CERN status - Nb cavity – Manufacturing 1

Task	External Company	CERN
Provide material as specification EDMS 1095252 (Plansee)	X	
Material extensive tests for acceptance : - Ultrasonic inspection, for continuity faults and for variations of attenuation - Surface roughness, Rt - Hardness, HV10 - Tensile properties, longitudinal and transverse to rolling direction - Microstructure, for grain size and uniformity - Electrical residual resistivity ratio RRR, in bulk material		x
Spinnnig of half-cells (8 middle, 2 end)	X	
Manufacture of 2 end groups	X	
Machining for iris and stiffening rings welding preparation	X	
Manufacture of NbTi flanges (main coupler, HOM, pick-up, extremities)	X	
Manufacture of interface to helium tank	X	
Degreasing	X	
3D control	X	
RF measurement of half-cell frequency	X	Provides equipment / RF specialist if needed

CERN status - Nb cavity – Manufacturing 1

Task	External Company	CERN
Ultrasonic cleaning; CP (20 µm on each side) inner and outer surface, rinsed in de-ionized filtered hot water of 0.2µm max, dried in laminar airflow in clean room 1000 or better	X	
3 µm CP if storage time > 8h after previous step	X	
EB welding of the irises (8 half cells, 2 end groups, helium tank interfaces, all Nb flanges) and from inside (within 8h from previous)	X	
EB welding of stiffening rings	X	
Inspection and dimensions control of “dumb-bell” + extremities	X	
Frequency measurement of dumb-bell + extremities	X	Provides equipment / RF specialist if needed
Machining of both equator ends determined by evaluation of frequency	X	
Ultrasonic cleaning; CP(20 µm on each side) inner and outer surface, rinsed in de-ionized filtered hot water of 0.2µm max, dried in laminar airflow in clean room 1000 or better	X	
Anodization of dumb-bell and inspection	X	
Grinding if needed + 20 µm CP, rinsed, dried, anodized again	X	

CERN status - Nb cavity – Manufacturing 2

Task	External Company	CERN
3 µm CP cleaning	X	
EB welding of all equators (4 dumbbells, 2 end groups, $p < 5 \cdot 10^{-5}$ mbar) from outside in full penetration; protection against Nb vaporization	X	
Leak test	X	
Field flatness measurement and tuning	X	Provides equipment / RF specialist if needed Participates for acceptance
Transport frame + delivery to CERN	X	

Process 1/4

- Proposed general process:
  - 1st Stage
    - Manufacturing of cavity as presented before
      (by Industry, some equipment to be provided by CERN, QA checks with CERN personnel present)
    - Delivery to CERN
    - EP “hard” (thickness 140 μm) – to be done at CERN
    - HPWR to remove residuals from EP (criteria TBD)
    - HV annealing at 800°C (1 – 2 h, 10^{-5} – 10^{-6} mbar)
    - Field flatness measurement + re-tuning if needed
    - Short EP 20 μm
    - HPWR in SM18 clean room
    - Closing of cavity, assembly of pickup probes and vacuum valves, drying by pumping, all in SM18 clean room; storage under vacuum
  - 2nd Stage
    - Assembly on vertical cryostat
    - Baking at 120°C
    - Cold RF test in vertical cryostat (at CERN)

Process 2/4

- Proposed general process:
  - 3rd Stage
    - Analysis of RF test; if OK goto 4th stage
    - If not, either (if no quench) goto 2nd stage “HPWR in SM18 clean room”

      or (if quench) go to optical inspection for identification of problem, mechanical intervention, short CP, etc,
  - 4th Stage
    - Disassembling in SM18 clean room the pickup probes and vacuum valves, cavity under protective gas at overpressure
    - Welding of the helium tank (Tank to be provided by CEA, welding by the cavity manufacturer) with cavity under protective gas
    - Leak test of He tank
    - Storage of cavity in SM18 clean room cabinet

Process 3/4

- Proposed general process:
  - 5th Stage
    - Assembling of the string of the 4 cavities in SM18 clean room with the pickup probes, couplers and gate valves
    - Pumping, leak test and baking in SM18 clean room
    - Assembling full cryomudule outside clean room
    - Horizontal cold test in bunker

Process 4/4

- Special equipment:
  - For RF tests (parts and complete cavity) + tuning
  - For transport
  - For storage (under N2 at atmospheric pressure)
  - For assembly into string of 4 cavities

  - Only RF measurements equipment are should be provided by CERN
  - All the others should be provided by the manufacturer
  - QA actions and repair interventions with CERN personnel present