

**THE RUSSIAN FEDERATION  
MINISTRY OF TRANSPORT OF THE RUSSIAN FEDERATION  
FEDERAL AIR TRANSPORT AGENCY**

## **AIRWORTHINESS DIRECTIVE (AD)**

March 1, 2024

No.2024-FATA-02074(16-Д)-01

Applicability – PS-90A, PS-90A-76, PS-90A1 Type Engines

Design Organization Country – the Russian Federation

**The corrective actions described in the present AD are mandatory. No operator may operate an aircraft subject to this AD other than in accordance with the requirements of this AD.**

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Subsequent to the flight accident that occurred on 07.12.2023 with the Tu-204C aircraft (RA-64024) associated with the in-flight shutdown of the PS-90A engine No.3949042232031B1 to support continued airworthiness of the PS-90A, PS-90A-76, PS-90A1 engines in order to ensure flight safety of the Russian Federation civil aviation aircraft fleet and based on the Technical Decision of UEC-Aviadvigatel No.PW-0018-2024 dd 30.01.2024 (hereinafter – the Technical Decision)

### **IT IS HEREBY SUGGESTED THAT:**

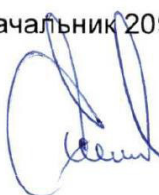
1. The operators of the PS-90A, PS-90A-76, PS-90A1 engines should perform an unscheduled inspection of all stages of the high pressure compressor of the engines specified in the Technical Decision and the accumulated operating time of which is greater than 4000 flight hours during the nearest scheduled periodic aircraft maintenance check.
2. The unscheduled inspection should be performed in accordance with the recommendations contained in the Technical Decision. The results of the works completed should be recorded in the inspection logs to be distributed to the engines design and manufacturing organizations.
3. The Airworthiness Directive (AD) should enter into force on 12.03.2024 and terminate upon fulfillment of the provisions of paragraphs 1-2 hereof.

Attachment: Technical Decision No.PW-0018-2024 dd 30.01.2024, 31 pages.

A.A. Dobryakov  
Deputy Director of Federal Air Transport Agency

**CONCURRED:**

Начальник 209 ВП МО РФ



В.Б. Мишенин

**APPROVED:**

Заместитель генерального  
конструктора - главный  
конструктор авиационных  
двигателей

А.В. Бусыгин

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Главный инженер

АО «ОДК-ПМ»



В.Т. Хайрулин

29.01.2024

## DECISION

**on Continued Airworthiness of the PS-90A, PS-90A-76, PS-90A1 Engines**

January 30, 2024

No. ПШ-0018-2024

Perm

3 pages

The flight accident with the PS-90A engine No.3949042232031B1 on the Tu-204C aircraft (RA-64024) occurred on 07.12.2023.

According to the Maintenance Manual, the routine inspection operations at all HPC stages are to be performed at the following engines:

- PS-90A and PS-90A1 – after 3 600 flight hours (then every 1 000 flights hours);
- PS-90A-76 – after 4 000 flights hours (then every 1 000 flights hours).

#### DECIDED:

An unscheduled inspection of all HPC stages is to be performed on the PS-90A, PS-90A-76, PS-90A1 engines in accordance with the list below (the operating time of which is greater than ~4 000 flight hours and the nearest scheduled maintenance check of which doesn't envisage any regular HPC inspections) on the following engine fleet in Russian airlines:

| Operator                                                               | Engine types | Engine number         | Operating time, hrs<br>TTSN /TSO, hrs |       |
|------------------------------------------------------------------------|--------------|-----------------------|---------------------------------------|-------|
|                                                                        |              |                       | TTSN                                  | TSO   |
| “Rossiya” Government Squadron<br>(Federal State Budgetary Institution) | PS-90A       | 3949044622072 Л1      | 4741                                  | -     |
|                                                                        |              | 3949042002011 Л2P5    | 22557                                 | 3973  |
|                                                                        |              | 3949044002031 B1P3    | 11537                                 | 5332  |
| Russian Post<br>(Federal State Unitary Enterprise)                     | PS-90A       | 3949041032009 B1P1/Л1 | 14291                                 | 4393  |
|                                                                        |              | 3949041922001 P1      | 14674                                 | 6972  |
|                                                                        |              | 3949042922004 P1      | 16059                                 | 9240  |
| Volga-Dnepr Airlines                                                   | PS-90A -76   | 3949854102049 P2      | 15307                                 | 4954  |
|                                                                        |              | 3949853922060 P1      | 10937                                 | 5562  |
|                                                                        |              | 3949854602007 Л1P3    | 22959                                 | 6656  |
|                                                                        |              | 3949853002024 B1P3    | 16600                                 | 7794  |
|                                                                        |              | 3949851102010 B1P2    | 14783                                 | 8292  |
|                                                                        |              | 3949852302019 B1/Л1P4 | 25923                                 | 10640 |
| Aviastar-TU Airlines                                                   | PS-90A       | 3949043202029 Л1P2B2  | 19988                                 | 6159  |
|                                                                        |              | 3949043201031 Л1P7B3  | 36986                                 | 6394  |

and oversees airlines:

| Operator                | Engine types | Engine number         | Operating time, hrs<br>TTSN /TSO, hrs |      |
|-------------------------|--------------|-----------------------|---------------------------------------|------|
|                         |              |                       | TTSN                                  | TSO  |
| Cubana de Aviacion S.A. | PS-90A       | 3949041722077J1P1     | 12602                                 | 5321 |
|                         |              | 3949042622055 P2      | 15376                                 | 5440 |
|                         |              | 3949044101057 P9      | 43839                                 | 6786 |
|                         |              | 3949041102003 B1/J2P6 | 43031                                 | 7314 |
|                         |              | 3949043202027 P2      | 10769                                 | 7500 |
|                         |              | 3949042522030 P1      | 14976                                 | 8250 |

The inspection may be combined with the nearest scheduled maintenance check.

The inspection is to be performed in accordance with the Engine Operation Manual:

PS-90A: 94-00-807P3 Section 072.30.00 Page 233 Task Card “Visual & Optical Inspection of PS-90A HPC Blades and Spacer Rings”;

PS-90A-76: 85-00-800P3 Section 072.30.00 Page 245 Task Card “Visual & Optical Inspection of PS-90A HPC Blades and Spacer Rings”.

|                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                         |                                                                                                   |                                                                                  |
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| to Maintenance Manual<br>No _____                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                       | TASK CARD                                                                                         | Pages<br>245...252e                                                              |
| Maintenance Manual Item<br>072.30.00B                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                   | Task Title<br>VISUAL & OPTICAL INSPECTION<br>OF HPC BLADES AND SPACER RINGS<br>(FIGURES 206, 207) | Manpower<br>6.0 MH.                                                              |
| Description of Operations and Technical Requirements                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                    |                                                                                                   | Works to be performed<br>in case of noncompliance with<br>Technical Requirements |
| <p>CAUTION.</p> <ol style="list-style-type: none"> <li>1 SAFETY MEASURES – 072.00.00, PAGE 203.</li> <li>2 GENERAL REQUIREMENTS TO INSTALLATION WORKS – 072.00.00, PAGE 413.</li> <li>3 PERFORM THE INSPECTION AT LEAST IN TWO HOURS AFTER ENGINE SHUTDOWN..</li> <li>4 IT IS PROHIBITED TO INSERT, RETRACT AND ADJUST THE ENDOSCOPE DURING THE ROTATION OF THE HPC ROTOR .</li> <li>5 ONLY EMPLOYEES WHO HAVE A PERMIT FOR OPTICAL INSPECTION WORKS AND WHO HAVE STUDIED SAFETY MEASURES ARE ALLOWED TO PERFORM INSPECTION WORKS .</li> <li>6 PERFORM THE WORKS IN THE FAN DUCT WITH A GROUP OF TWO-THREE PERSONS, ONE OF WHICH MUST ALWAYS STAY NEAR THE THRUST REVERSER CONTROL LEVER AND NOT ALLOW ITS OCCASIONAL MOVEMENT.</li> <li>7 FLAWS SIZE AND CHARACTERISTICS ARE DETERMINED BY THE INSPECTOR VISUALLY BASED ON THE EXPERIENCE.</li> <li>8 IT IS PROHIBITED TO ROTATE THE HPC ROTOR IF THE FUEL FILTERS ARE REMOVED FROM THE ENGINE .</li> </ol> <p>WARNING.</p> <ol style="list-style-type: none"> <li>1 INSTALL A BANNER PROHIBITING ENGINE STARTING AND CONNECTION OF THE GROUND HYDRAULIC PLANT TO THE ENGINE HYDRAULIC SYSTEM IN THE COCKPIT.</li> <li>2 SECURE THE THRUST REVERSER IN THE “FORWARD THRUST” POSITION (072.80.00, PAGE 209).</li> </ol> |                                                                                                   | Check                                                                            |

| Description of Operations and Technical Requirements                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                            |              |                |      |      | Works to be performed<br>in case of noncompliance with<br>Technical Requirements | Check       |      |      |      |  |              |                |   |     |  |            |        |   |     |                                           |  |
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| <p>1 Prepare a set of replaceable parts in accordance with Table 1.</p> <p>Table 1 – Kitting of Parts and Components</p> <table><tr><th>Pos.</th><th>Designation</th><th>Name</th><th>Q-ty</th><th>Note</th></tr><tr><td></td><td>H08-440-02-6</td><td>Locking washer</td><td>4</td><td>New</td></tr><tr><td></td><td>94-03-1392</td><td>Gasket</td><td>2</td><td>New</td></tr></table> <p>2 Install a handle or an electric drive for HPC rotor turning (072.00.00, Page 611 or 613).</p> <p>3 Install a fixture for the works in the fan duct 94-27-893 (072.70.00, Page 401) and prepare a portable light.</p> <p>4 Prepare an endoscope for operation using an optical instrument technical description.</p> <p>Note – In the process of operation wipe the surfaces of the optical elements of the endoscope with a clean cloth wetted with alcohol and wrung out.</p> <p>5 Inspect HPC 1<sup>st</sup> stage blades from the leading edge side:</p> <p>5.1 Remove panels “1-4” and “1-5” (072.70.00, Page 407).</p> <p>5.2 Set the IGV vanes in “0” position by IGV scales by simultaneous rotation of rollers with levers using two fixtures 93-19-811.</p> <p>5.3 Install the wrench 19-601 assembled with an adapter into the threaded hole of the inspection hatch plug 1 on the HPC IGV housing and screw it clockwise. Press the plug, sink it and turn it clockwise by 90°. Remove the plug from the engine .</p> <p>Notes - 1 The IGV plug is marked "HPC" on the end surface.</p> |              |                |      |      | Pos.                                                                             | Designation | Name | Q-ty | Note |  | H08-440-02-6 | Locking washer | 4 | New |  | 94-03-1392 | Gasket | 2 | New | Repair the locks<br>(072.70.00, Page 203) |  |
| Pos.                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                            | Designation  | Name           | Q-ty | Note |                                                                                  |             |      |      |      |  |              |                |   |     |  |            |        |   |     |                                           |  |
|                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                 | H08-440-02-6 | Locking washer | 4    | New  |                                                                                  |             |      |      |      |  |              |                |   |     |  |            |        |   |     |                                           |  |
|                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                 | 94-03-1392   | Gasket         | 2    | New  |                                                                                  |             |      |      |      |  |              |                |   |     |  |            |        |   |     |                                           |  |

| Description of Operations and Technical Requirements                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                         | Works to be performed<br>in case of noncompliance with<br>Technical Requirements | Check |
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| <p>2 During the inspection, turn the HPC rotor with an electric drive or a handle for turning the HPC rotor. Determine the completion of one revolution of the HPC rotor by the pulse counter on the remote control of the electric drive or visually mark the first blade to be checked.</p> <p>3 The number of blades in the 1<sup>st</sup> stage impeller – 34 pcs.</p> <p>5.4 Insert the endoscope in the hatch 1 between IGV vanes with the direction of view towards the nozzle . Inspect the HPC 1<sup>st</sup> stage blades from the leading edge side, vibration shrouds and vibration shroud joints.</p> <p><b>CAUTION. TAKE PRECAUTIONS DURING BLADES INSPECTION, ELIMINATING THE FAILURE OF THE ENDOSCOPE, INGESTION OF ITS PARTS AND FOREIGN OBJECTS IN THE ENGINE FLOWPATH..</b></p> <p>Blades damage acceptable for operation without rectification.</p> <p>a) The presence of a smooth bend of corner of the 1st stage blade profile from the leading edge side (Figure 206, Table 2):</p> <ul style="list-style-type: none"> <li>- the total number of blades with bend in the impeller – ten, maximum;</li> <li>- adjacent – three, maximum.</li> </ul> <p>b) The presence of nicks with the depth of 0.1 mm, maximum:</p> <ul style="list-style-type: none"> <li>- on the airfoil profile section (pressure side, suction side) and blade leading and trailing edges;</li> <li>- on vibration shrouds (for 1<sup>st</sup> and 2<sup>nd</sup> stage blades).</li> </ul> <p>c) The presence of leading and trailing edge damage – two nicks on each.<br/>In total on both edges – three nicks, maximum.</p> |                                                                                  |       |

| Description of Operations and Technical Requirements                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                 | Works to be performed<br>in case of noncompliance with<br>Technical Requirements      | Check |
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| <p>CAUTION. NOT ACCEPTABLE:</p> <ol style="list-style-type: none"> <li>1 SHARP EXTENDING EDGES OF NICKS. RECTIFY IN ACCORDANCE WITH INSTRUCTION 94-01-805H250.</li> <li>2 CRACKS IN THE LOCATIONS OF BENDS AND NICKS ON THE BLADE AIRFOIL SECTION AND EDGES. CRACKS PRESENCE CHECK - VISUAL .</li> <li>3 NICKS WITH BULGING METAL ON THE BACK SIDE OF THE BLADE.</li> <li>4 NICKS IN ONE CROSS SECTION OF THE AIRFOIL AT BLADE LEADING AND TRAILING EDGE.</li> <li>5 NICKS IN THE SECTIONS WITH THE DISTANCE BETWEEN THEM OF LESS THAN 10 MM.</li> <li>6 NICKS ON THE AIRFOIL TIP.</li> <li>7 TORN NICKS AND BENDS OF THE BLADE AIRFOIL SECTION .</li> <li>8 UNSHROUDING.</li> </ol> <p>5.5 Mark the blades with the damage acceptable for operation after rectification in accordance with Instruction 94-01-805H250.</p> <p>CAUTION. PRESENT THE BLADES DAMAGE BEYOND RECTIFICATION LIMITS TO THE ENGINE MANUFACTURER REPRESENTATIVE TO TAKE DECISION ON ENGINE FURTHER OPERATION OR REPAIR.</p> <p>5.6 Carefully retract the endoscope from the hatch.</p> <p>5.7 Put the plug in the inspection hatch 1. Press and sink it and turn it clockwise by 90°. Pull the plug all the way out. Make sure that the marks on the plug and the hatch body are aligned. Unscrew and remove the wrench from the plug.</p> <p>CAUTION. DEPRESSION OF THE END SURFACE OF THE PLUG RELATIVE TO THE SURFACES "P" AND "C" IS NOT ACCEPTABLE .</p> | <p>Eliminate HPC 1<sup>st</sup> stage blade unshrouding<br/>(072.30.00, Page 469)</p> |       |



| Description of Operations and Technical Requirements                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                     | Works to be performed in case of noncompliance with Technical Requirements | Check               |                    |                   |                   |                     |                   |                   |                     |                   |                   |                     |  |  |
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| <p>6 Inspect the HPC blades of the downstream stages and stage 3...12 spacer rings..</p> <p>Notes -</p> <ol style="list-style-type: none"> <li>1 The plug has a marking on the inner end surface corresponding to the stage number..</li> <li>2 Perform plug removal, blades inspection and plug installation back into its position successively for each stage..</li> <li>3 Number of blades in impellers: 1 stage – 34 pcs.</li> </ol> <table border="0" style="margin-left: 100px;"> <tr> <td>Stage 2 – 35 pcs.</td><td>Stage 6 – 75 pcs.</td><td>Stage 10 – 92 pcs.</td></tr> <tr> <td>Stage 3 – 39 pcs.</td><td>Stage 7 – 82 pcs.</td><td>Stage 11 – 101 pcs.</td></tr> <tr> <td>Stage 4 – 45 pcs.</td><td>Stage 8 – 91 pcs.</td><td>Stage 12 – 105 pcs.</td></tr> <tr> <td>Stage 5 – 67 pcs.</td><td>Stage 9 – 95 pcs.</td><td>Stage 13 – 103 pcs.</td></tr> </table> <p>6.1 Remove panels “2-3”, “2-4”, “3-3”, “3-4” (072.70.00, Page 407).</p> <p>6.2 Remove the plug from the inspection hatch of the respective stage:</p> <p>6.2.1 For inspection hatches at the 1<sup>st</sup> stage vane assembly 2 and 3<sup>rd</sup> stage vane assembly 3 – similar to Item 5.3.</p> <p>Notes – If hatches with threaded plugs are used on the case with HPC 1<sup>st</sup>, 2<sup>nd</sup> ad 3<sup>rd</sup> stage vanes, proceed as follows:</p> <ol style="list-style-type: none"> <li>1) Unlock the inspection hatch plug.</li> <li>2) Install the wrench 19-590 assembled with the adapter and torque wrench in the recess of the plug.</li> <li>3) Unscrew the plug, counterclockwise, and carefully remove from the engine.</li> </ol> <p>6.2.2 For inspection hatches at the 5...12<sup>th</sup> stage vane assemblies proceed as follows::</p> <ul style="list-style-type: none"> <li>- unlock the inspection hatch plug;</li> <li>- install the wrench 32-27-899 on the plug;</li> <li>- unscrew the plug, counterclockwise, and carefully remove from the engine.</li> </ul> | Stage 2 – 35 pcs.                                                          | Stage 6 – 75 pcs.   | Stage 10 – 92 pcs. | Stage 3 – 39 pcs. | Stage 7 – 82 pcs. | Stage 11 – 101 pcs. | Stage 4 – 45 pcs. | Stage 8 – 91 pcs. | Stage 12 – 105 pcs. | Stage 5 – 67 pcs. | Stage 9 – 95 pcs. | Stage 13 – 103 pcs. |  |  |
| Stage 2 – 35 pcs.                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                        | Stage 6 – 75 pcs.                                                          | Stage 10 – 92 pcs.  |                    |                   |                   |                     |                   |                   |                     |                   |                   |                     |  |  |
| Stage 3 – 39 pcs.                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                        | Stage 7 – 82 pcs.                                                          | Stage 11 – 101 pcs. |                    |                   |                   |                     |                   |                   |                     |                   |                   |                     |  |  |
| Stage 4 – 45 pcs.                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                        | Stage 8 – 91 pcs.                                                          | Stage 12 – 105 pcs. |                    |                   |                   |                     |                   |                   |                     |                   |                   |                     |  |  |
| Stage 5 – 67 pcs.                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                        | Stage 9 – 95 pcs.                                                          | Stage 13 – 103 pcs. |                    |                   |                   |                     |                   |                   |                     |                   |                   |                     |  |  |

| Description of Operations and Technical Requirements                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                      | Works to be performed<br>in case of noncompliance with<br>Technical Requirements | Check |
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| <p>6.3 Insert the endoscope in the hatch between the guide vanes with the direction of view towards the air intake and inspect the blades from the trailing edge side. Turn the endoscope 180 degrees and inspect the next stage blades from the leading edge side.</p> <p>Notes – 1 Inspect the blades similar as described in Items 5.4, 5.5 as relevant for each stage.</p> <p>2 Acceptable for operation without rectification are the blades with corner bends at the tip part of the blade with the size of 1x1 mm, max:</p> <ul style="list-style-type: none"> <li>- 1<sup>st</sup> stage blades from the trailing edge side;</li> <li>- 2...13<sup>th</sup> stage blades at the leading and trailing edges.</li> </ul> <p>6.4 The acceptable number of blades containing the damages specified in Items 5.4, 6.3 per the impeller:</p> <ul style="list-style-type: none"> <li>- Stages 1, 2 – 6 blades, max;</li> <li>- Stages 3, 4, 5 – 8 blades, max;</li> <li>- Stages 6, 7, 8 – 10 blades, max;</li> <li>- Stages 9...13 – 12 blades, max;.</li> </ul> <p>6.5 Inspect 3...12th stages spacer rings.</p> <p>CAUTION. MARKS OF VANES RUBBING AGAINST THE SPACER RINGS SURFACE AND A VISIBLE GAP BETWEEN THE SPACER RING AND THE IMPELLER DISK ARE NOT ACCEPTABLE.</p> <p>6.6 Carefully retract the endoscope from the hatch.</p> <p>6.7 Install the plug of the respective stage into the inspection hatch:</p> |                                                                                  |       |

| Description of Operations and Technical Requirements                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                       | Works to be performed<br>in case of noncompliance with<br>Technical Requirements | Check |
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| <p>6.7.1 For inspection hatches at the 1<sup>st</sup> stage vane assembly 2 and 3<sup>rd</sup> stage vane assembly 3 – similar to Item 5.7.</p> <p>Note – If hatches with threaded plugs are used on the case with HPC 1<sup>st</sup>, 2<sup>nd</sup> ad 3<sup>rd</sup> stage vanes, proceed as follows:</p> <ol style="list-style-type: none"> <li>1) Install the plug on the inspection hatch of the respective stage and screw it clockwise by hand.</li> <li>2) Tighten the plug with the wrench 19-590, the adapter and the torque wrench. The torque is 2.0...2.5 kgf·m.</li> <li>3) Lock the plug with wire – Type 44 (070.00.03, Page 1, Figure 18).</li> </ol> <p>6.7.2 For inspection hatches at the 5...12th stage vane assemblies proceed as follows:</p> <ol style="list-style-type: none"> <li>a) install the plug of the respective stage on the inspection hatch and screw it clockwise by hand;</li> <li>b) tighten the plug with the wrench 32-27-899, the adapter and the torque wrench. The torque is 2.0...2.5 kgf·m.</li> <li>c) lock with wire the following plugs:               <ul style="list-style-type: none"> <li>- inspection hatch plugs 4, 5, 6 – Type 44 (070.00.03, page 1, Figure 18);</li> <li>- inspection hatch plugs 7, 10 – Type 41 (070.00.03, page 1, Figure 15);</li> <li>- inspection hatch plugs 8, 9 - Type 42 (070.00.03, page 1, Figure 16).</li> </ul> </li> </ol> <p>7 Inspect the 13th stage blades from the trailing edge side:</p> <p>7.1 Unlock, unscrew and remove the bolts 12 (2 pcs.) used to secure the plug 11 of combustor diffuser hatch from the engine left or right side. Remove the plug with a gasket.</p> <p>7.2 Remove the gasket from the plug.</p> <p>7.3 Insert the endoscope in the hatch of combustor diffuser and install between the nozzle vanes with the direction of view towards the air intake. Inspect the 13<sup>th</sup> stage blades from the trailing edge side</p> |                                                                                  |       |

| Description of Operations and Technical Requirements                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                             | Works to be performed<br>in case of noncompliance with<br>Technical Requirements | Check |
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| <p>7.4 Carefully retract the endoscope from the hatch..</p> <p>8 Install the plug 11 on the combustor diffuser hatch::</p> <p>8.1 Install a new gasket in the plug 11 recess..</p> <p>8.2 Install the plug 11 on the combustor diffuser hatch and secure it with bolts 12 (2 pcs.) with new locking washers.</p> <p>8.3 Tighten the bolts 12 used to secure the plug 11. The torque is 0.8...1.3 kgf·m.</p> <p>8.4 Lock the bolts with new locking washers (070.00.03, Page 1).</p> <p>9 Install the removed panels “1-4”, “1-5”, “2-3”, “2-4”, “3-3” and “3-4” (072.70.00, Page 411).</p> <p>10 Remove the fixture for works in the fan duct 94–27–893 (072.70.00, Page 401).</p> <p>11 11Remove the handle or electric drive for HPC rotor turning from the engine accessory drive gearbox (72.00.00, Page 611 or 613).</p> <p style="text-align: center;">ВНИМАНИЕ. 1 UNLOCK THE THRUST REVERSER IN THE “FORWARD THRUST” POSITION (072.80.00, PAGE 209).<br/>2 TAKE AWAY THE BANNER PROHIBITING ENGINE STARTING AND CONNECTION OF THE GROUND HYDRAULIC PLANT TO THE ENGINE HYDRAULIC SYSTEM FROM THE COCKPIT.</p> <p>12 Make a record of the works performed in the engine log book.</p> <p>13 Generate an HPC blades inspection report (see Annex A) in three copies, forward one copy to both the engine design and engine manufacturing organizations.</p> |                                                                                  |       |

| Description of Operations and Technical Requirements                                                                                                                                                                                                                                                                                                                                                                                                                         |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                        | Works to be performed<br>in case of noncompliance with<br>Technical Requirements                                                                                                                                                                                                                                                                              | Check |
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| Instrumentation                                                                                                                                                                                                                                                                                                                                                                                                                                                              | Tools and fixtures                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                     | Consumables                                                                                                                                                                                                                                                                                                                                                   |       |
| <p>"OLYMPUS" IPLEX FX video endoscope including:</p> <ul style="list-style-type: none"> <li>- system unit IV8000-2, with the changeable working part IV8420 (diameter 4 mm, length 2000 mm) with adapters IV84-AT120D/FF and IV84-AT120S/FF</li> <li>- changeable working part IV8620 (diameter 6 mm, length 2000 mm) with adapters IV86-AT120D/FF and IV86-AT120S/FF</li> </ul> <p>It is allowed to use endoscopes that meet the technical requirements (see 070.00.07)</p> | <p>Socket wrench head 19-916<br/>S=10 (with internal square 10)<br/>Head for HPC plugs removal and installation S=10 32-27-899<br/>Box wrench 19-140 S=10x12<br/>Torque wrench M=0,3...1,5 kgf·m 84-27-827-01<br/>Torque wrench M=1,0...5,0 kgf·m 84-27-828<br/>Wrench for quick-release plugs removal 19-601(M8) S<sub>sq</sub>=10 (inner)<br/>Cutting pliers Type 1X2H8 TY39-26-003578 87514-2009<br/>Hammer 19-801<br/>Adapter 93-19-810<br/>Flat-nose pliers 7814-0266 И H6.X.6 GOST 5547-93<br/>IGV vanes turning device 19-593 – 2 pcs.<br/>Fixture for works in the fan duct 94-27-893<br/>Swivel handle 19-8028<br/>Portable light 93-27-844<br/>Rod 19-011(extension to the swivel handle 19-8028)<br/>Rod 19-8027 S<sub>sq</sub>=10 (inner)<br/>Caulking tool 84-19-022 (for plate lock locking)<br/>Wrench for plugs removal 19-590 S=8</p> | <p>Cloth with finished edges of 0.4 x 0.4 m made of cotton fabric<br/>GOST 29298-2005 - 2 pcs.<br/>Nefras – C50/170 GOST 8505-80 or Nefras – C2-80/120<br/>TU 38.401-67-108-92 - 0.5 l<br/>Lubricant CIATIM-221 (ЦИАТИМ-221) GOST 9433-80 - 0.1 kg<br/>Wire 0,8-TC-1-12X18H10T<br/>GOST 18143-72 - 1.5 m<br/>Ethyl alcohol<br/>GOST P 55878-2013 - 0.05 l</p> |       |

| Description of Operations and Technical Requirements                                                     |                                     | Works to be performed<br>in case of noncompliance with<br>Technical Requirements | Check |
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| Table 2 – Values of HPC 1 <sup>st</sup> stage blade airfoil section corner bend at the leading edge side |                                     |                                                                                  |       |
| Blade airfoil section corner bend value                                                                  |                                     |                                                                                  |       |
| Height from the tip, (H), mm                                                                             | Width from the leading edge (S), mm | Bend value, ( $\Delta$ ) mm                                                      |       |
| 25, max                                                                                                  | 8, max                              | 1,5, max                                                                         |       |

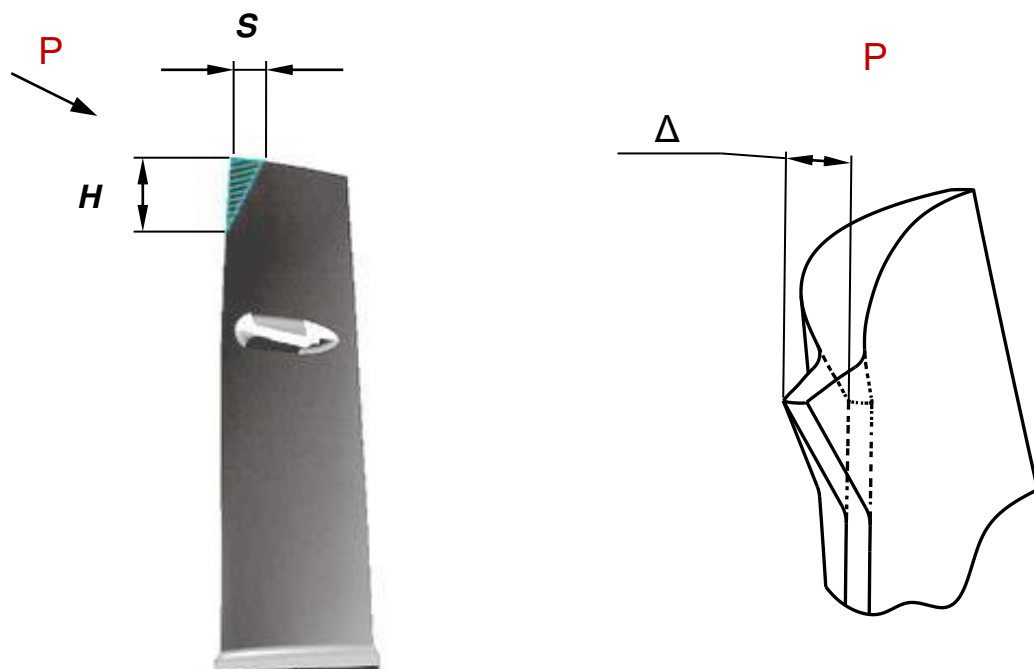


Figure 206 – Diagram of acceptable values of HPC 1<sup>st</sup> stage blade airfoil section corner bend at the leading edge side

| Description of Operations and Technical Requirements                                                                                                                         | Works to be performed in case of noncompliance with Technical Requirements | Check |
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| <div data-bbox="302 427 1989 863"></div> <p data-bbox="607 1193 1720 1230">Figure 207 – Diagram of HPC blades and spacer rings inspection hatches location (Part 1 of 3)</p> |                                                                            |       |

| Description of Operations and Technical Requirements                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                     | Works to be performed in case of noncompliance with Technical Requirements | Check |
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| <div data-bbox="533 331 1868 1161"> </div> <div data-bbox="398 1177 1995 1417"> <p>1 – Stage 1 blade inspection hatch, IGV case<br/> 2 – Stage 1 &amp; 2 blade inspection hatch – St.1 vane assembly<br/> 3 – Stage 3 &amp; 4 blade inspection hatch - St.3 vane assembly<br/> 4 – Stage 5 &amp; 6 blade inspection hatch - St.5 vane assembly<br/> 5 – Stage 6 &amp; 7 blade inspection hatch - St.6 vane assembly<br/> 6 – Stage 7 &amp; 8 blade inspection hatch - St.7 vane assembly<br/> 7 – Stage 9 &amp; 10 blade inspection hatch - St.9 vane assembly<br/> 8 – Stage 10&amp; 11 blade inspection hatch - St.10 vane assembly<br/> 9 – Stage 11 &amp; 12 blade inspection hatch - St.11 vane assembly<br/> 10 – Stage 12 &amp; 13 blade inspection hatch - St.12 vane assembly<br/> 11 – Combustor diffuser hatch plug<br/> 12 – bolt</p> </div> |                                                                            |       |
| Figure 207 – Diagram of HPC blades and spacer rings inspection hatches location (Part 2 of 3)                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                            |                                                                            |       |

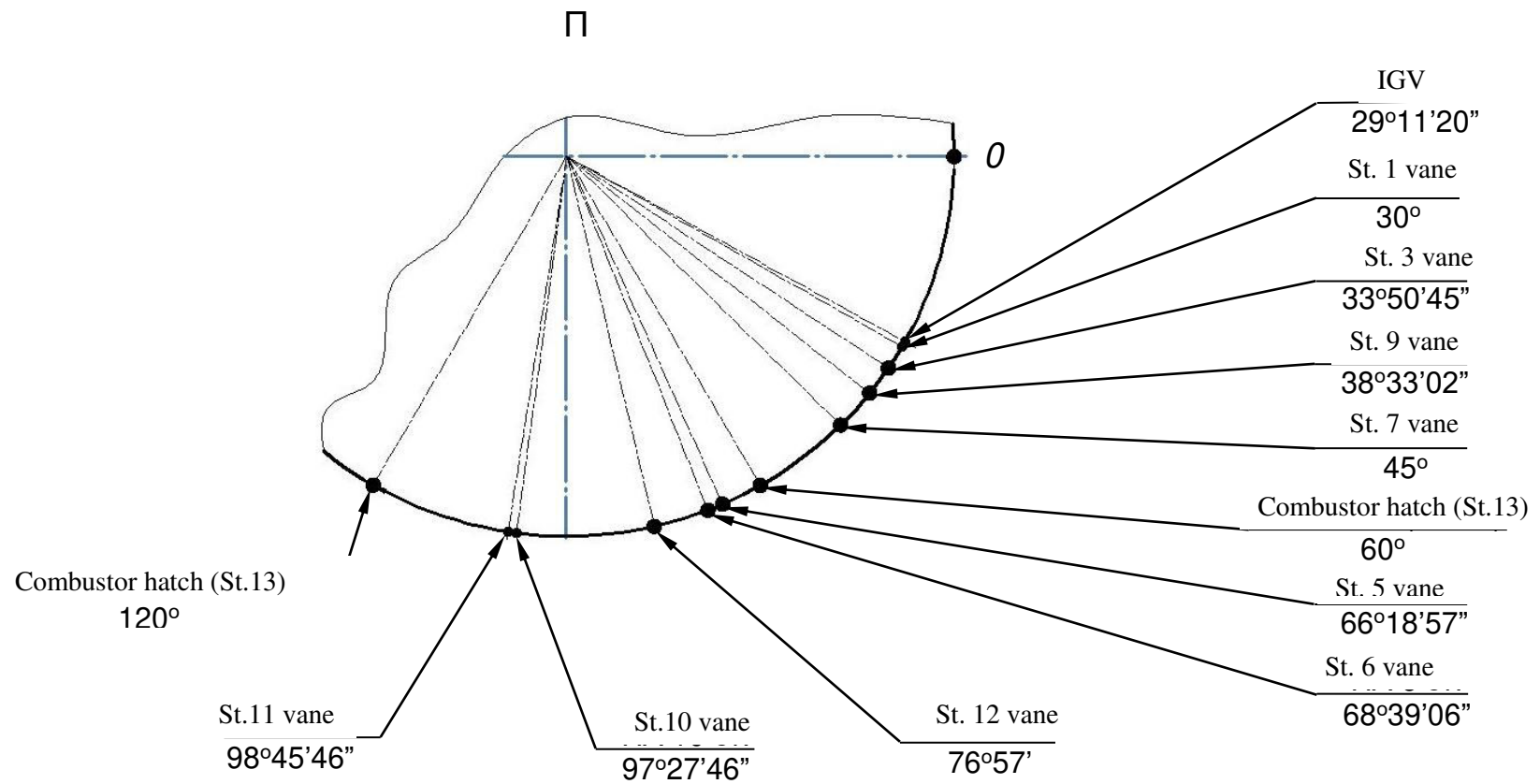


Figure 207 – Diagram of HPC blades and spacer rings inspection hatches location (Part 3 of 3)

| Description of Operations and Technical Requirements                        |                                                            |                                                             |                        |                                                                                                                                                               |                                      |                                                  |      |                                                      |                                          | Works to be performed<br>in case of noncompliance with<br>Technical Requirements |      |          | Check      |    |
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| <b>Annex A</b><br><b>(mandatory)</b><br><b>HPC Blades Inspection Report</b> |                                                            |                                                             |                        |                                                                                                                                                               |                                      |                                                  |      |                                                      |                                          |                                                                                  |      |          |            |    |
| Product – PS-90A Engine...                                                  |                                                            |                                                             |                        |                                                                                                                                                               |                                      |                                                  |      |                                                      |                                          |                                                                                  |      |          |            |    |
| Engine No.: ...                                                             |                                                            |                                                             |                        |                                                                                                                                                               |                                      |                                                  |      |                                                      |                                          |                                                                                  |      |          |            |    |
| TTSN (hours/ cycles): ...                                                   |                                                            |                                                             |                        |                                                                                                                                                               | TSO (hours/ cycles): ...             |                                                  |      |                                                      |                                          |                                                                                  |      |          |            |    |
| A/C model: ...                                                              |                                                            |                                                             | A/C number: ...        |                                                                                                                                                               |                                      | Powerplant number: ...                           |      |                                                      |                                          |                                                                                  |      |          |            |    |
| Work type (maintenance, post-flight inspection, etc.): ...                  |                                                            |                                                             |                        |                                                                                                                                                               |                                      |                                                  |      |                                                      |                                          |                                                                                  |      |          |            |    |
| Work completion date (DD. MM. Year): ...                                    |                                                            |                                                             |                        |                                                                                                                                                               |                                      |                                                  |      |                                                      |                                          |                                                                                  |      |          |            |    |
| Work performed by (Name): ...                                               |                                                            |                                                             |                        |                                                                                                                                                               |                                      |                                                  |      |                                                      |                                          |                                                                                  |      |          |            |    |
| Operator representative (Name): ...                                         |                                                            |                                                             |                        |                                                                                                                                                               |                                      |                                                  |      |                                                      |                                          |                                                                                  |      |          |            |    |
| <b>Table 3 – HPC Flowpath Inspection Results</b>                            |                                                            |                                                             |                        |                                                                                                                                                               |                                      |                                                  |      |                                                      |                                          |                                                                                  |      |          |            |    |
| Stage number                                                                | Total number<br>of blades<br>containing<br>damage,<br>pcs. | Total number<br>of blades<br>with<br>rectification,<br>pcs. | Damage description *   |                                                                                                                                                               |                                      |                                                  |      |                                                      |                                          |                                                                                  |      |          |            |    |
|                                                                             |                                                            |                                                             | Conventional blade No. | Type of damage,<br>(N – nick;<br>D – dent of the<br>airfoil section;<br>B – bend of<br>edge;<br>BC – bend of<br>corner) and<br>their quantity<br>on the blade | Size from<br>blade tip<br>(l),<br>mm | Damage size.<br>( $K_{max}$ , $L_{max}$ ),<br>mm |      | Depth of<br>dent on the<br>airfoil<br>section,<br>mm | Edge<br>bend size<br>( $\delta$ ),<br>mm | Corner bend size<br>( $H_{max}$ , $S_{max}$ , $\Delta$ )                         |      |          | Compliance |    |
|                                                                             |                                                            |                                                             |                        |                                                                                                                                                               |                                      | Kmax                                             | Lmax |                                                      |                                          | Hmax                                                                             | Smax | $\Delta$ | Specs      | NO |
|                                                                             |                                                            |                                                             |                        |                                                                                                                                                               |                                      |                                                  |      |                                                      |                                          |                                                                                  |      |          |            |    |
|                                                                             |                                                            |                                                             |                        |                                                                                                                                                               |                                      |                                                  |      |                                                      |                                          |                                                                                  |      |          |            |    |
|                                                                             |                                                            |                                                             |                        |                                                                                                                                                               |                                      |                                                  |      |                                                      |                                          |                                                                                  |      |          |            |    |

\* – Columns should be filled depending on the type of damage (nicks, dents on the airfoil section, edge bending or corner bending), indicating their number and quantity per one blade, and must be accompanied by photos or video records.

|                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                        |                                                                                                   |                                                                                  |       |
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| to Maintenance Manual<br>No. _____                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                     | TASK CARD                                                                                         | Pages<br>233...244a                                                              |       |
| Maintenance Manual Item<br>072.30.00B                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                  | Task Title<br>VISUAL & OPTICAL INSPECTION<br>OF HPC BLADES AND SPACER RINGS<br>(FIGURES 206, 207) | Manpower<br>6.0 MH.                                                              |       |
| Description of Operations and Technical Requirements                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                   |                                                                                                   | Works to be performed<br>in case of noncompliance with<br>Technical Requirements | Check |
| <p>WARNING. BEFORE YOU START THE WORKS, BE SURE TO FAMILIARIZE YOURSELF WITH THE SAFETY MEASURES, SECTION 072.00.00, PAGE 203.</p> <p>WARNING. PERFORM THE INSPECTION AT LEAST IN TWO HOURS AFTER ENGINE SHUTDOWN.</p> <p>WARNING. 1 DE-ENERGIZE THE AIRCRAFT ONBOARD ELECTRICITY SUPPLY SYSTEM.</p> <p>2 INSTALL A BANNER PROHIBITING ENGINE STARTING IN THE COCKPIT.</p> <p>3 SECURE THE THRUST REVERSER IN THE “FORWARD THRUST” POSITION (073.21.00, PAGE 203 OR 072.80.00, PAGE 209).</p> <p>CAUTION. 1 IT IS PROHIBITED TO INSERT, RETRACT AND ADJUST THE ENDOSCOPE DURING THE ROTATION OF THE HPC ROTOR.</p> <p>2 ONLY EMPLOYEES WHO HAVE A PERMIT FOR OPTICAL INSPECTION WORKS AND WHO HAVE STUDIED SAFETY MEASURES ARE ALLOWED TO PERFORM INSPECTION WORKS.</p> <p>3 FLAWS SIZE AND CHARACTERISTICS ARE DETERMINED BY THE INSPECTOR VISUALLY BASED ON THE EXPERIENCE.</p> <p>4 IT IS PROHIBITED TO ROTATE THE HPC ROTOR IF THE FUEL FILTERS ARE REMOVED FROM THE ENGINE.</p> <p>CAUTION. GENERAL REQUIREMENTS TO INSTALLATION WORKS – SECTION 072.00.00, PAGE 413.</p> <p>1 Prepare a set of replaceable parts in accordance with Table 1.</p> |                                                                                                   |                                                                                  |       |



| Description of Operations and Technical Requirements | Works to be performed<br>in case of noncompliance with<br>Technical Requirements | Check |
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Table 1 – Kitting of Parts and Components

| Pos. | Designation  | Name           | Q-ty | Note |
|------|--------------|----------------|------|------|
|      | H08-440-02-6 | Locking washer | 4    | New  |
|      | 94-03-1392   | Gasket         | 2    | New  |

- 2 Install a handle or an electric drive for HPC rotor turning (072.00.00, page 607 or 609).
- 3 Install a fixture for the works in the fan duct (072.70.00, page 209), put the mats on the inner surfaces of the front casing and TRU doors, prepare a portable light.
- 4 Prepare an endoscope for operation using an optical instrument technical description.  
 Note – In the process of operation wipe the surfaces of the optical elements of the endoscope with a clean cloth wetted with alcohol and wrung out.
- 5 Inspect HPC 1<sup>st</sup> stage blades from the leading edge side:
  - 5.1 Remove panels “1-4” and “1-5” (072.70.00, page 401).
  - 5.2 Set the IGV vanes in “0” position by IGV scales by simultaneous rotation of rollers with levers using two fixtures 93-19-811.
  - 5.3 Install the wrench 19-601 assembled with an adapter into the threaded hole of the inspection hatch plug 1 on the HPC IGV housing and screw it clockwise. Press the plug, sink it and turn it clockwise by 90°. Remove the plug from the engine.

Notes - 1 The IGV plug is marked "HPC" on the end surface.

2 During the inspection, turn the HPC rotor with an electric drive or a handle for turning the HPC rotor. Determine the completion of one revolution of the HPC rotor by the pulse counter on the remote control of the electric drive or visually mark the first blade to be checked.

3 The number of blades in the 1<sup>st</sup> stage impeller – 34 pcs.

Repair the locks  
(072.70.00, page 203)

| Description of Operations and Technical Requirements | Works to be performed<br>in case of noncompliance with<br>Technical Requirements | Check |
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5.4 Insert the endoscope in the hatch 1 between IGV vanes with the direction of view towards the nozzle .  
Inspect the HPC 1<sup>st</sup> stage blades from the leading edge side, vibration shrouds and vibration shroud joints.

CAUTION. TAKE PRECAUTIONS DURING BLADES INSPECTION, ELIMINATING THE FAILURE OF THE ENDOSCOPE, INGESTION OF ITS PARTS AND FOREIGN OBJECTS IN THE ENGINE FLOWPATH.

Blades damage acceptable for operation without rectification.

- a) The presence of a smooth bend of corner of the 1<sup>st</sup> stage blade airfoil section from the leading edge side (Figure 206, Table 2):
  - the total number of blades with bend in the impeller – ten, maximum;
  - adjacent – three, maximum.
- b) The presence of nicks with the depth of 0.1 mm, maximum:
  - on the airfoil profile section (pressure side, suction side) and blade leading and trailing edges;
  - on vibration shrouds (for 1<sup>st</sup> and 2<sup>nd</sup> stage blades).
- c) The presence of leading and trailing edge damage – two nicks on each.  
In total on both edges – three nicks, maximum.

CAUTION. NOT ACCEPTABLE:

- 1 SHARP EXTENDING EDGES OF NICKS. RECTIFY IN ACCORDANCE WITH INSTRUCTION 94-01-805И250.
- 2 CRACKS IN THE LOCATIONS OF BENDS AND NICKS ON THE BLADE AIRFOIL SECTION AND EDGES. CRACKS PRESENCE CHECK - VISUAL.
- 3 NICKS WITH BULGING METAL ON THE BACK SIDE OF THE BLADE.
- 4 NICKS IN ONE CROSS SECTION OF THE AIRFOIL AT BLADE LEADING AND TRAILING EDGE.
- 5 NICKS IN THE SECTIONS WITH THE DISTANCE BETWEEN THEM OF LESS THAN 10 MM.
- 6 NICKS ON THE AIRFOIL TIP.
- 7 TORN NICKS AND BENDS OF THE BLADE AIRFOIL SECTION.
- 8 UNSHROUDING

Eliminate HPC 1<sup>st</sup> stage  
blade unshrouding  
(072.30.00, page 449)

| Description of Operations and Technical Requirements                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                  | Works to be performed<br>in case of noncompliance with<br>Technical Requirements | Check               |                    |                   |                   |                     |                   |                   |                     |                   |                   |                     |  |  |
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| <p>5.5 Mark the blades with the damage acceptable for operation after rectification in accordance with Instruction 94-01-805И250.</p> <p>CAUTION. PRESENT THE BLADES DAMAGE BEYOND RECTIFICATION LIMITS TO THE ENGINE MANUFACTURER REPRESENTATIVE TO TAKE DECISION ON ENGINE FURTHER OPERATION OR REPAIR.</p> <p>5.6 Carefully retract the endoscope from the hatch.</p> <p>5.7 Put the plug in the inspection hatch 1. Press and sink it and turn it clockwise by 90°. Pull the plug all the way out. Make sure that the marks on the plug and the hatch body are aligned. Unscrew and remove the wrench from the plug.</p> <p>CAUTION. DEPRESSION OF THE END SURFACE OF THE PLUG RELATIVE TO THE SURFACES "P" AND "C" IS NOT ACCEPTABLE</p> <p>6 Inspect the HPC blades of the downstream stages and stage 3...12 spacer rings.</p> <p>Notes –</p> <ul style="list-style-type: none"> <li>1 The plug has a marking on the inner end surface corresponding to the stage number.</li> <li>2 Perform plug removal, blades inspection and plug installation back into its position successively for each stage.</li> <li>3 Number of blades in impellers: 1 stage – 34 pcs.</li> </ul> <table border="1" data-bbox="497 1010 1366 1157"> <tr> <td>Stage 2 – 35 pcs.</td><td>Stage 6 – 75 pcs.</td><td>Stage 10 – 92 pcs.</td></tr> <tr> <td>Stage 3 – 39 pcs.</td><td>Stage 7 – 82 pcs.</td><td>Stage 11 – 101 pcs.</td></tr> <tr> <td>Stage 4 – 45 pcs.</td><td>Stage 8 – 91 pcs.</td><td>Stage 12 – 105 pcs.</td></tr> <tr> <td>Stage 5 – 67 pcs.</td><td>Stage 9 – 95 pcs.</td><td>Stage 13 – 103 pcs.</td></tr> </table> <p>6.1 Remove panels “2-3”, “2-4”, “3-3”, “3-4” (072.70.00, page 401).</p> <p>6.2 Remove the plug from the inspection hatch of the respective stage:</p> <p>6.2.1 For inspection hatches at the 1<sup>st</sup> stage vane assembly 2 and 3<sup>rd</sup> stage vane assembly 3 – similar to Item 5.3.</p> <p>Note – If hatches with threaded plugs are used on the case with HPC 1<sup>st</sup>, 2<sup>nd</sup> ad 3<sup>rd</sup> stage vanes, proceed as follows:</p> <ul style="list-style-type: none"> <li>1) Unlock the inspection hatch plug.</li> <li>2) Install the wrench 19-590 assembled with the adapter and torque wrench in the recess of the plug.</li> </ul> | Stage 2 – 35 pcs.                                                                | Stage 6 – 75 pcs.   | Stage 10 – 92 pcs. | Stage 3 – 39 pcs. | Stage 7 – 82 pcs. | Stage 11 – 101 pcs. | Stage 4 – 45 pcs. | Stage 8 – 91 pcs. | Stage 12 – 105 pcs. | Stage 5 – 67 pcs. | Stage 9 – 95 pcs. | Stage 13 – 103 pcs. |  |  |
| Stage 2 – 35 pcs.                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                     | Stage 6 – 75 pcs.                                                                | Stage 10 – 92 pcs.  |                    |                   |                   |                     |                   |                   |                     |                   |                   |                     |  |  |
| Stage 3 – 39 pcs.                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                     | Stage 7 – 82 pcs.                                                                | Stage 11 – 101 pcs. |                    |                   |                   |                     |                   |                   |                     |                   |                   |                     |  |  |
| Stage 4 – 45 pcs.                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                     | Stage 8 – 91 pcs.                                                                | Stage 12 – 105 pcs. |                    |                   |                   |                     |                   |                   |                     |                   |                   |                     |  |  |
| Stage 5 – 67 pcs.                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                     | Stage 9 – 95 pcs.                                                                | Stage 13 – 103 pcs. |                    |                   |                   |                     |                   |                   |                     |                   |                   |                     |  |  |

| Description of Operations and Technical Requirements                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                   | Works to be performed<br>in case of noncompliance with<br>Technical Requirements | Check |
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| <p>3) Unscrew the plug, counterclockwise, and carefully remove from the engine.</p> <p>6.2.2 For inspection hatches at the 5...12<sup>th</sup> stage vane assemblies proceed as follows:</p> <ul style="list-style-type: none"> <li>- unlock the inspection hatch plug;</li> <li>- install the wrench 32-27-899 on the plug;</li> <li>- unscrew the plug, counterclockwise, and carefully remove from the engine.</li> </ul> <p>6.3 Insert the endoscope in the hatch between the guide vanes with the direction of view towards the air intake and inspect the blades from the trailing edge side. Turn the endoscope 180 degrees and inspect the next stage blades from the leading edge side.</p> <p>Notes –</p> <ul style="list-style-type: none"> <li>1 Inspect the blades similar as described in Items 5.4, 5.5 as relevant for each stage.</li> <li>2 Acceptable for operation without rectification are the blades with corner bends at the tip part of the blade with the size of 1x1 mm, max: <ul style="list-style-type: none"> <li>- 1<sup>st</sup> stage blades from the trailing edge side;</li> <li>- 2...13<sup>th</sup> stage blades at the leading and trailing edges.</li> </ul> </li> </ul> <p>6.4 The acceptable number of blades containing the damages specified in Items 5.4, 6.3 per the impeller:</p> <ul style="list-style-type: none"> <li>- Stages 1, 2 – 6 blades, max;</li> <li>- Stages 3, 4, 5 – 8 blades, max;</li> <li>- Stages 6, 7, 8 – 10 blades, max;</li> <li>- Stages 9...13 – 12 blades, max;.</li> </ul> <p>6.5 Inspect 3...12<sup>th</sup> stages spacer rings.</p> <p>CAUTION. MARKS OF VANES RUBBING AGAINST THE SPACER RINGS SURFACE AND A VISIBLE GAP BETWEEN THE SPACER RING AND THE IMPELLER DISK ARE NOT ACCEPTABLE.</p> <p>6.6 Carefully retract the endoscope from the hatch.</p> <p>6.7 Install the plug of the respective stage into the inspection hatch:</p> <p>6.7.1 For inspection hatches at the 1<sup>st</sup> stage vane assembly 2 and 3<sup>rd</sup> stage vane assembly 3 – similar to Item 5.7.</p> |                                                                                  |       |

| Description of Operations and Technical Requirements                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                              | Works to be performed<br>in case of noncompliance with<br>Technical Requirements | Check |
|-----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|----------------------------------------------------------------------------------|-------|
| <p>Note – If hatches with threaded plugs are used on the case with HPC 1<sup>st</sup>, 2<sup>nd</sup> ad 3<sup>rd</sup> stage vanes, proceed as follows:</p> <ol style="list-style-type: none"> <li>1) Install the plug on the inspection hatch of the respective stage and screw it clockwise by hand.</li> <li>2) Tighten the plug with the wrench 19-590, the adapter and the torque wrench. The torque is 2.0...2.5 kgf·m.</li> <li>3) Lock the plug with wire – Type 44 (070.00.03, page 6, Figure 17).</li> </ol> <p>6.7.2 For inspection hatches at the 5...12<sup>th</sup> stage vane assemblies proceed as follows:</p> <ol style="list-style-type: none"> <li>a) install the plug of the respective stage on the inspection hatch and screw it clockwise by hand.</li> <li>b) tighten the plug with the wrench 32-27-899, the adapter and the torque wrench. The torque is 2.0...2.5 kgf·m.</li> <li>c) lock with wire the following plugs: <ol style="list-style-type: none"> <li>- inspection hatch plugs 4, 5, 6 – Type 44 (070.00.03, page 6, Figure 17);</li> <li>- inspection hatch plugs 7, 10 – Type 41 (070.00.03, page 6, Figure 14);</li> <li>- inspection hatch plugs 8, 9 - Type 42 (070.00.03, page 6, Figure 16).</li> </ol> </li> </ol> <p>7 Inspect the 13<sup>th</sup> stage blades from the trailing edge side:</p> <p>7.1 Unlock, unscrew and remove the bolts 12 (2 pcs.) used to secure the plug 11 of combustor diffuser hatch from the engine left or right side. Remove the plug with a gasket.</p> <p>7.2 Remove the gasket from the plug.</p> <p>7.3 Insert the endoscope in the hatch of combustor diffuser and install between the nozzle vanes with the direction of view towards the air intake. Inspect the 13<sup>th</sup> stage blades from the trailing edge side.</p> <p>7.4 Carefully retract the endoscope from the hatch.</p> <p>8 Install the plug 11 on the combustor diffuser hatch:</p> <p>8.1 Install a new gasket in the plug 11 recess.</p> <p>8.2 Install the plug 11 on the combustor diffuser hatch and secure it with bolts 12 (2 pcs.) with new locking washers.</p> |                                                                                  |       |

| Description of Operations and Technical Requirements                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                 | Works to be performed<br>in case of noncompliance with<br>Technical Requirements | Check |
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| <p>8.3 Tighten the bolts 12 used to secure the plug 11. The torque is 0.8...1.3 kgf·m.</p> <p>8.4 Lock the bolts with new locking washers – Type 22 (070.00.03, page 2, Figure 2).</p> <p>9 Install the removed panels “1-4”, “1-5”, “2-3”, “2-4”, “3-3” and “3-4” (072.70.00, page 403)</p> <p>10 Remove the fixture for works in the fan duct (072.70.00, page 209).</p> <p>11 Remove the handle or electric drive for HPC rotor turning from the engine accessory drive gearbox (072.00.00, page 607 or 609).</p> <p>11a After completion of works:</p> <ul style="list-style-type: none"> <li>- take away the mats from the inner surface of the front casing and TRU doors;</li> <li>- remove the fixture for works in the fan duct (072.70.00, page 209);</li> <li>- inspect the fan duct for foreign objects and mechanical damage;</li> <li>- unlock the thrust reverser in the “Forward Thrust” position (073.21.00, page 203 or 072.80.00, page 209).</li> <li>- take away the banner prohibiting engine starting from the cockpit.</li> </ul> <p>12 Make a record of the works performed in the engine log book.</p> <p>13 Generate an HPC blades inspection report (see Annex A) in three copies, forward one copy to both the engine design and engine manufacturing organizations.</p> |                                                                                  |       |

| Description of Operations and Technical Requirements                                                                                                                                                                                                                                                                          |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                     | Works to be performed<br>in case of noncompliance with<br>Technical Requirements                                                                                                                                                                                                                                                              | Check |
|-------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|-------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|-----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|-------|
| Instrumentation                                                                                                                                                                                                                                                                                                               | Tools and fixtures                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                  | Consumables                                                                                                                                                                                                                                                                                                                                   |       |
| <p>OLYMPUS Iplex GX/GT video endoscopic system with a changeable probe with a diameter of 6 mm, the length of the working part is 2 m with a set of changeable lenses.<br/>The video endoscopes with similar performance may be used if the engine design organization confirms the possibility of their use (070.00.07).</p> | <p>Socket wrench head 19-916<br/>S=10 (with internal square 10)<br/>Head for HPC plugs removal and installation 32-27-899 S<sub>sq</sub>=10 (inner)<br/>Box wrench 19-140 S=10x12<br/>Torque wrench M=0,3...1,5 kgf·m 84-27-827-01<br/>Torque wrench M=1,0...5,0 kgf·m 84-27-828<br/>Wrench for quick-release plugs removal 19-01(M8) S<sub>sq</sub>=10 (inner)<br/>Cutting pliers Type1X2H8 TY39-26-0030578 87514-2009<br/>Hammer 19-801.<br/>Adapter 93-19-810 (outer square10 x inner square 13)<br/>Flat-nose pliers 7814-0266 И H6.X.6 GOST 5547-93<br/>IGV vanes turning device 93-19-811 (19-593)<br/>Swivel handle 19-8028 S<sub>sq</sub>=10<br/>Portable light 93-27-844<br/>Rod 19-011(extension to the swivel handle 19-8028)<br/>Rod 19-8027 S<sub>sq</sub>=10 (inner)<br/>Caulking tool 84-19-022 (for plate lock locking)<br/>Wrench for plugs removal 19-590 S=8</p> | <p>Cloth with finished edges of 0.4 x 0.4 m made of cotton fabric GOST 29298-2005 - 2 pcs.<br/>Nefras – C50/170 GOST 8505-80 or Nefras – C2-80/120 TU 38.401-67-108-92 - 0.5 l<br/>Lubricant CIATIM-221 (ЦИАТИМ-221) GOST 9433-80 - 0.1 kg<br/>Wire 0,8-TC-1-12X18H10T GOST 18143-72 - 1.5 m<br/>Ethyl alcohol GOST P 55878-2013 - 0.05 l</p> |       |
|                                                                                                                                                                                                                                                                                                                               | - 2 pcs.                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                            |                                                                                                                                                                                                                                                                                                                                               |       |

|                                                      |                                                                                  |       |
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| Description of Operations and Technical Requirements | Works to be performed<br>in case of noncompliance with<br>Technical Requirements | Check |
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Table 2 – Values of HPC 1<sup>st</sup> stage blade airfoil section corner bend at the leading edge side

| Blade airfoil section corner bend value |                                     | Bend corner |
|-----------------------------------------|-------------------------------------|-------------|
| Height from the tip, (H), mm            | Width from the leading edge (S), mm |             |
| 25, max                                 | 10, max                             | 10°, max    |

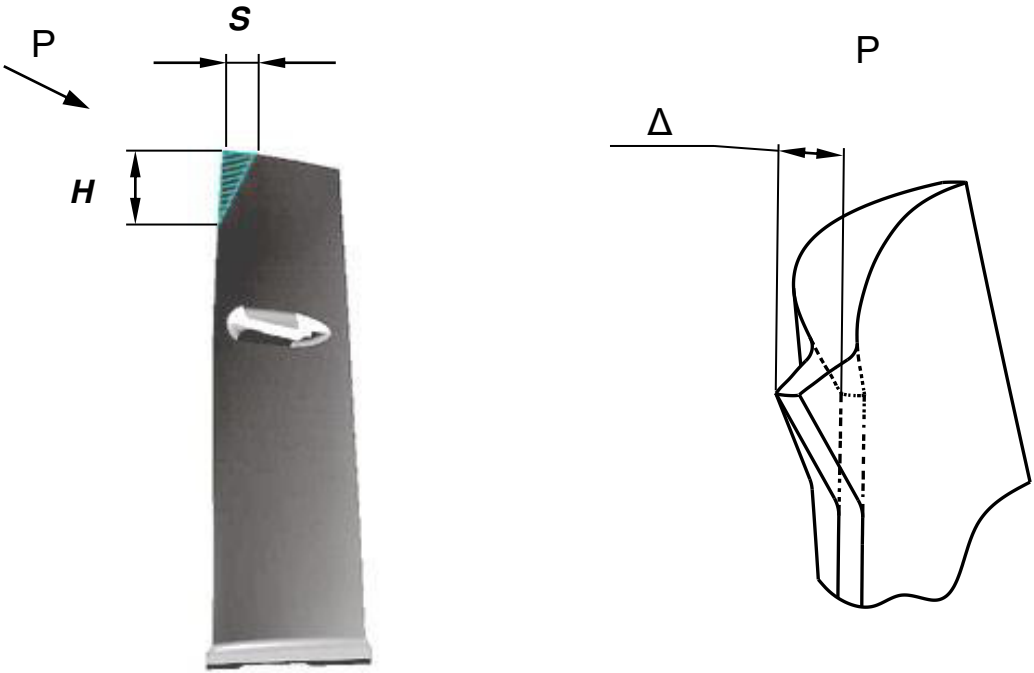


Figure 206 – Diagram of acceptable values of HPC 1<sup>st</sup> stage blade airfoil section corner bend at the leading edge side

| Description of Operations and Technical Requirements | Works to be performed<br>in case of noncompliance with<br>Technical Requirements | Check |
|------------------------------------------------------|----------------------------------------------------------------------------------|-------|
|------------------------------------------------------|----------------------------------------------------------------------------------|-------|

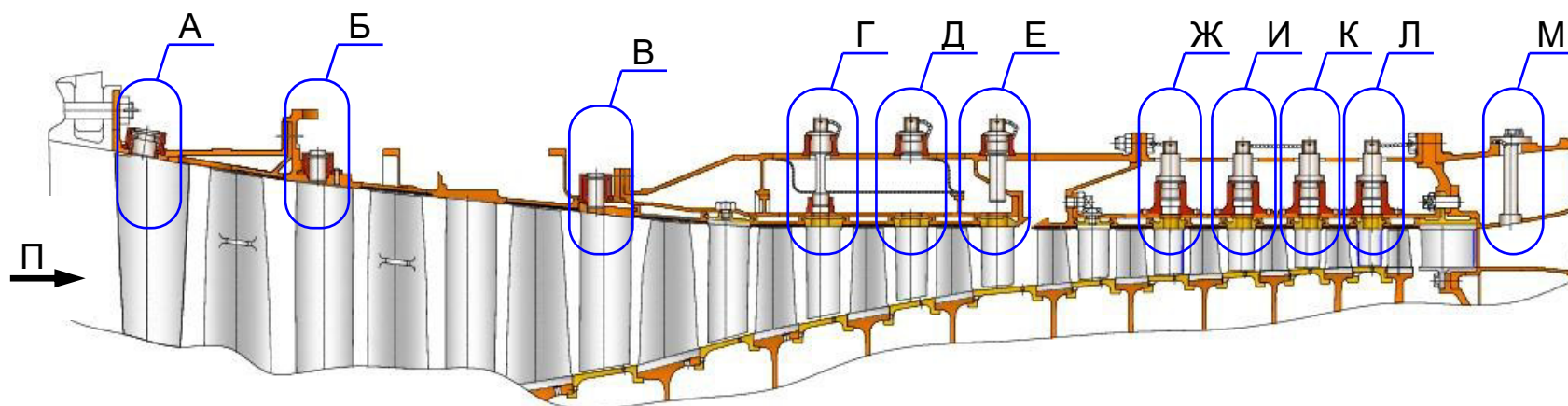
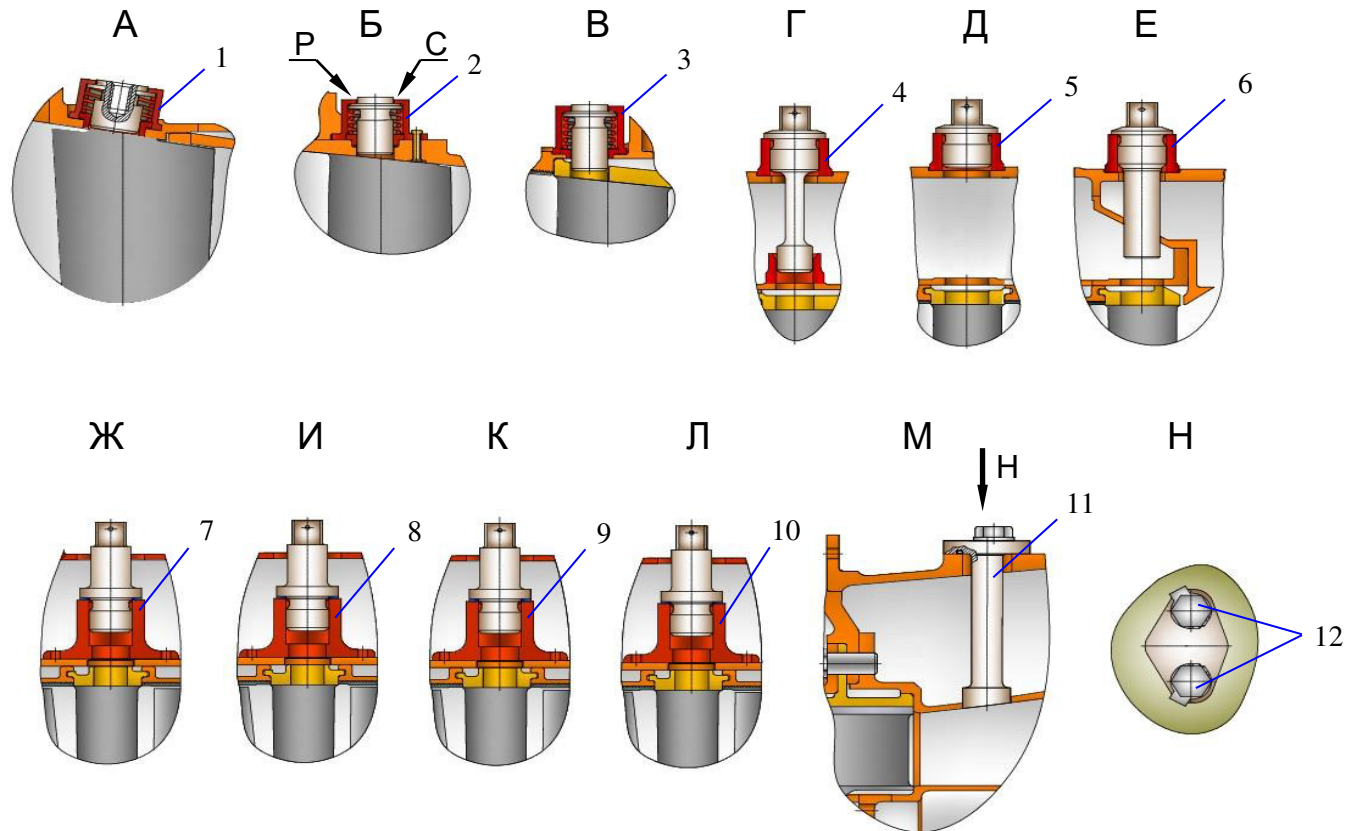


Figure 207 – Diagram of HPC blades and spacer rings inspection hatches location (Part 1 of 3)

| Description of Operations and Technical Requirements | Works to be performed in case of noncompliance with Technical Requirements | Check |
|------------------------------------------------------|----------------------------------------------------------------------------|-------|
|------------------------------------------------------|----------------------------------------------------------------------------|-------|



- 1 – Stage 1 blade inspection hatch, IGV case
- 2 – Stage 1 & 2 blade inspection hatch – St.1 vane assembly
- 3 – Stage 3 & 4 blade inspection hatch - St.3 vane assembly
- 4 – Stage 5 & 6 blade inspection hatch - St.5 vane assembly
- 5 – Stage 6 & 7 blade inspection hatch - St.6 vane assembly
- 6 – Stage 7 & 8 blade inspection hatch - St.7 vane assembly

- 7 – Stage 9 & 10 blade inspection hatch - St.9 vane assembly
- 8 – Stage 10& 11 blade inspection hatch - St.10 vane assembly
- 9 – Stage 11 & 12 blade inspection hatch - St.11 vane assembly
- 10 – Stage 12 & 13 blade inspection hatch - St.12 vane assembly
- 11 – Combustor diffuser hatch plug
- 12 – bolt

Figure 207 – Diagram of HPC blades and spacer rings inspection hatches location (Part 2 of 3)

| Description of Operations and Technical Requirements | Works to be performed<br>in case of noncompliance with<br>Technical Requirements | Check |
|------------------------------------------------------|----------------------------------------------------------------------------------|-------|
|------------------------------------------------------|----------------------------------------------------------------------------------|-------|

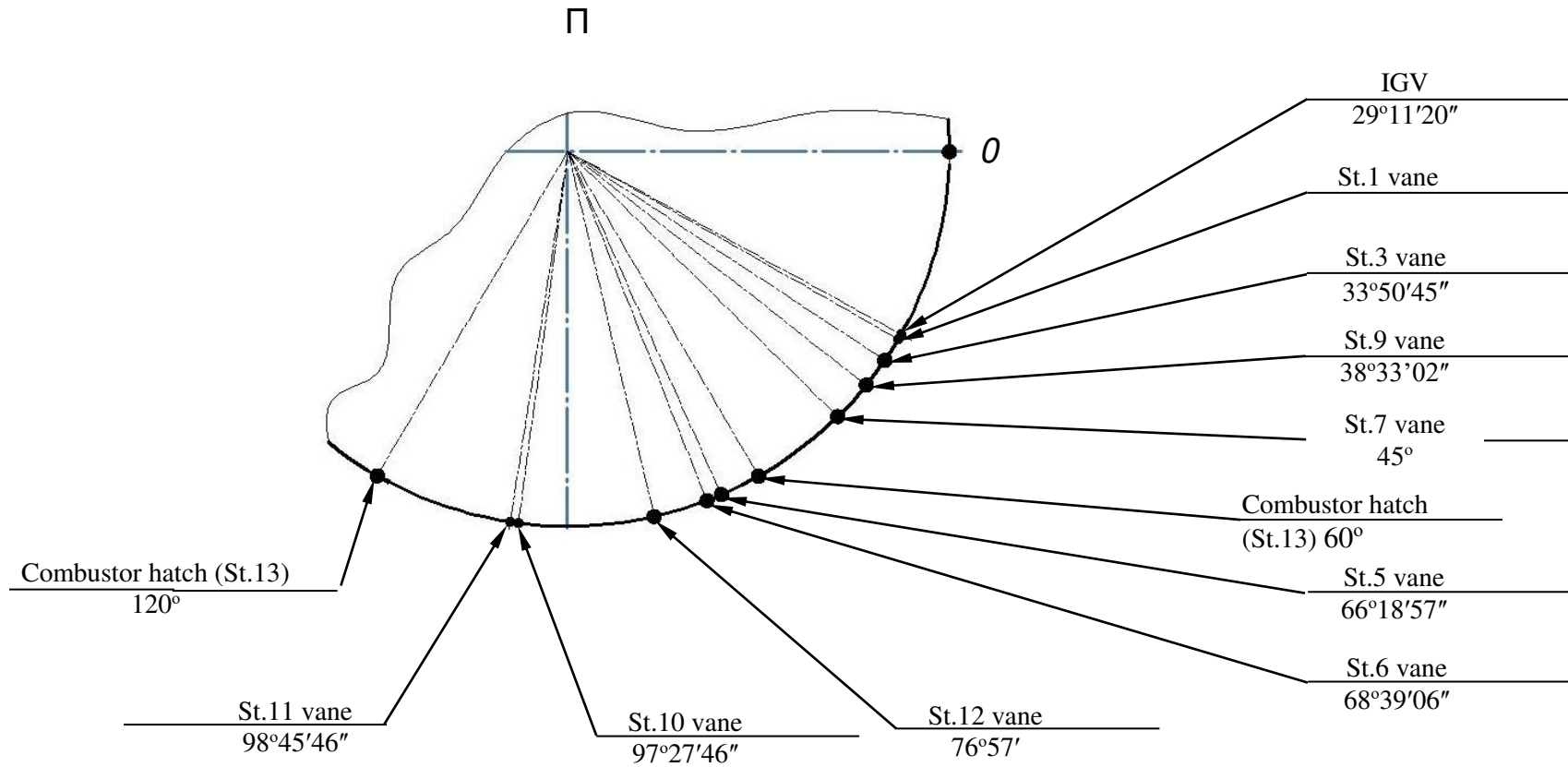


Figure 207 – Diagram of HPC blades and spacer rings inspection hatches location (Part 3 of 3)

|                                                      |                                                                                  |       |
|------------------------------------------------------|----------------------------------------------------------------------------------|-------|
| Description of Operations and Technical Requirements | Works to be performed<br>in case of noncompliance with<br>Technical Requirements | Check |
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Annex A  
(mandatory)  
HPC Blades Inspection Report

Product – PS-90A Engine...

Engine No.: ...

TTSN (hours/ cycles): ...

TSO (hours/ cycles): ...

A/C model: ...

A/C number: ...

Powerplant number: ...

Work type (maintenance, post-flight inspection, etc.): ...

Work completion date (DD. MM. Year): ...

Work performed by (Name): ...

Operator representative (Name): ...

Table 4 – HPC Flowpath Inspection Results

| Stage number | Total number of blades containing damage, pcs. | Total number of blades with rectification, pcs. | Damage description *   |                                                                                                                                    |                             |                                            |           |                                          |                                 |                                                       |           |          |            |    |
|--------------|------------------------------------------------|-------------------------------------------------|------------------------|------------------------------------------------------------------------------------------------------------------------------------|-----------------------------|--------------------------------------------|-----------|------------------------------------------|---------------------------------|-------------------------------------------------------|-----------|----------|------------|----|
|              |                                                |                                                 | Conventional blade No. | Type of damage, (N – nick; D – dent of the airfoil section; B – bend of edge; BC – bend of corner) and their quantity on the blade | Size from blade tip (l), mm | Damage size. ( $K_{max}$ , $L_{max}$ ), mm |           | Depth of dent on the airfoil section, mm | Edge bend size ( $\delta$ ), mm | Corner bend size ( $H_{max}$ , $S_{max}$ , $\Delta$ ) |           |          | Compliance |    |
|              |                                                |                                                 |                        |                                                                                                                                    |                             | $K_{max}$                                  | $L_{max}$ |                                          |                                 | $H_{max}$                                             | $S_{max}$ | $\Delta$ | Specs      | NO |
|              |                                                |                                                 |                        |                                                                                                                                    |                             |                                            |           |                                          |                                 |                                                       |           |          |            |    |
|              |                                                |                                                 |                        |                                                                                                                                    |                             |                                            |           |                                          |                                 |                                                       |           |          |            |    |
|              |                                                |                                                 |                        |                                                                                                                                    |                             |                                            |           |                                          |                                 |                                                       |           |          |            |    |
|              |                                                |                                                 |                        |                                                                                                                                    |                             |                                            |           |                                          |                                 |                                                       |           |          |            |    |

\* - Columns should be filled depending on the type of damage (nicks, dents on the airfoil section, edge bending or corner bending), indicating their number and quantity per one blade, and must be accompanied by photos or video records.