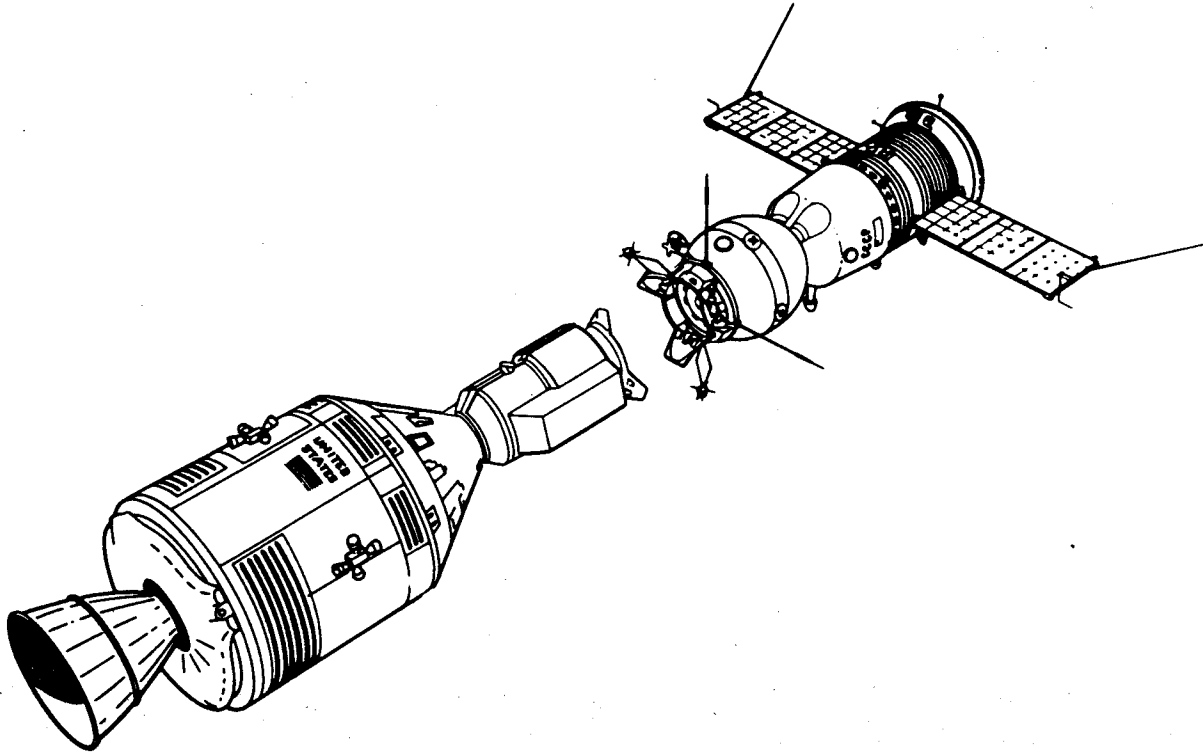


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RS MERRIAM

ASTP 40001.1
FEBRUARY 7, 1975

APOLLO SOYUZ TEST PROJECT



DESIGN CHARACTERISTICS

FOR SOYUZ AND APOLLO

USA - USSR

| | | | | | |
|---|---------|----------------------------------|-----------------------------------|---------------------------------------|-------------------------------|
| 1 | USA | <i>S. Blackmer</i> С. Блэкмер | <i>I. Glikman</i> И. Гликман | <i>M. P. Frank</i> М. П. Франк | <i>G. Lanni</i> Г. Ланни |
| 1 | СССР | <i>В. Бобков</i> В. Бобков | <i>И. Трущенко</i> И. Трущенко | <i>А. Елисеев</i> А. Елисеев | <i>К. Бушуев</i> К. Бушуев |
| ORIGINAL | USA | <i>S. Blackmer</i> С. Блэкмер | <i>M. G. G. G.</i> М. Г. Г. Г. | <i>F. C. Littleton</i> Ф. Литтлтон | <i>G. Lanni</i> Г. Ланни |
| ОРИГИНАЛ | СССР | <i>В. Бобков</i> В. Бобков | <i>Н. Хабарин</i> Н. Хабарин | <i>А. Елисеев</i> А. Елисеев | <i>К. Бушуев</i> К. Бушуев |
| REISSUE NO. | COUNTRY | PREPARED | TRANSLATION VERIFIED | WORKING GROUP CHAIRMAN | DIRECTOR |
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1.0

INTRODUCTION

This document provides general design characteristics of the Soyuz and Apollo spacecrafts for reference during development of compatible rendezvous and docking systems necessary for the test flight. References are made to ASTP and IED documents that contain detailed interacting and compatibility requirements which take precedence.

2.0

ABBREVIATIONS

| | | |
|--|--------|---------|
| Apollo Soyuz Test Project | ASTP | ЭПАС |
| Soyuz Spacecraft | Soyuz | Союз |
| Apollo Spacecraft | Apollo | Аполлон |
| Launch Vehicle | LV | РН |
| Soyuz Orbital Compartment (module) | OM | OM |
| The Soyuz Descent Vehicle | DV | СА |
| Instrument-Assembly Module | IAM | ПАО |
| Apollo Command Module | CM | КМ |
| Apollo Service Module | SM | СЛМ |
| Apollo Command and Service Module | CSM | КСМ |
| Docking Module | DM | СМ |
| Apollo Spacecraft with the Docking Module | CSM/DM | КСМ/СМ |
| Androgynous Peripheral Docking System | APDS | АПАС |
| Attitude and Motion Control System Soyuz | AMCS | СОУД |
| Guidance and Navigation System | GNS | -СНН |
| Stabilization and Control System | SCS | -ССУ |
| Descent Power System | DPS | СУС |
| Rendezvous and Corrective Power System | RCPS | СКДВ |

Approaching and Orientation

| | | |
|---------------------------------------|------|------|
| Engines | AOE | ДПО |
| Orientation Engines | OE | ДО |
| Service Propulsion System | SPS | МДУ |
| Reaction Control System | RCS | РСУ |
| Life Support System | LSS | СОЖ |
| Launch Escape System | LES | CAC |
| Electric Power System | EPS | СЭП |
| Cable System | CS | БКС |
| Radiotelemetry System | RTS | РТС |
| Radio Guidance System | RGS | СРН |
| Temperature Control System | TCS | СТР |
| Compartments Pressurization System | PS | СНО |
| Command and Signal Radio Line | CSRL | КРЛ |
| Crew Optical Alignment System | COAS | ОСРВ |

3.0 SOYUZ DESIGN CHARACTERISTICS

3.1 SOYUZ GENERAL CONFIGURATION

3.1.1 Soyuz spacecraft general view is shown on Figure 3-1. The spacecraft coordination systems are defined in IED 50401.

3.1.2 The arrangement of orientation and control systems sensors and optical instruments of the spacecraft is included in the ASTP 10000 document.

3.1.3 The arrangement of orientation onboard lights and light pulsing beacon is included in the ASTP 10000 document. The requirements for the development and the mounting are given in IED 50301.

3.1.4 The arrangement of spacecraft docking targets is given in the ASTP 10000 document. The requirements for development and tolerances for mounting of docking targets are included in IED 50201 document. The check technique of the docking targets position is given in the IED 50202 document. The construction schemes of the main and additional (ABC) targets are shown in Figures 3-15 and 3-27.

The docking target ABC is used as a source of additional information about the angles and relative spacecraft orientation during docking. This target is a tridimensional device mounted on Soyuz spacecraft and can be viewed through Apollo sighting device.

- 3.1.5 The arrangement of spacecraft radio system antennas is given in ASTP 10000 document. The construction scheme of compatible VHF-radio station antennas are shown in Figures 3-16 and 3-17.
- 3.1.6 The spacecraft engines arrangement is given in IED 50401.
- 3.1.7 The identification marks scheme on the spacecraft are shown on sheet 11.
- 3.1.8 The Soyuz docking tunnel equipment is shown in Figure 3-30.
- 3.2 SOYUZ HABITABLE MODULES ARRANGEMENT
- 3.2.1 The orbital module arrangement (OM)
 - 3.2.1.1 The orbital module interior is shown in Figure 3-2, 3-25, and 3-26.
 - 3.2.1.2 The Apollo radio station mounting in the orbital module is shown in Figure 3-3.
 - 3.2.1.3 The arrangement of TV and movie cameras and lamps in the orbital module is shown in Figure 3-4.
 - 3.2.1.4 The scheme of the hatch cover is shown in Figure 3-5. Hatch details are defined in IED 50723.
 - 3.2.1.5 The scheme of the crew-with-guests allocation in the orbital module is shown in Figure 3-6.

- 3.2.1.6 The general view of orbital module control panel and display console systems are shown in Figure 3-7 and 3-8. Detail LSS controls are defined in IED 50723.
- 3.2.1.7 The general view of orbital module J-box is shown in Figure 3-9.
- 3.2.1.8 The equipment to be transferred from Apollo to Soyuz and from Soyuz to Apollo is identified in IED's 50720 and 50721 respectively. The Soyuz transfer equipment container is used for stowage and transportation of the following TV and photographic equipment during cosmonaut transfer to Apollo:
- TV camera TK-6
 - TV camera bracket
 - still camera FK-6
 - film rolls for still camera FK-6
- The container design and equipment layout is given in Figure 3-31. The container location in OM is shown in Figure 3-28.
- 3.2.2 The descent vehicle (DV) arrangement.
- 3.2.2.1 The descent vehicle interior is shown in Figure 3-10 and 3-32.
- 3.2.2.2 The general view of the cosmonauts' instrument panel of DV is shown in Figure 3-11.
- 3.2.2.3 The general view of command signal devices in DV is defined in ASTP 20202.

- 3.2.2.4 The general view of the DV compatible VHF-radio-stations control panel is shown in Figure 3-12.
- 3.2.2.5 The arrangement of TV-camera and lamps in the descent vehicle, including Apollo TV camera installation on bracket, is shown in Figure 3-13.
- 3.2.2.6 The scheme of the identification marks in DV is shown in Figure 3-14.
- 3.2.2.7 Description and overall dimensions of the baffle used in "Artificial solar eclipse" experiment are given in USSR WG 1- 107 and USSR WG3-032 documents.
- 3.3 THE MAIN INERTIAL-MASS-AND-STIFFNESS PERFORMANCE OF THE SOYUZ
- 3.3.1 The Mass of the Spacecraft and its Modules
- The nominal mass values of the spacecraft at the time of docking are $683 \text{ kgm}^{-1} \text{ sec}^2$ including:
- orbital module $127 \text{ kgm}^{-1} \text{ sec}^2$;
 - descent vehicle $286 \text{ kgm}^{-1} \text{ sec}^2$;
 - instrument assembly module $270 \text{ kgm}^{-1} \text{ sec}^2$.
- 3.3.2 The Soyuz central and centrifugal moments of inertia up to the docking is given in IED 50401.
- 3.3.3 The Soyuz center of mass position at the time of docking is contained in IED 50401.

3.3.4 The spacecraft mass distributed along its length, the moment of inertia distributed along the linear axis, as well as the flexural, torsional shear and longitudinal stiffness distributed along the spacecraft length are given in IED 50401. Mass and stiffness characteristics of the solar panels is also included in IED 50401.

3.4 FLIGHT CERTIFICATION TEST LEVELS OF THE SOYUZ COMPATIBLE AND INTERACTING EQUIPMENT TAKING INTO ACCOUNT FLIGHT AND GROUND HANDLING CONDITIONS.

3.4.1 Dynamic Conditions:

3.4.1.1 Acceleration (constant)

- in the direction of X-axis 6g duration 600 sec.
- in the direction of Y, Z axes \pm 3g duration 600 sec.

3.4.1.2 Random vibrations (spectral density of vibro-accelerations):

- | | [f] | [s(f)] |
|----------------------|-------------|-------------------------------|
| - in frequency range | 20-100 HZ | 0.035-0.07 g ² /HZ |
| - in frequency range | 100-400 HZ | 0.07 g ² /HZ |
| - in frequency range | 400-2000 HZ | 0.07-0.05 g ² /HZ |

s(f) variation in the ranges shown is linear. Test duration in each of the 3 axes, X, Y, Z, is 300 seconds. For the Apollo VHF/AM transceiver and range tone transfer assembly, taking into account its mounting provisions, the modes of sinusoidal and random vibration presented in IED 50101 are acceptable.

3.4.1.3 Shock loads:

- acceleration $\pm 40g$;
- impulse duration within the limits of 1-3 m. sec;
- semi-sinusoidal or sawtooth impulse shape;
- 6 shocks in each direction X, Y, Z (3 shocks in two opposite directions along the axis).

3.4.1.4 Acoustic Effects

- The maximum total level of acoustic noise is up to 135 DB inside the orbital and instrument assembly modules.
- The levels of sound pressure inside the orbital and instrument assembly modules in 1/3-Octave frequency band, $L_{1/3}(f)$ are presented in the table below.

| 1/3 Octave Band Central Frequency | : Sound Pressure Levels within : 1/3 octave band, dB re $2 \cdot 10^{-5}$: N/m ² |
|-----------------------------------|--|
| 40 | 122 |
| 50 | 123 |
| 63 | 124 |
| 80 | 126 |
| 100 | 126 |
| 125 | 126 |
| 160 | 126 |
| 200 | 126 |
| 250 | 124 |
| 315 | 122 |
| 400 | 120 |
| 500 | 118 |
| 630 | 116 |
| 800 | 114 |
| 1000 | 112 |
| 1250 | 110 |
| 1600 | 108 |
| 2000 | 106 |
| 2500 | 104 |
| 3150 | 102 |
| 4000 | 100 |

Total 135 db

NOTE: Outside the orbital module the level of sound pressure is 6 DB higher.
The duration of acoustic effect is 60 seconds.

3.4.2 Environmental conditions: (During Testing)

3.4.2.1 Gas atmosphere: (In Habitable Modules)

- composition - 21-40% O₂, 57-78% N₂, to 3% CO₂, to 2%H₂, 0.5% He
- pressure range 450-970 mmHg
- temperature range 10-30C
- relative humidity 20-90% at the temperature from 10°C to 25°C and 20-80% at the temperature from 25°C to 30°C.

3.4.2.2 Pressurization during the ground tests (in the compartments) with the helium-air mixture to 1.7 KG/cm². He will be to 30% in the volume, during 24 hours. Pressure variation rate - to $10 \frac{\text{mmHg}}{\text{sec}}$.

3.4.2.3 Vacuuming during the ground tests (in the compartments) - to 10⁻⁴ mmHg during 24 hours. Pressure variation rate - to $10 \frac{\text{mmHg}}{\text{sec}}$.

3.5 LIGHTING OF HABITABLE MODULES OF THE SOYUZ

3.5.1 List and location of lamps of the lighting system.

The following lamps are installed in the DV:

- two working illumination lamps (WIL)
- four special lighting lamps (SLL)

The following lamps are installed in the OM:

- two working illumination lamps (WIL)

- five special lighting lamps (SLL)
- special lighting transferable lamp (STLL)
- transferable lighting unit (TLU)

The layout for the lamps in the special lighting and working illumination systems in the DV and the OM are presented in Figure 3-13 and 3-4. The working illumination lamps in the DV and OM are stationary and their location will not be changed.

The lamps of the special lighting system in the DV are stationary and are installed on brackets. The location of the special lighting lamps will be determined more precisely during lighting simulation in the mockup stage with the Soyuz photography and television equipment.

The lamps of the special lighting system in the OM are installed by means of a "C"-clamp on the handrail.

It is possible to change the position of these lamps on the handrail within the limits of the connecting cable and to rotate them in two perpendicular planes from 50 to 100°, depending on specific lamp location.

The direction of the lamps will be determined more precisely during lighting simulation in the mockup with the Soyuz photography and television equipment.

The special lighting transferable lamp and transferable lighting unit are placed in the OM. They are provided for additional illumination during filming and television coverage, if required.

3.5.2

Characteristics of the Working and Special Lighting

3.5.2.1 Working Illumination

The dimensional outline of the working illumination lamp is shown in Figure 3-18. The lamp contains removable light unit (A) and a power assembly (B). The light unit has a transparent light-diffusing, unbreakable case in which a white, U-shaped luminescent lamp is contained.

The power assembly changes the dc voltage of the onboard circuitry to 20 KHz ac.

The working illumination lamps have a continuous adjustment of brightness. Each lamp has an axial rating of 50-60 candlepower. The light distribution curves in the longitudinal and vertical planes of the lamp are shown in Figure 3-19. The spectral characteristics of the lamp are shown in Figure 3-20. The color temperature of the lamp is not less than 3900⁰K.

The coordinates of chromacity are:

$$x = 0.412;$$

$$y = 0.397.$$

The working illumination system according to the data from the preliminary light simulation in the mockup, creates an average of 107 lux illumination level in the DV; and in the OM of 85 lux at the maximum brightness level of the lamps.

3.5.2.2 Special Lighting

The dimensional outline of the Special Lighting lamp is shown in Figure 3-21 a light reflector (A) and a light source (B) are installed in the body of the lamp. The lamp has a protective grille (C) over the front which is connected to the lamp through a threaded joint.

A halogen incandescent lamp with a rated power of 27 volts is used as the light source. Each lamp has an axial candlepower rating of 160-200 C.P.

The light distribution curves for the lamp are shown in Figure 3-22. The spectral characteristics of the lamp are shown in Figure 3-23.

The color temperature of the lamp is 3000-3200°K. The coordinates of chromacity are:

$$x = 0.424;$$

$$y = 0.400.$$

The configuration of the lamp permits the installation of a removable, light-reflecting screen or of a correcting filter at a distance of about 4-8 cm. from the lamp instead of the protective grille.

The Special Illumination transferable lamp is shown in Figure 3-24. The technical light characteristics of the transferable lamp correspond exactly with the characteristics of the Special Lighting lamps, in the DV and OM. The transferable lamp has a cable of 4-5 meters in length.

3.5.2.3

Based on results of Soyuz mockup equipment compatibility tests and checkouts, a transferable lighting unit (TLU), consisting of 3 working illumination lamps, was added to Soyuz spacecraft equipment. The stowage place of TLU is container No. 11. General view of TLU is shown in Figure 3-29.

3.5.3 Lighting System Control

Working Illumination in the DV is controlled from Command Signal assemblies. The lamps may be switched on and off individually.

Regulation of the illumination brightness is performed from the instrument panel.

Working Illumination in the OM is controlled from the OM panel and from the DV command signal assemblies.

The two lamps of the Working Illumination System may be turned on or off on the OM panel.

One lamp (WIL-1) of the Working Illumination System may be turned on or off from the Command Signal Assemblies of the DV.

The control of the brightness of illumination in the OM is performed from the OM panel.

The cluster of Special Lighting lamps in the DV, SIL-VI, SIL-VII, SIL-VIII is turned on simultaneously with the activation of the TV cameras, and may also be turned on and off without activation of the TV camera from the Command Signal Assemblies.

The fourth Special Illumination (SIL-IX) lamp is controlled by a separate toggle switch installed over the instrument panel.

The Special Illumination lamps in the OM have been divided into two groups:

- Group I with three lamps, SIL I, SIL II, SIL III.
- Group II with two lamps SIL IV, SIL V. It is possible to turn on and off the lamps in Groups I and II from the OM panel. Lamps SIL-I through SIL-V are also automatically switched on when the TV cameras are activated.

The STILL or TLU, after connection with a cable to the adapter plug of the OM circuit, may be switched on and off by a toggle switch on the OM panel and by a switch on the lamp itself.

4.0 APOLLO SPACECRAFT DESIGN CHARACTERISTICS

4.1 APOLLO GENERAL CONFIGURATION

4.1.1 The Apollo CSM/DM general view is shown in Figures 4-1 and 4-2. The spacecraft coordinate systems are defined in IED 50401.

4.1.2 The requirements and arrangement of the flashing light beacon, the orientation lights, and the docking floodlight are contained in IED 50301.

4.1.3 The requirements, description, location, and installation tolerances for the docking target mounted on the docking module are contained in IED 50201. The location is also shown in Figures 4-1 and 4-2.

4.1.4 The requirements for the Apollo VHF antenna assembly are given in IED 50101 together with data on location and performance.

4.1.5 The arrangement of the service module reaction control system of the attitude control engines is shown in IED 50401, together with their performance characteristics.

4.2 APOLLO HABITABLE MODULES ARRANGEMENT

4.2.1 Command Module (CM)

4.2.1.1 The command module general view is shown in Figures 4-3 and 4-4.

4.2.1.2 The command module interior is shown in Figures 4-5 through 4-9.

- 4.2.1.3 The provisions for mounting TV cameras and 16 mm movie cameras in the command module are shown in Figure 4-10. The command module interior floodlight provisions are shown in Figure 4-11.
- 4.2.1.4 The location of the command module side hatch is shown in Figures 4-3, and 4-8. Side hatch details are shown in Figure 4-12. The location of the command module forward tunnel hatch is shown in Figure 4-5. The forward hatch is similar in design to the docking module hatch.
- 4.2.1.5 The location of the CSM docking system probe is shown in Figure 4-3. Details of the CSM docking system are shown in Figure 4-13. The drogue assembly is mounted in the docking module. The probe and drogue assemblies are removed after CSM/DM docking is achieved and stowed in the command module as shown in Figure 4-9.
- 4.2.1.6 The layout of the command module displays and controls system is shown in Figure 4-14.
- 4.2.1.7 The equipment that is transferred from Apollo to Soyuz and from Soyuz to Apollo is identified in IED's 50720 and 50721 respectively.
- 4.2.2 Docking module (DM)
- 4.2.2.1 The inboard profile of the docking module is shown in Figure 4-15. The allocation of space within the docking module is shown in Figure 4-16.
- 4.2.2.2 The docking module dimensions are given in Figures 4-17 and 4-18.
- 4.2.2.3 Details of the docking module's hatches and pressure equalization valves are shown in IED 50706.

4.2.2.4 The docking module displays and controls arrangements are shown in Figure 4-19 for convenience, and determined in IED's 50706 and 50601.

4.2.2.5 The locations for mounting TV cameras and 16 mm movie cameras in the docking module are shown in Figure 4-20. The docking module interior floodlight provisions are shown in Figure 4-21.

4.3 APOLLO INERTIAL MASS AND STIFFNESS PROPERTIES

4.3.1 The nominal mass values of the Apollo spacecraft at the time of docking are:

| | <u>kg-sec²/m</u> |
|------------------|-----------------------------|
| Command module | 605 |
| Service module | 640 |
| Docking module | 205 |
| | <hr/> |
| Total spacecraft | 1450 |

4.3.2 The Apollo central and centrifugal moments of inertia at docking are given in IED 50401.

The distribution of mass along the length of the Apollo spacecraft is given in IED 50401 together with the distribution of flexural, torsional, shear, and longitudinal stiffness. The distribution of moments of inertia is given along the linear axis.

4.4 FLIGHT CERTIFICATION OF THE APOLLO DOCKING MODULE COMPATIBLE AND INTERACTIVE SYSTEMS.

4.4.1 DYNAMIC CONDITIONS:

- 4.4.1.1 Acceleration (steady state)
- in the direction of X axis at 4.9g.
 - in the direction of Y and Z axes at 0.1g.
- 4.4.1.2 Sinusoidal Vibration
- 5-35 Hz at 0.4g peak.
- 4.4.1.3 Random Vibration
- 20 - 200 Hz at +6dB/octave
 - 200 - 450 Hz at $0.03 \text{ g}^2/\text{Hz}$
 - 450 - 2000 Hz at -3dB/octave
- Vibration duration is 60 seconds in each of three mutually perpendicular axes.
- 4.4.1.4 Shock:
- Shock response spectra based on an analysis using $Q = 10$ and one-sixth-octave center frequencies.
- (1) DM primary structure within 304.8mm of the SLA truss-to-DM interface:
- 100 - 1000 Hz at +9dB/octave
 - 1000 - 6000 Hz at 1000g peak
 - 6000 - 10000 Hz at -6dB/octave
- (2) DM primary structure between 304.8mm and 1270.0mm from the SLA truss-to-DM interface:
- 100 - 1000 Hz at +9dB/octave
 - 1000 - 6000 Hz at 500g peak
 - 6000 - 10000 Hz at -6dB/octave
- (3) DM primary structure greater than 1270.0mm from the SLA truss-to-DM interface.
- 100 - 1000 Hz at +9dB/octave
 - 1000 - 6000 Hz at 100g peak
 - 6000 - 10000 Hz at -6dB/octave

4.4.1.5 Acoustics

| 1/3 Octave Band Center Frequency Hz | DM External Noise Spectra (1/3 Octave Band Sound Pressure Level-- dB re 20 μ N/M ²) | |
|---|---|--------------------------|
| | Lift-Off t - 0 Seconds | Mach 1 t = 60 seconds |
| 20 | 114 | 105 |
| 25 | 117 | 112 |
| 31.5 | 120 | 114 |
| 40 | 126 | 116 |
| 50 | 128 | 116 |
| 63 | 130 | 117 |
| 80 | 133 | 117 |
| 100 | 135 | 118 |
| 125 | 134 | 118 |
| 160 | 132 | 118 |
| 200 | 130 | 120 |
| 250 | 129 | 121 |
| 315 | 127 | 121 |
| 400 | 124 | 122 |
| 500 | 122 | 119 |
| 630 | 121 | 119 |
| 800 | 120 | 118 |
| 1000 | 117 | 113 |
| 1250 | 116 | 110 |
| 1600 | 114 | 109 |
| 2000 | 112 | 109 |
| 2500 | 108 | 108 |
| 3150 | 106 | 107 |
| 4000 | 104 | 105 |
| 5000 | 102 | 104 |
| Overall | 141 | 129 |

4.4.2 Apollo joint flight environmental envelope

4.4.2.1 The range of environmental conditions for the docking module is given IED 50702.

4.4.2.2 The range of environmental conditions for the command module is given in IED 50701.

4.5 COMMAND MODULE AND DOCKING MODULE LIGHTING

4.5.1 Command Module Lighting

Lighting in the command module is provided by six fluorescent light assemblies, located as shown in Figure 4-11. Each assembly contains two lamps, each rated at 600 lumens. The three types of assemblies for sidewall lights, couch lights and couch strut lights are shown in Figures 4-22, 4-23, and 4-24, respectively.

The lighting controls for the six light assemblies are located on three different control panels. The right hand sidewall and couch light controls are located on the right side of the cabin on Panel 5 (Figure 4-14, Sheet 5). The left-hand sidewall and couch light controls are located on the left side of the cabin on Panel 8 (Figure 4-14, Sheet 6). The controls for both strut lights are located on the left side of the cabin in Panel 100 (Figure 4-14, Sheet 8).

Each light control consists of two toggle switches and a rotory rheostat. One toggle switch selects which of the two lamps (no. 1 or no. 2) in each assembly is to be connected to the rheostat. The second toggle switch acts as an "ON-OFF" switch for the

other lamp. The rheostat provides a continuous intensity control for the lamp selected for dimming.

The command module cabin illumination may be varied from zero to 430 lux. With the one lamp on full brightness in each of the six light assemblies the illumination in the command module cabin is 215 lux (20 foot-candles) at the main display and control panel. With both lamps on full brightness in all six light assemblies the illumination is 430 lux.

The chromaticity value of the command module lamps is $X=0.365$ to 0.425 and $Y=0.365$ to 0.400 on the CIE diagram. The color temperature is 4800K to 5100K. The spectral distribution of the light is shown in Figure 4-25.

4.5.2 Docking Module Lighting

Lighting in the docking module is provided by three fluorescent light assemblies located as shown in Figure 4-21. The docking module light assemblies are the same as those used for the command module strut lights, shown in Figure 4-24.

The lighting control for the three docking module lights is located on Panel 815 (Figure 4-19, Sheet 2). The control consists of two toggle switches. Each toggle switch controls one lamp in all three light assemblies. Toggle switch no. 1 turns on lamp no. 1 in all three assemblies and switch no. 2

turns on lamp no. 2 in all three assemblies. There is no continuous intensity dimming control.

With one lamp on in all three assemblies the illumination in the docking module will range from 32 to 75 lux (3 to 7 foot-candles), depending upon position. With both lamps on in all three light assemblies the illumination will range from 75 to 105 lux (7 to 10 foot-candles).

The chromaticity, color temperature and spectral distribution are the same as for the command module, described in paragraph 4.5.1.

4.5.3 Apollo Portable Light

The dimensions, weight, and other physical characteristics of the Apollo portable light are shown in Figure 4-26. The chromaticity, color temperature, and spectral distribution of the Apollo portable light are approximately the same as for the command module lights, described in paragraph 4.5.1.

4.6 CSM AND DM VENTING CHARACTERISTICS

The gases and liquids vented from the CSM and CM while docked with the Soyuz spacecraft are given in Table 4.1, together with the flow rates, durations, venting frequency, propulsive forces, and vent locations.

TABLE 4.1 CSM/DM NOMINAL VENTING CHARACTERISTICS WHILE DOCKED WITH SOYUZ

| <u>SYSTEM</u> | <u>VENT PURPOSE</u> | <u>MATERIAL VENTED</u> | <u>PROPULSIVE FORCE, NEWTON</u> | <u>FLOW RATE, KG/SEC</u> | <u>DURATION</u> | <u>FREQUENCY</u> | <u>VENT NAME</u> | <u>VENT LOCATION</u> |
|---------------|--|------------------------|---------------------------------|--------------------------------------|-------------------------|------------------|---------------------|--|
| CSM | CABIN LEAKAGE | CABIN GAS | | 5.04×10^{-6} | CONTINUOUS | | | |
| CSM | FECAL ODOR REMOVAL | CABIN GAS | 0.0485 | 1.008×10^{-4} at 259mmHg | 30 SEC. | 3/DAY | URINE DUMP NOZZLE * | X _{A6} =26065.5MM Y _{A6} =-1454.2MM Z _{A6} =-1165.0MM |
| CSM | CABIN OXYGEN ENRICHMENT TO OFFSET N ₂ BUILDUP FROM EXPERIMENT | CABIN GAS | 0.0485 | 1.008×10^{-4} at 259mmHg | TBD | TBD | URINE DUMP NOZZLE * | |
| CSM | URINE DUMP | URINE | 0.0859 | 7.56×10^{-3} | APPROX. 80 SEC. | APPROX. 9/DAY | URINE DUMP NOZZLE * | |
| CSM | URINE FLUSHING | H ₂ O | 9.34×10^{-3} | 5.0×10^{-3} | 10 SEC PER DUMP | APPROX. 9/DAY | URINE DUMP NOZZLE * | |
| CSM | URINE NOZZLE DRYING | CABIN GAS | 0.0485 | 1.008×10^{-4} | 2 to 5 MINUTES PER DUMP | APPROX. 9/DAY | URINE DUMP NOZZLE * | |
| CSM | POTABLE AND WASTE WATER BLEED | O ₂ | 7.76×10^{-5} | 4.03×10^{-6} | CONTINUOUS | | URINE DUMP NOZZLE * | |
| CSM | EVAPORATIVE COOLING | H ₂ O | 0.0476 | 6.30×10^{-5} | APPROX. 1/2 OF ORBIT | EACH ORBIT | CM STEAM DUCT * | X _{A6} =26118.7MM Y _{A6} =-1621.4MM Z _{A6} =-847.1MM |

* DIRECTED 57.5° TO +X₆ AXIS

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ASTP 40001.1

TABLE 4.1 CSM/DM NOMINAL VENTING CHARACTERISTICS WHILE DOCKED WITH SOYUZ (CONT)

| SYSTEM | VENT PURPOSE | MATERIAL VENTIED | PROPULSIVE FORCE, NEWTON | FLOW RATE, KG/SEC | DURATION | FREQUENCY | VENT NAME | VENT LOCATION |
|---------------------------|---|-----------------------------------|--------------------------|--|--|--------------------------------------|-------------------------------------|--|
| CSM | WASTE WATER DUMP | H ₂ O | 0.512 | 0.0208 | 10 to 15 MINUTES | ONCE PER DAY | WASTE WATER DUMP * NOZZLE * | X _{A6} =26,053.3MM Y _{A6} =1234.4MM Z _{A6} =1397.0MM |
| CSM (3 FUEL CELLS) | PURGE | O ₂ | 0.0445 FOR EACH CELL | 7.56X10 ⁻⁵ FOR EACH CELL | 120 SEC. EACH CELL | TWICE FOR EACH CELL | FUEL CELL O ₂ PURGE VENT | X _{A6} =24,244.0MM Y _{A6} =-1511.3MM Z _{A6} =1244.6MM |
| CSM (3 FUEL CELLS) | PURGE | H ₂ + H ₂ O | 0.325 FOR EACH CELL | H ₂ :8.82X10 ⁻⁵ H ₂ O:0.64X10 ⁻⁵ FOR EACH CELL | 80 SEC. EACH CELL | ONCE FOR EACH CELL | FUEL CELL H ₂ PURGE VENT | X _{A6} =25,476.2MM Y _{A6} =1676.4MM Z _{A6} =-1005.8MM |
| DM | TUNNEL 2 VENT | CABIN GAS | NON-PROPULSIVE VENT | 3.0X10 ⁻³ at 550 mmHg | 84 SEC (66 to 96) 15 MINUTES (12 to 20) | 1,2,3 CREW TRANSFERS 4TH TRANSFER | DM VENT | X _{A6} =29253.6MM Y _{A6} =-718.8MM Z _{A6} =0 |
| DM | O ₂ PURGE RELIEF | CABIN GAS | NON-PROPULSIVE VENT | 5.0X10 ⁻³ at 479 mmHg | 5.8 MINUTES (3.8 - 7.8) | EACH CREW TRANSFER | DM VENT | |
| DM | LOW PRESSURE DUMP | CABIN GAS | NON-PROPULSIVE VENT | 5.0X10 ⁻³ at 479 mmHg | 5.2 MINUTES (5 to 6) | EACH CREW TRANSFER | DM VENT | |
| SM EXPERIMENT (MA-048) | PURGE SENSORS AND REPLACE GAS | 10% CH ₄ , 90% A | NEGLIGIBLE | 10 cc/MIN | CONSTANT | | MA-048 VENT | X _{A6} =22333.0MM Y _{A6} =-1003.3MM Z _{A6} =-1676.4MM |
| DM EXPERIMENT | EVACUATION OF FURNACE | CABIN GAS | TBD | TBD | TBD | ONCE EACH EXPERIMENT | FURNACE EXPERIMENT VENT | X _{A6} =29,255.4MM Y _{A6} =-502.9MM Z _{A6} =-502.9MM |
| SMRCS | SEE IED 50006, IED 50401 AND USA WG1-010. | | | | | | | |

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Figure 4-25

CM/DM FLOOD LAMP SPECTRAL DISTRIBUTION
КМ/СМ СВЕТИЛЬНИКИ, СПЕКТРАЛЬНОЕ РАСПРЕДЕЛЕНИЕ
CEI CHROMATICITY: X=0,3950, Y=0,3767
ХРОМАТИЧНОСТЬ

ARBITRARY UNITS
ПРОИЗВОЛЬНЫЕ ЕДИНИЦЫ

100

50

0

400

500

600

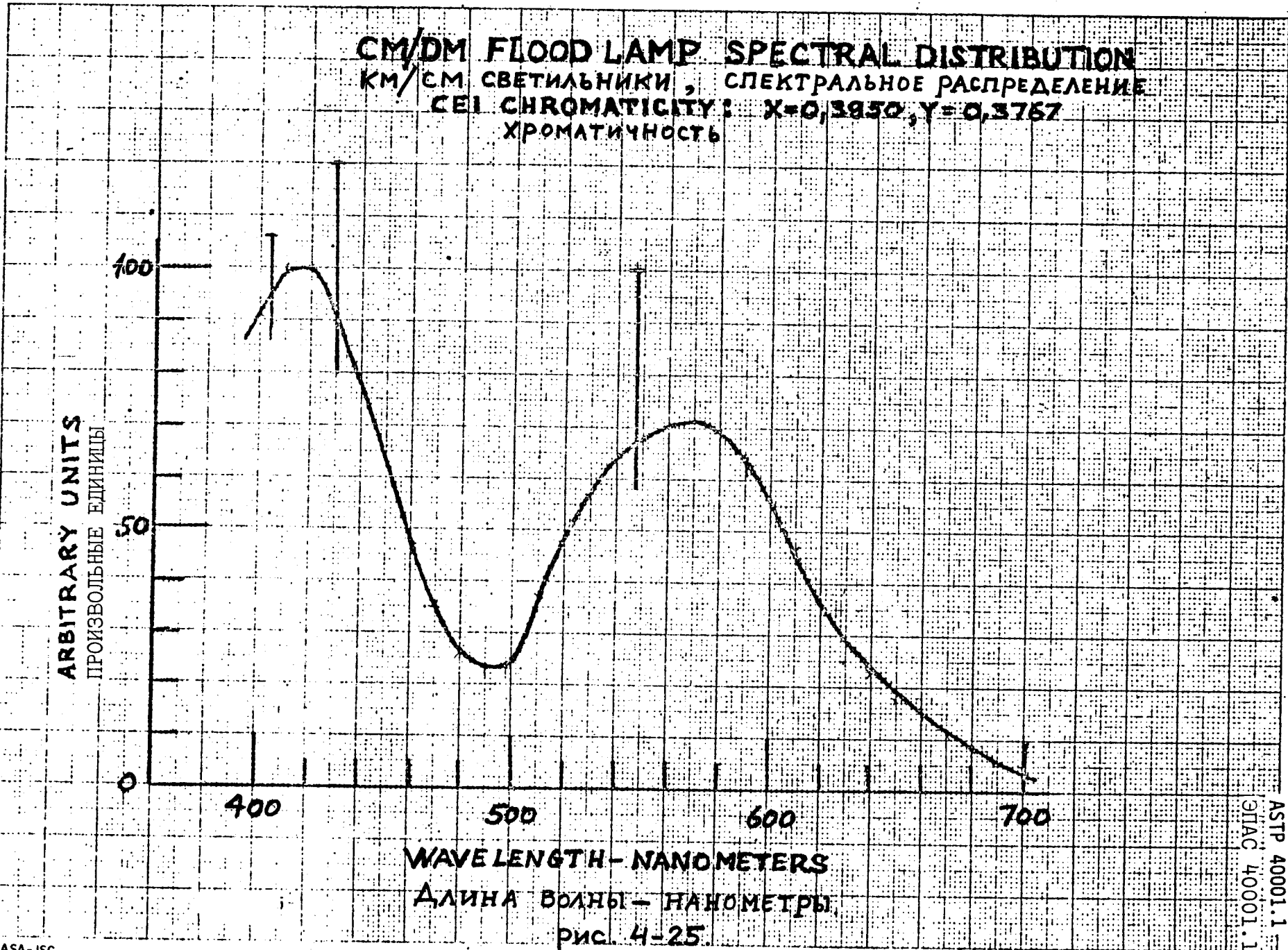
700

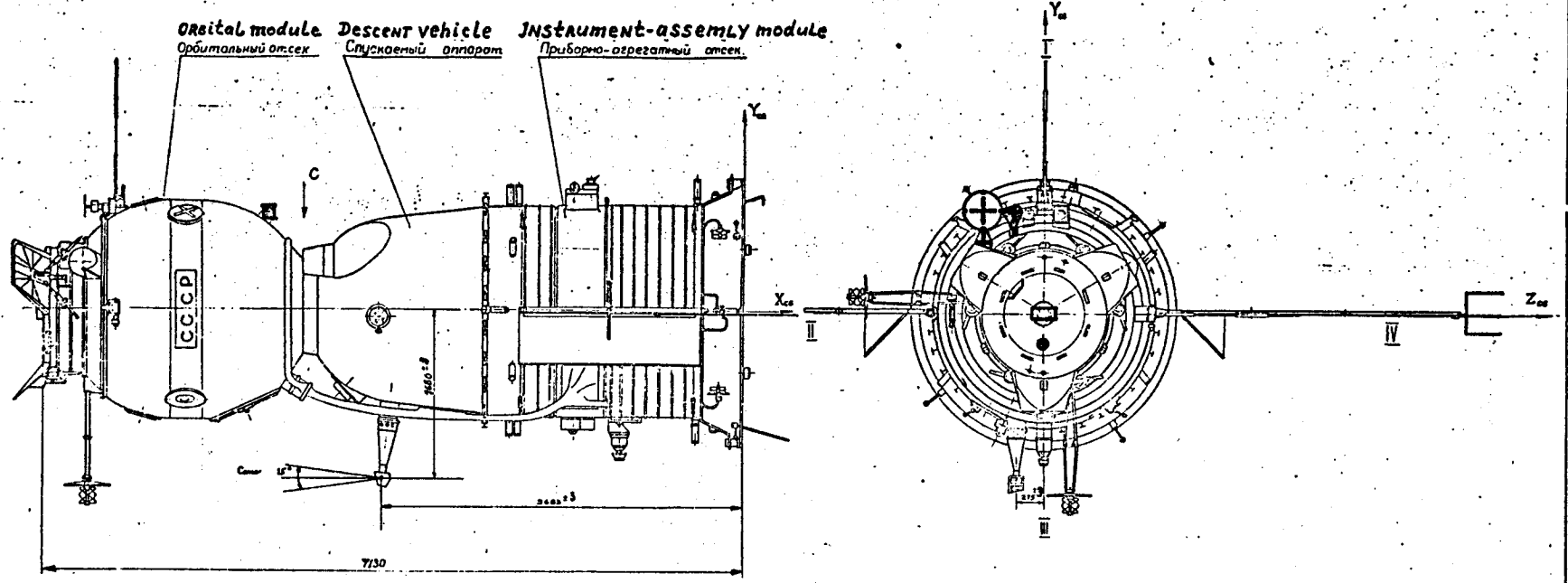
WAVELENGTH - NANOMETERS

ДЛИНА ВОЛНЫ - НАНОМЕТРЫ

рис. 4-25

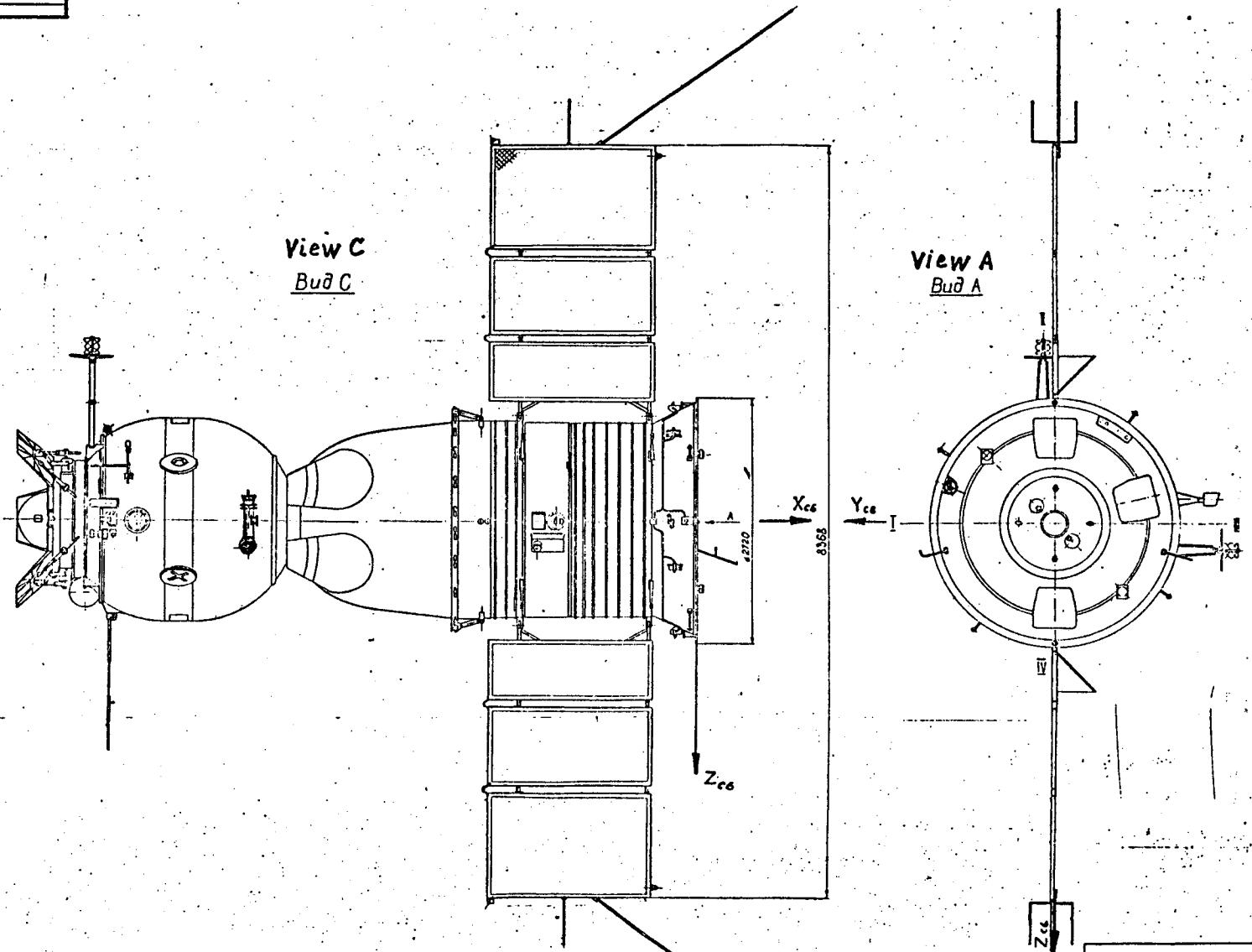
ASTP 40001.1
ЭТАС 40001.1





| | | | | | | |
|----------------------------------|--|--|--|-----|-----|------|
| GENERAL VIEW OF SOYUZ SPACECRAFT | | | | APR | MAY | JUNE |
| Общий вид КСЗС/ТА, СОЮЗ | | | | APR | MAY | JUNE |
| РИС. 3-1 | | | | | | |
| FIG. 3-1 | | | | | | |

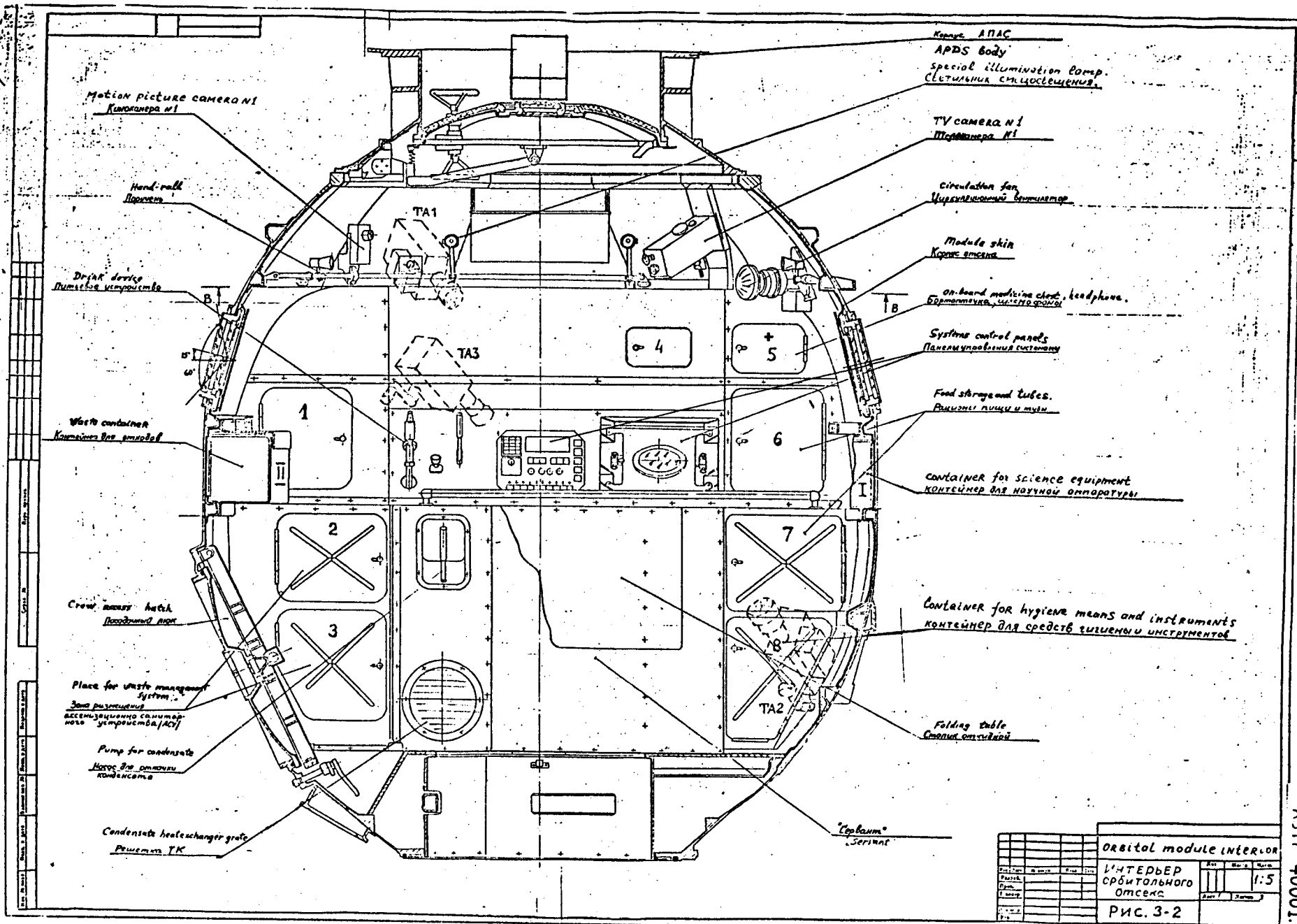
ЭТАС 40001.1
АСТР 40001.1



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|----------|---------|------|------|---|---|---|
| № докум. | Исполн. | Дата | Стр. | № | № | № |
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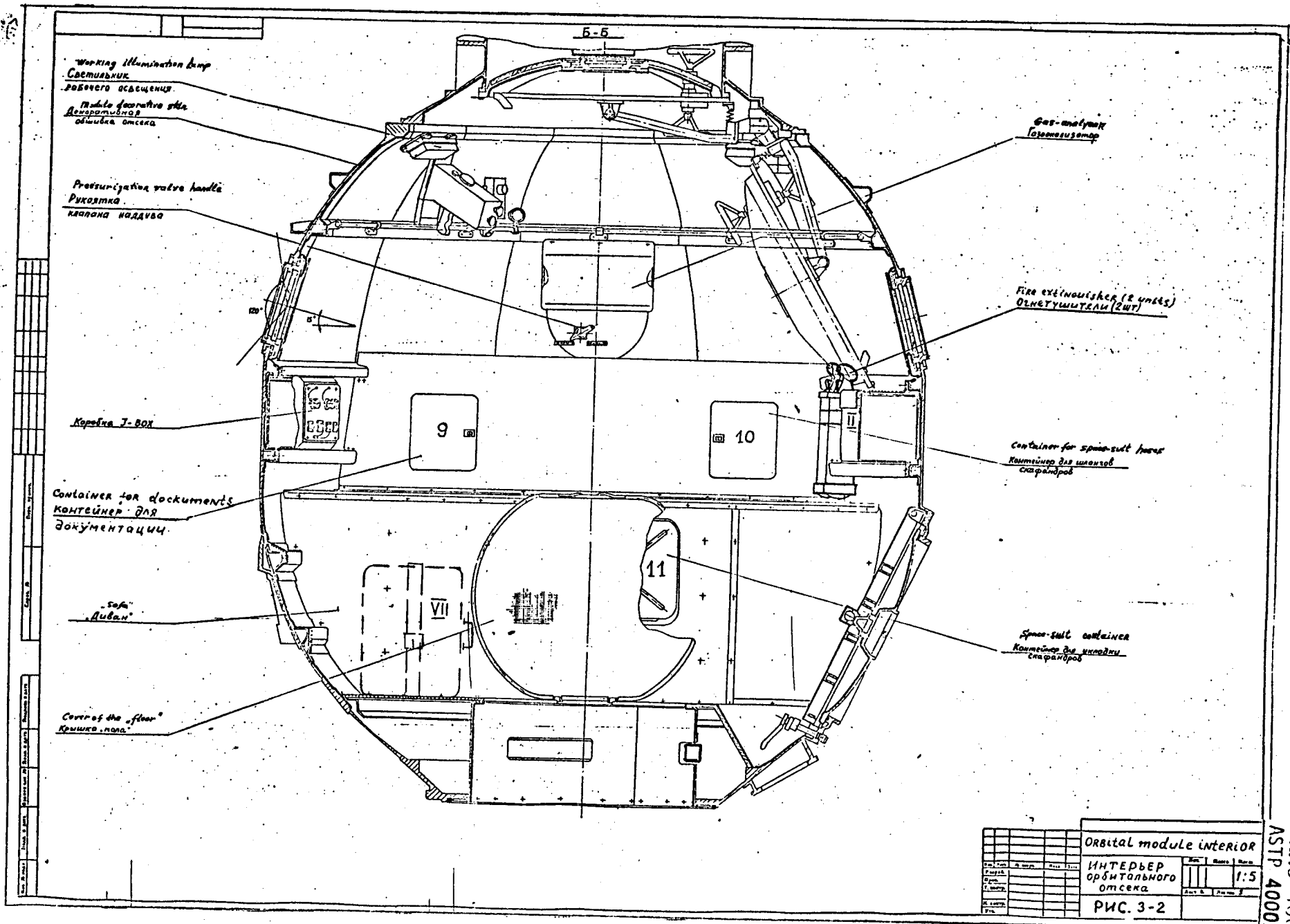
General view of Soyuz
spacecraft
Общий вид
космического корабля
Созюз
Рис. 3-1
Fig 3-1

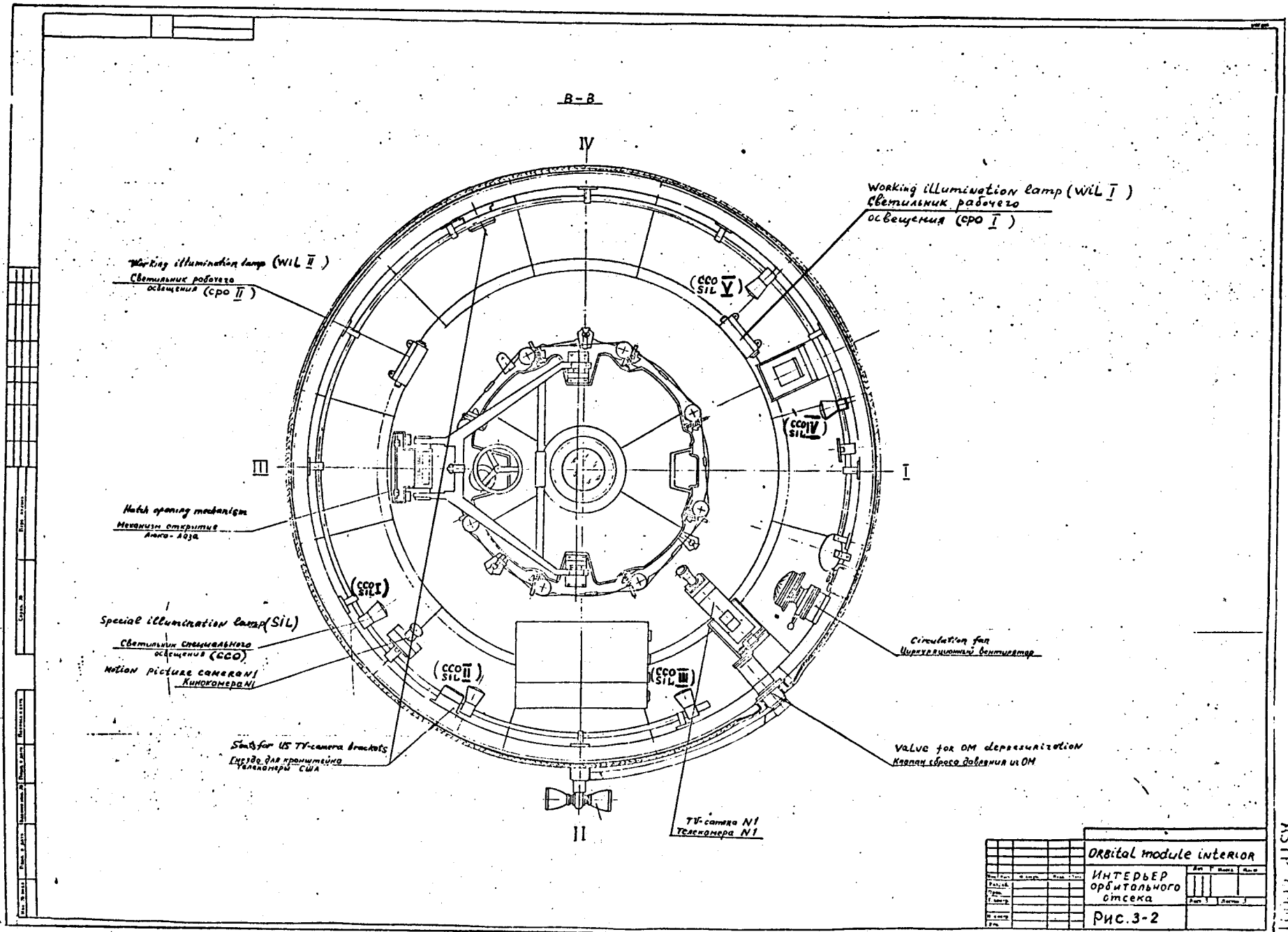
ГИАС 40001.1
ASTP 40001.1



| | |
|------------------------------|-----|
| ORBITAL MODULE INTERIOR | |
| ИНТЕРЬЕР ОРБИТАЛЬНОГО ОТСЕКА | |
| Scale | 1:5 |
| РИС. 3-2 | |

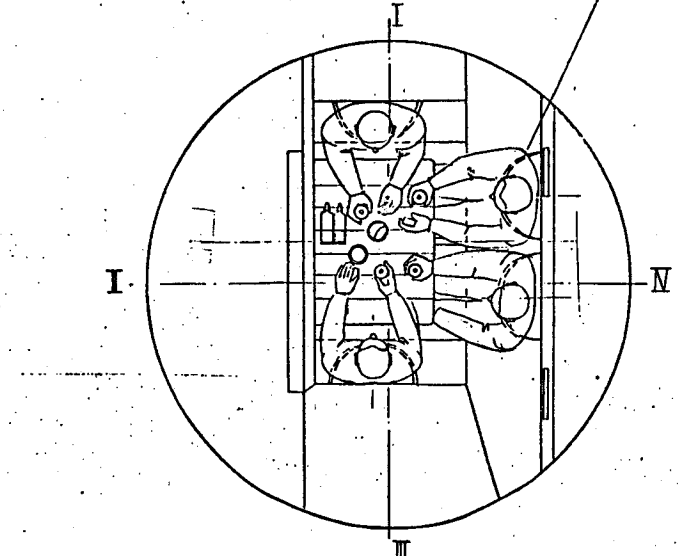
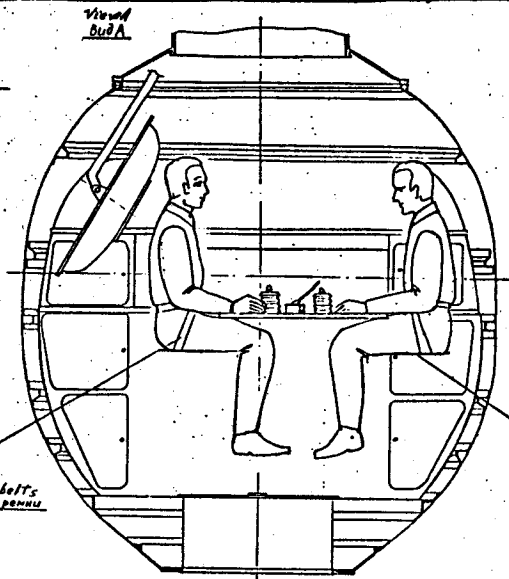
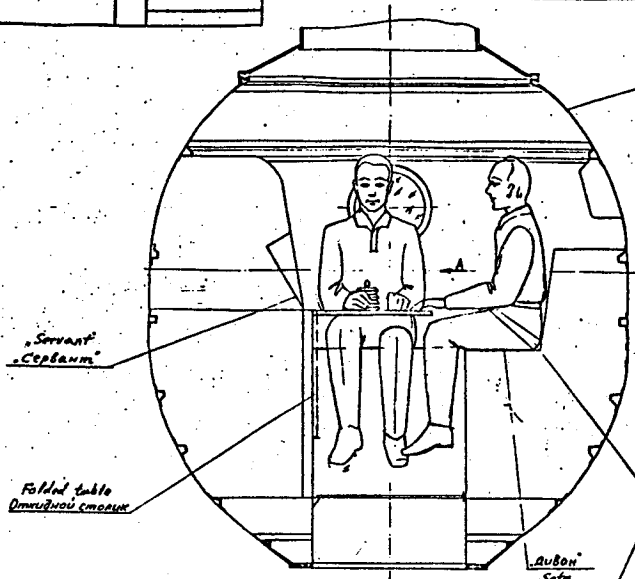
АПДС 40001.1
 АСП 40001





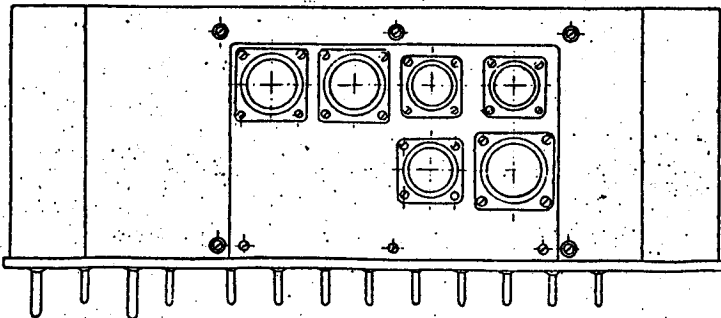
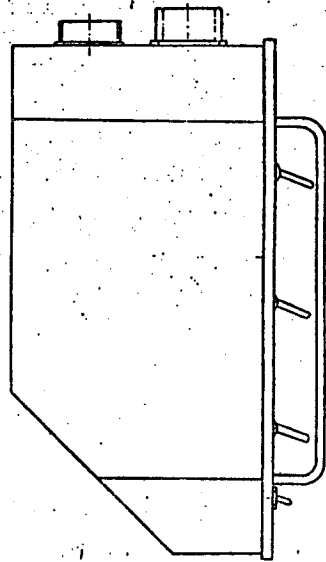
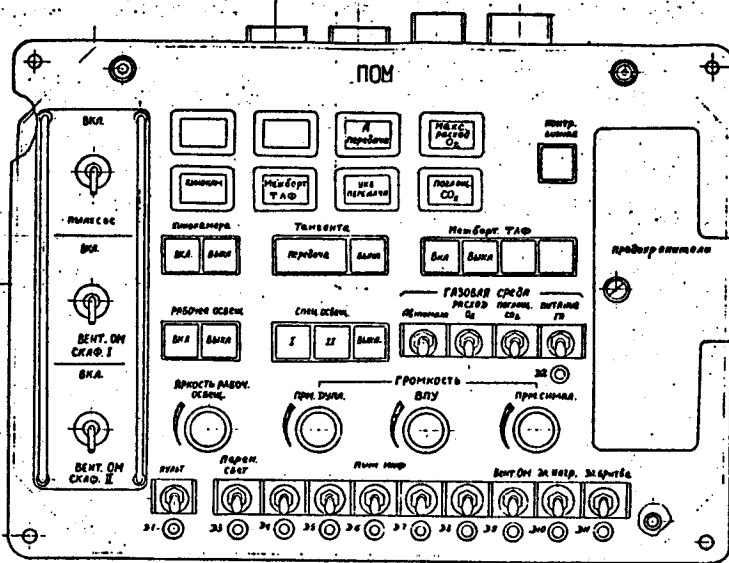
| | | | |
|-------------------------|-----|------------------------------|-----|
| Orbital module interior | | ИНТЕРЬЕР орбитального отсека | |
| Scale | 1:1 | Scale | 1:1 |
| Author | | Checked | |
| Date | | Approved | |
| Рис. 3-2 | | | |

ЭТАС 40001.1
АСТР 40001.1



| | | | | JOINT CREW LOCATION | | |
|--|-----|---------|-----|---------------------|---|------|
| № | Имя | Фамилия | Пол | № | № | № |
| 1 | | | | | | 1:10 |
| Схема размещения специального экипажа в ОМ | | | | № | № | |
| Рис. 3-6 | | | | | | |

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|----------|---------|------|------|------------------------------------|------|---------|
| | | | | General view of OM display console | | |
| | | | | Общий вид пульты OM | | |
| | | | | рис. 3-8 | | |
| № докум. | И. вып. | Дата | Стр. | № | Изм. | Исполн. |
| | | | | | | 1:1 |
| | | | | Авт. 1/1/1/1/1 | | |
| | | | | Ин. 1/1/1/1/1 | | |
| | | | | Про. 1/1/1/1/1 | | |

ЭТАС 40001.1
ASTP 40001.1

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portable lamp with independent power supply
Переносной светильник с автономным питанием

Cabin dynamic loudspeaker
Кабинный динамик

Working illumination lamp
Светильник рабочего освещения

VHF equipment control panel
Пульт управления радиостанцией УКВ

Helix cap steering wheel
Штурвал крышки люка-лаза

Helix cap
Крышка люка-лаза

Special illumination lamp
Светильник спецосвещения

Command-signal device
Командно-сигнальное устройство

TV-camera N3
Телекамера N3

Instrument panel
Приборная панель пульты

Block of engines
DPS jet housing

Sighting device
Визир-ориентатор

Seat leg
Стойка кресла

Instruments and assemblies
Приборы и агрегаты

Cosmonaut seat (cockpit)
Кресло космонавта

Illuminator
Иллюминатор

Control handle
Ручка управления

Instruments and assemblies
Приборы и агрегаты

| | | |
|-------------------------------|-----------|--|
| Descent vehicle interior | | |
| Интерьер спускаемого аппарата | Scale 1:5 | |
| рис. 3-10 | | |

ЭПАС 40301.1
АСТР 40001.1

Special illumination lamp
Светильник спецосвещения

Working illumination lamp
Светильник рабочего освещения

Special illumination lamp
Светильник спецосвещения

Notch cap steering wheel
Штурвал крышки люка-газа

Illuminator (window)
Иллюминатор

Special illumination lamp
Светильник спецосвещения

Command-signal device
Командно-сигнальное устройство

TV-camera N3
Телекамера N3

Instrument panel
Приборная панель пульта

Complex of landing means
Комплекс средств приземления

Working illumination lamp
Светильник рабочего освещения

Special illumination lamp
Светильник спецосвещения

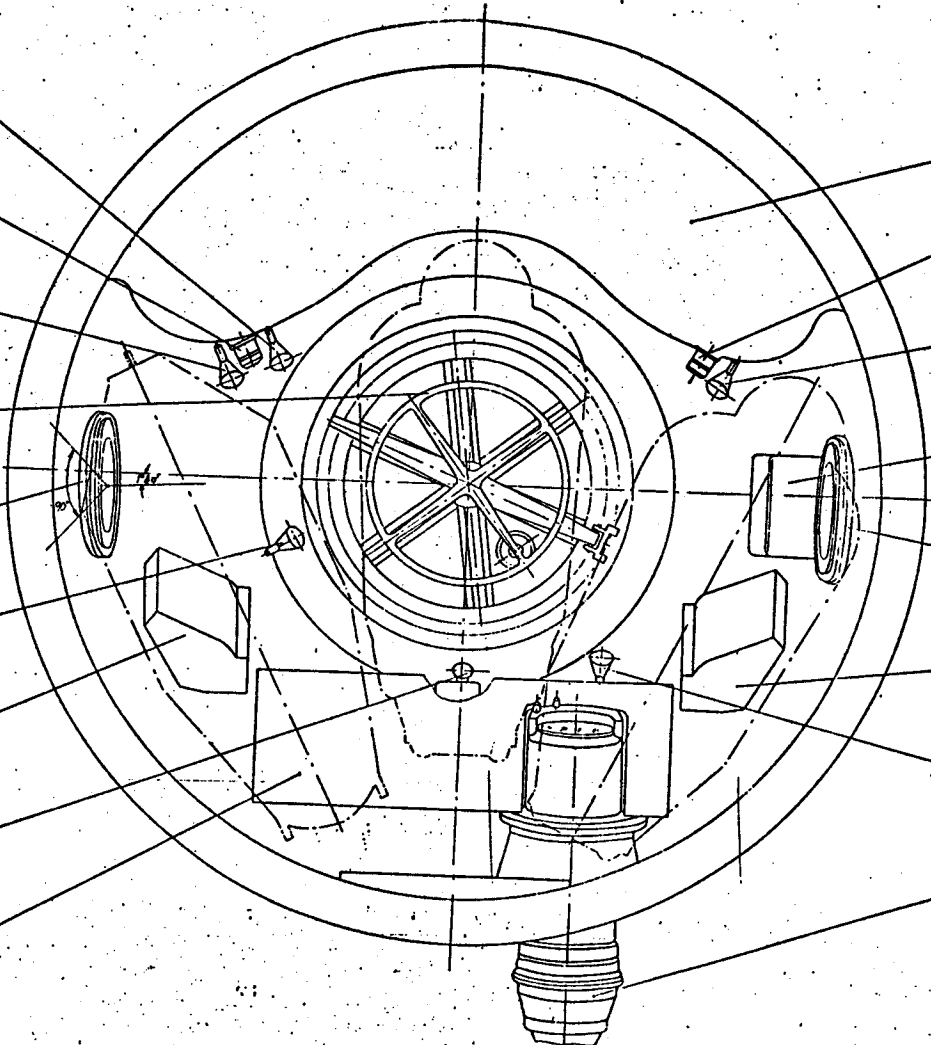
VHF-equipment control panel
Пульт управления радиостанцией УКВ

Illuminator (window)
Иллюминатор

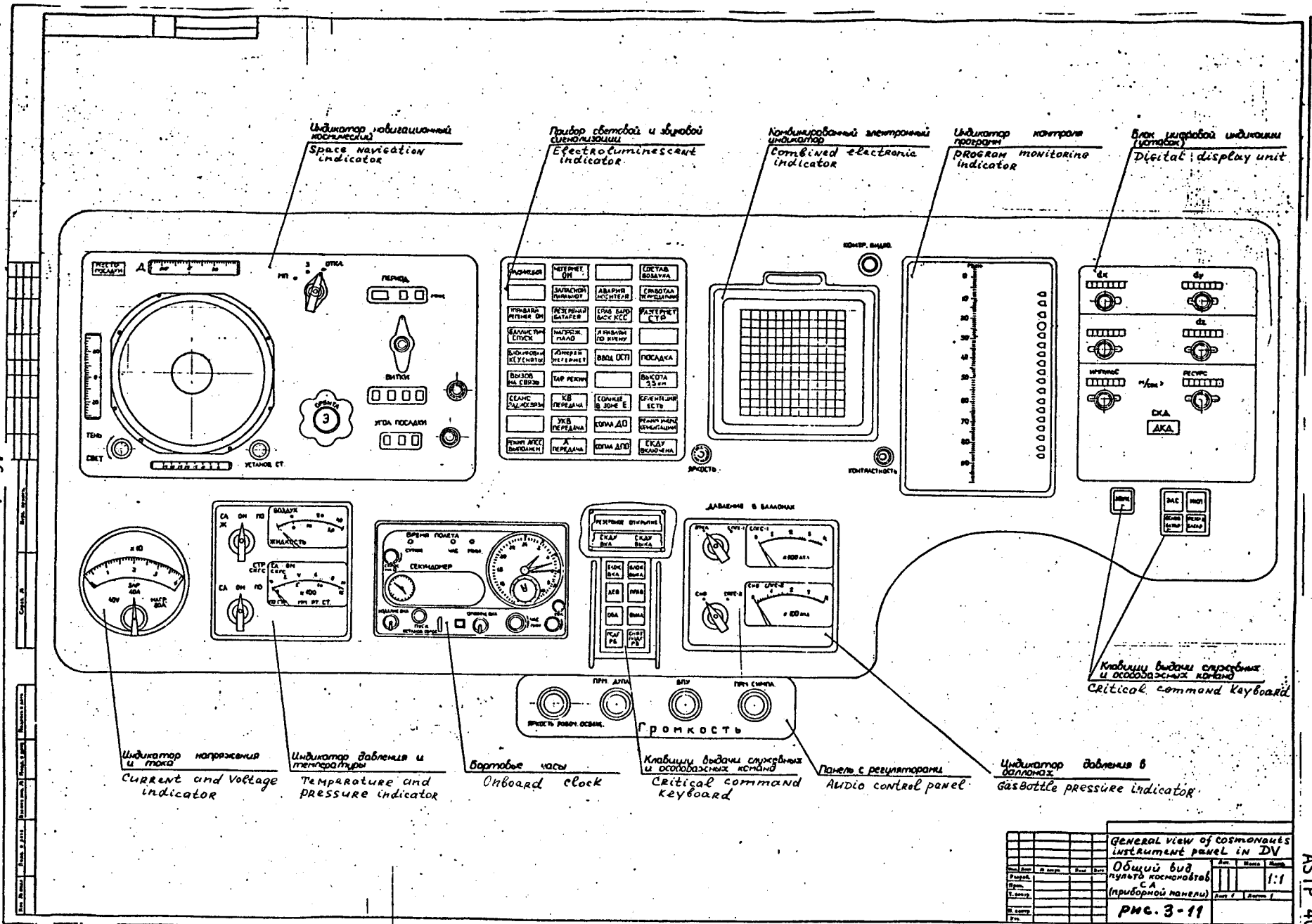
Command-signal device
Командно-сигнальное устройство

Special illumination lamp
Светильник спецосвещения

Sight-navigator
Визир-ориентатор



| | | | | | | |
|-------|--------|------|-----|-------------------------------|---------|-------|
| | | | | Descent vehicle interior | | |
| № п/п | № инв. | Дата | Вид | № | Масштаб | Листы |
| 1 | | | | | 1:5 | 1 |
| | | | | Интерьер спускаемого аппарата | | |
| | | | | Рис. 3-10 | | |



GENERAL VIEW OF COSMONAUTS INSTRUMENT PANEL IN DV
 Общий вид пульт космонавтов СА (приборной панели)
 Рис. 3-11