




## **RFQ ASSEMBLY AND MANUFACTURING PLAN #04\_BY A.GARBAYO**


*See "20111005\_Assembly plan\_v2.ppt" for more details*

*Follow "how to handle free oxygen copper" document attached.*

### **1. MACHINING PROCESS AT MANUFACTURERS**

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- 1.1.** ROUGH MACHINING
  - 1.2.** CHECK THAT COPPER IS STABLE
  - 1.3.** MACHINING OF OUTER SURFACES AND EXTERNAL FEATURES
  - 1.4.** DRILL TWO DOWEL HOLES ONTO MAIN OUTER SURFACE OF THE VANE
  - 1.5.** STURDY PLATE
    - 1.5.1.** PUT A STURDY PLATE ONTO THE MACHINE
    - 1.5.2.** BOLT IT DOWN TIGHTLY
    - 1.5.3.** SKIM IT FLAT (GOOD FLATNESS AND PARALELISM TOLERANCES)
    - 1.5.4.** MACHINE A DOWEL HOLE AND A DOWEL SLOT INTO THE STURDY PLATE.
    - 1.5.5.** CLOCK AND RECORD THE POSITION OF THE DOWEL HOLE OF THE PLATE.
  - 1.6.** LOCATE THE MAJOR VANE WITH TWO DOWELS ONTO THE STURDY PLATE
  - 1.7.** DRILL OUT DOWEL HOLES TO EACH FRONT END FACE OF THE VANE
  - 1.8.** MACHINE THE VANE TIP (MODULATION)
  - 1.9.** FINE MACHINING OF THE INTERNAL PROFILE OF THE VANE (CLOVER PROFILE)
  - 1.10.** CHECK AND INSPECT FINAL TOLERANCES AT MANUFACTURERS
  - 1.11.** REPEAT PROCESS FOR THE REST OF THE VANES 

### **2. VANE TO VANE ALIGNMENT WITHOUT O-RING IN PLACE**

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- 2.1.** INSPECTION OF THE VANES AT THE METROLOGY LAB BY DAVE WILSHER TO CHECK THAT MACHINING FULFILLS WITH THE REQUIREMENTS
  - 2.2.** ASSEMBLE VANE INTO THE CRADLE
  - 2.3.** PREPARE RFQ SUPPORT BENCH AND FRAMEWORK AT R8 FOR ASSEMBLY
  - 2.4.** INSTALL LASER TRACKER L-743 FROM METROLOGY LAB IN R8
  - 2.5.** CHECK FRAMEWORK AND RAILS AND ALIGN IF NEEDED
  - 2.6.** BOLT-ON THE ALIGNMENT BLOCKS TO THE VANE
  - 2.7.** CRANE IN CRADLE AND VANE TO THE RFQ SUPPORT BENCH IN R8.
  - 2.8.** TRACKING AND ALIGN MAJOR VANE WITH LASER L-743
  - 2.9.** CHECK "DATUM D" OF THE MAJOR VANE AGAIN
  - 2.10.** CLEAN MAJOR VANE
  - 2.11.** PROTECT SEALING FACES AND VANE WITH THIN ALUMINUM STRIPS
  - 2.12.** LOOSEN OFF TRANSVERSE ALIGNMENT BLOCKS
  - 2.13.** ATTACH ALIGNMENT JIG AND DOWEL IT TO THE MAJOR VANE TO BOTH ENDS
  - 2.14.** ATTACH LIFTING RODS TO MINOR VANE
  - 2.15.** CLEAN MINOR VANE
  - 2.16.** BRING MINOR VANE INTO POSITION
  - 2.17.** REMOVE SEALING FACE PROTECTION ONCE MINOR VANES IS IN POSITION
  - 2.18.** REPEAT PROCEDURE FOR SECOND MINOR VANE
  - 2.19.** ALIGN MINOR VANES VERTICALLY BY USING THE LASER TRACKER L-743
  - 2.20.** CHECK, INSPECT AND ALIGN AGAIN DATUM-D OF THE MINOR VANES IF NEEDED
  - 2.21.** ALIGN MINOR VANES LONGITUDINALLY AND TRANSVERSALLY BY USING THE ALIGNMENT JIG (BY DOWELING TO BOTH MINOR VANES AND MAJOR VANE)

- 2.22. REMOVE ALIGNMENT JIG FROM BOTH ENDS
- 2.23. CRANE INTO POSITION TOP MAJOR VANE
- 2.24. ATTACH ALIGNMENT JIG TO TOP MAJOR VANE AND MINOR VANES
- 2.25. ALIGN MAJOR VANE AND DOWEL ON THE ALIGNMENT JIG
- 2.26. TIGHT THE VANES UP
- 2.27. REMOVE ALIGNMENT END FLANGES AND ALIGNMENT JIG
- 2.28. REMOVE ALIGNMENT BLOCKS
- 2.29. FIT DOWEL BLOCKS, DOWEL THEM AND BOLT THEM TO THE ALIGNED RFQ PARTS
- 2.30. PACKAGING THE SECTION AND SEND IT BACK TO THE MANUFACTURER

### **3. FINAL MACHINING AT THE MANUFACTURERS**

- 3.1. DRILLING LOWER DOWEL BLOCKS
- 3.2. DRILLING UPPER DOWEL BLOCKS
- 3.3. LABELLING DOWEL BLOCKS AND RFQ
- 3.4. CRANE IN THE VANES BACK TO THE STURDY PLATE ONTO THE CNC MACHINE
- 3.5. MILL END FACES TO LENGTH (DIMENSION GIVEN FROM THE DOWEL HOLE OF THE MAIN OUTER SURFACE)
- 3.6. DEBURRING END FACES

### **4. SECTION ASSEMBLY WITH O-RING IN PLACE**

- 4.1. FITTING LOWER BAFFLES BEFORE ASSEMBLY
- 4.2. LOWER MAJOR VANE INTO CRADLE
- 4.3. CLEAN MAJOR VANE
- 4.4. FIT 3D O-RING
- 4.5. FIT STRIPS TO PROTECT SEALING FACE AND VANE TIP
- 4.6. KEEP O-RING IN PLACE BY USING SIMPLE FOLDED ALUMINUM PIECES
- 4.7. LOCATE MINOR VANE BETWEEN THE LONGITUDINAL O-RING SECTIONS AND LOWER ONTO DOWELS (make sure that O-ring section is still in its groove)
- 4.8. BOLT DOWN MINOR VANES BY FITTING END ALIGNMENT FLANGES, BY USING "SOFT" PINS AND BY DOWELLING ALIGNMENT JIG TO BOTH ENDS.
- 4.9. FIT TOP MAJOR VANE
- 4.10. TIGHT DOWN
- 4.11. CHECK ALIGNMENT BY USING "SOFT" PINS ON END FLANGES AND BY USING LASER TRACKER L-743
- 4.12. REMOVE END FLANGES AND ALIGNMENT JIG
- 4.13. **POSSIBLE BEAD PULL TEST**
- 4.14. FIT END FLANGES
- 4.15. FIT TUNERS OR BLANK THEM OFF
- 4.16. FIT VACUUM PUMP
- 4.17. BLANK OFF LOWER VACUUM PORT
- 4.18. PERFORM VACUUM TEST
- 4.19. FIT BAFFLES AND LIDS (bottom baffles are already fitted as it is easier prior to mounting the major vane in the cradle)
- 4.20. RUN COOLING WATER AND CHECK FOR LEAKS

### **5. SECTION TO SECTION ALIGNMENT ONTO THE FETS AND RFQ SUPPORT BENCH**

- 5.1. TO BE DISCUSSED YET

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