and 300 ± 10 psig. Conclude the test by rechecking and recording ambient leakage at 50 ± 5, 150 ± 5, and 300 ± 10 psig.

4.3.3.2 Low Temp Leakage - MHD

Repeat 4.3.1.2 at each temperature level except check only three pressure levels: 50 ± 5, 150 ± 5, and 300 ± 10 psig. Conclude the test by rechecking and recording ambient leakage at 50 ± 5, 150 ± 5, and 300 ± 10 psig.

4.3.3.3 Low Temp Leakage - Interface

Repeat 4.3.1.3 at each temperature level except check only three pressure levels: 50 ± 5, 150 ± 5, and 300 ± 10 psig. Conclude the test by rechecking and recording ambient leakage at 50 ± 5, 150 ± 5, and 300 ± 10 psig.

4.4 Functional Testing

Install the SHD and the MHD in test fixture 76300801 as shown in Figure 5 for functional testing.

4.4.1 Engage/Disengage

With the SHD and MHD installed at nominal alignment but disengaged, actuate the electric motor ball screw drive and engage the disconnect halves. Observe carefully for any indication of jamming or binding. Stop immediately if any improper engagement becomes evident and investigate before continuing.

Once full engagement is properly achieved, reverse the motor drive and fully disengage the disconnect halves. Repeat the engage/disengage cycle and record the readings indicated by the force washers. Also record drive motor current and voltage.
4.4.1 Engage/Disengage (continued)

Apply 50 ± 5 psig to the MHD and repeat the engage/disengage cycle. Record the force washer readings. Repeat at 50 ± 5 psig increments to 300 ± 10 psig.

Reinstall the MHD at 3° misalignment and .060 offset. Repeat 4.4.1 under misaligned conditions.

4.4.2 Thermal Capability - Low Limit

Reinstall the 76300901 fixture in the environmental chamber per Figure 4 with the disconnect halves in the misaligned position. Cool the interior of the chamber in -25 ± 5 °F increments from ambient to -50 °F or the lowest practicable temperature, whichever occurs first. At each temperature perform an engage/disengage cycle, beginning each cycle with the units disengaged. Perform one cycle with each of the following pressure combinations at each temp and record the forces indicated by the force washers.

<table>
<thead>
<tr>
<th>MHD</th>
<th>SHD</th>
</tr>
</thead>
<tbody>
<tr>
<td>300</td>
<td>0</td>
</tr>
<tr>
<td>300</td>
<td>150</td>
</tr>
<tr>
<td>300</td>
<td>300</td>
</tr>
</tbody>
</table>

4.4.3 Thermal Capability - High Limit

Repeat 4.4.2 except heat the interior of the chamber in 25 ± 5 °F increments from ambient to +250 ± 10°F or the highest practicable temperature, whichever occurs first. Remove environmental chamber following test.

4.5 Flow and Pressure Drop

With the SHD and MHD engaged at the maximum separation position connect the MHD 1/2" flow port to a pressurized water reservoir. Install a 0-100 psig Δ P gage across the disconnect inlet and outlet. Connect the SHD 1/2" flow port to a 1/2" full flow capability ball valve with 1/2" O.D. x .058 tubing and the ball valve to a 0-20 GPM water flowmeter. Pressurize the water reservoir to its operating pressure or 300 psig ± 10 psig, whichever is lower. Using the ball valve to regulate flow, increase flow in 2.0 ± 0.5 GPM increments until full flow is reached with the ball valve full open. Record the flows and corresponding Δ P values. Make two runs to verify data accuracy.
4.5 **Flow and Pressure Drop (continued)**

Repeat the above test with the SHD and MHD engaged at the nominal separation distance.

4.6 **Interface Volume**

Close the ball valve leading to the flowmeter. Place an open topped container under the interface area of the mated disconnect. Bleed off trapped gas bubbles from the setup. Use the ball screw drive to engage and disengage the SHD and MHD 100 times. Catch and retain the water which spills from the disconnect at each cycle. Make an accurate measurement of the total volume captured at 10, 50, and 100 cycles, and record the values.

4.7 **Life Cycle**

With the SHD and MHD installed at maximum misalignment in the 76300901 fixture, perform the required life cycle testing.

4.7.1 **Life Cycle - Ambient Temp**

Pressurize the MHD to 300 ± 10 psig. Repeat 4.3.1 prior to, and following, the 100 cycles. Environmental temperature must be 75 ± 20°F. Perform 100 engage/disengage cycles, venting the SHD to zero pressure during the disengaged position of the cycle. Maintain 300 ± 10 psig on the MHD throughout the test.

Repeat the test except vent the SHD only to 150 ± 25 psig during the disengaged portion of the cycle.

4.7.2 **Life Cycle - Low Temp**

Reinstall the 76300901 fixture in the environmental chamber per Figure 4. Cool the interior to -50°F or to the lowest practicable temperature, whichever occurs first, and repeat 4.7.1 except perform 75 engage/disengage cycles instead of 100 at each of the two SHD vent settings. Repeat 4.3.1, except at the low temperature, prior to, and following the 75 cycles.

4.7.3 **Life Cycle - High Temp**

Heat the interior of the environmental chamber to +250°F or the highest practicable temperature, whichever occurs first, and repeat 4.7.1 except perform 75 engage/disengage cycles instead of 100 at each of the two SHD vent settings. Repeat 4.3.1, except at the high temperature, prior to, and following the 75 cycles.
4.8 Vibration

Install the mated disconnect in the vibration test fixture furnished by outside test facility and pressurize it to 300 ± 10 psig. Subject the mated disconnect to the following vibration levels for 14 minutes each in the radial and axial direction.

<table>
<thead>
<tr>
<th>FREQUENCY RANGE (Hz)</th>
<th>ACCELERATION SPECTRAL DENSITY</th>
</tr>
</thead>
<tbody>
<tr>
<td>20-40</td>
<td>Increasing at 6 dB/octave</td>
</tr>
<tr>
<td>40-150</td>
<td>0.5 g²/Hz</td>
</tr>
<tr>
<td>150-2000</td>
<td>Decreasing at 6dB/octave</td>
</tr>
</tbody>
</table>

Repeat 4.3.1 at the conclusion of vibration testing.

4.9 Burst

Using the vibration test fixture if suitable or other specially designed burst test fixture, pressurize the mated disconnect to 600 ± 25 psig, for a minimum of five minutes. Depressurize to zero and examine the disconnect for distortion. If none is evident, disengage the SHD and the MHD and pressurize each to 600 ± 25 psig for a minimum of five minutes. Depressurize to zero and examine the halves for distortion.

Repeat the above test at 900 psig, and then at 1200 psig. Permanent deformation during any portion of the burst test is allowable, but the test should be terminated short of actual fracture if possible. The highest pressure which does not cause distortion and the highest overall test pressure should both be recorded.

4.10 Post Test Inspection

Disassemble, measure, and visually inspect the disconnect, component parts and seals. Record any evidence of distortion, wear contamination, etc.
APPENDIX I

TEST LOGS - DATA SHEETS

76300001-501 AND 76300101-501

ORBITAL SERVICING DISCONNECTS
4.1 Examination of Product

Remarks:

---

4.2.1 Unmated Proof Test 76300001-501 Module Half Disconnect (MHD)
— psig applied for — minutes.
Permanent deformation detected? —

4.2.2 Unmated Proof Test 76300101-501 Spacecraft Half Disconnect (SHD)
— psig applied for — minutes.
Permanent deformation detected? —

4.2.3 Mated Proof Test
— psig applied for — minutes.
Permanent deformation detected? —

4.3.1.1 Ambient Temp Leakage - SHD
Temp — °F 1/8" NPT VENT PORT CAPPED? —
Pressure, psig Leak Rate, sees
---
---
---
---
---
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1/8" NPT VENT PORT UNCAPPED? —

4.3.1.2 Ambient Temp Leakage - MHD
Temp — °F

REMARKS:

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**Remarks:**

**Tester:**

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### 4.5 Flow and Pressure Drop

**SHD/MHD Separation Distance**

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**REMARKS:**

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**Remarks:**

**Tester:**

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### 4.6 Interface Volume

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<tr>
<th>Cycle #</th>
<th>Measured Volume cc</th>
<th>in³</th>
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### 4.7.1 Life Cycle - Ambient Temp

#### a) Pre-cycling Leak Test

<table>
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<th>MHD (vent port uncapped)</th>
<th>INTERFACE</th>
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<tbody>
<tr>
<td>PRESS</td>
<td>PRESS</td>
<td>PRESS</td>
</tr>
<tr>
<td>psig</td>
<td>leakagé</td>
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</table>

#### b) Cycling Test

<table>
<thead>
<tr>
<th>Temp °F</th>
<th>Pressure, psig</th>
<th>MHD</th>
<th>SHD</th>
<th>Cycle #</th>
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### REMARKS:

Tester
c) Post-cycling Leak Test

<table>
<thead>
<tr>
<th>SHD (vent port capped)</th>
<th>MHD (vent port uncapped)</th>
<th>INTERFACE</th>
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<tbody>
<tr>
<td>PRESS</td>
<td>LEAKAGE</td>
<td>PRESS</td>
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<td>psig</td>
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4.7.2 Life Cycle - Low Temp

a) Pre-cycling Low Temp Leak Test

<table>
<thead>
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<th>MHD (vent port uncapped)</th>
<th>INTERFACE</th>
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<tr>
<td>TEMP</td>
<td>PRESS</td>
<td>LEAKAGE</td>
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</table>

b) Cycling Test

<table>
<thead>
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<th>Temp °F</th>
<th>Pressure, psig</th>
<th>MHD</th>
<th>SHD</th>
<th>CYCLE #</th>
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REMARKS:__________________________

TESTER__________________________
### 4.7.3 Life Cycle - High Temp

#### a) Pre-cycling High Temp Leak Test

<table>
<thead>
<tr>
<th>SHD (vent port capped)</th>
<th>MHD (vent port uncapped)</th>
<th>INTERFACE</th>
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<tbody>
<tr>
<td>TEMP °F</td>
<td>PRESS psig</td>
<td>LEAKAGE secs</td>
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#### b) Cycling Test

<table>
<thead>
<tr>
<th>Temp °F</th>
<th>Pressure, psig</th>
<th>MHD</th>
<th>SHD</th>
<th>CYCLE #</th>
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REMARKS:

TESTER
### Test Log

#### 1) Post Cycling High Temp Leak Test

<table>
<thead>
<tr>
<th>Temp</th>
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<th>Leakage</th>
<th>Temp</th>
<th>Press</th>
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<th>Press</th>
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#### 4.8 Vibration

<table>
<thead>
<tr>
<th>Pressure, psig</th>
<th>Axis</th>
<th>Duration, min.</th>
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For details of frequency response, see report prepared by outside test lab.

#### Post vibration leak test

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#### Remarks:

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</table>
4.9 Burst

<table>
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<tr>
<th>psig applied for</th>
<th>minutes</th>
<th>(Mated disconnected)</th>
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Maximum pressure achieved without permanent deformation: **_psig_**

Maximum pressure overall: **_psig_**

Description of deformation: 

Description of fracture (if any): 

4.10 Post Test Inspection

(Record measurements, description, etc.)

Remainder of page is blank

Remarks: 

Tester: 