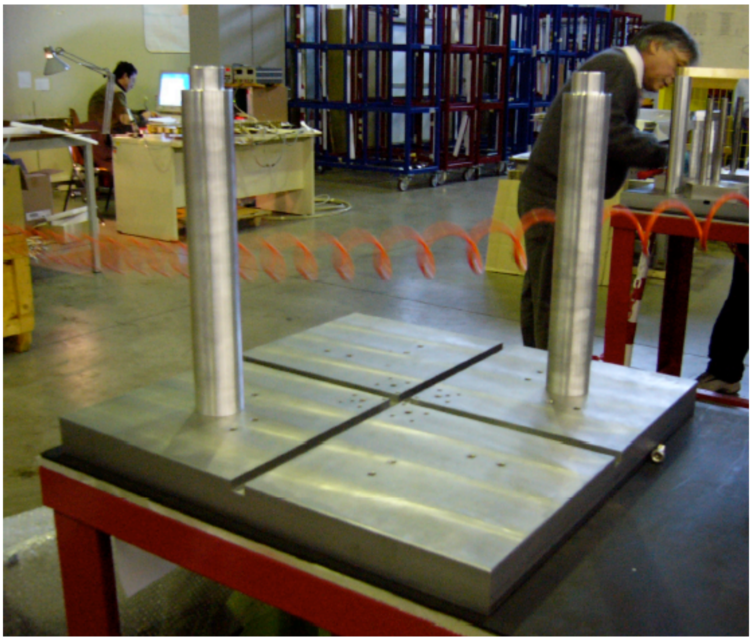
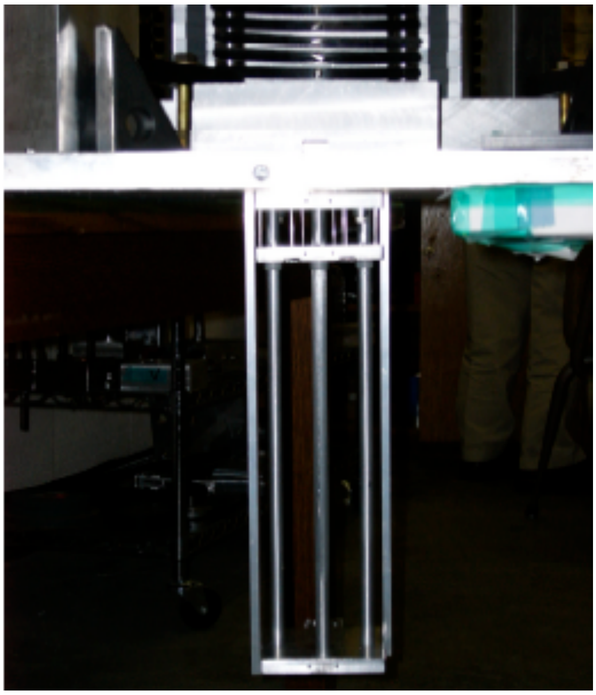
EMCal ALICE modules stacking / assembly

User's Manual / Tutorial Manoel Dialinas updated 25.01.08

1. Put assembly fixture dust clean, and all surfaces degreased.



2. Check guide rods system (guiding rods Ø 1.30 mm) below the table, and start to rise up them.



3. Mount stop system on the table

4. Mount the two Ø6 locating pins on the center block, for the FrontPlate, on the assembly tooling.

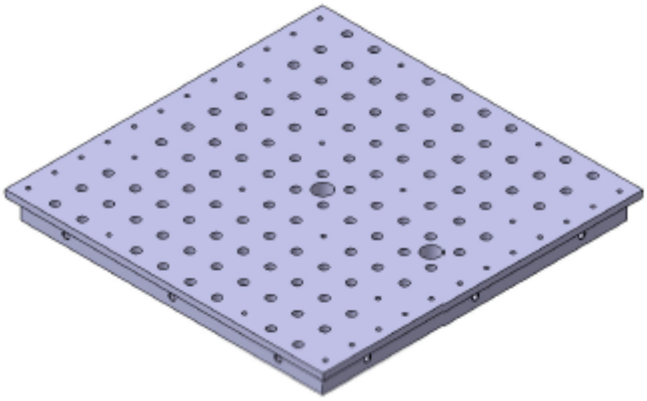
5. Front plate : drawing 26K200_E, locate Phi and Eta sides, check outer sizes (mainly width in Phi direction) and thickness of the edge for strap,

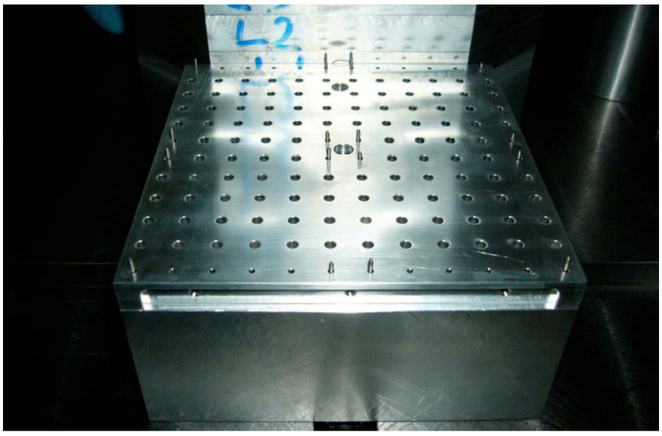
6. Compression Plate : locate Phi and Eta sides, check outer sizes (drawing 26K202_E)

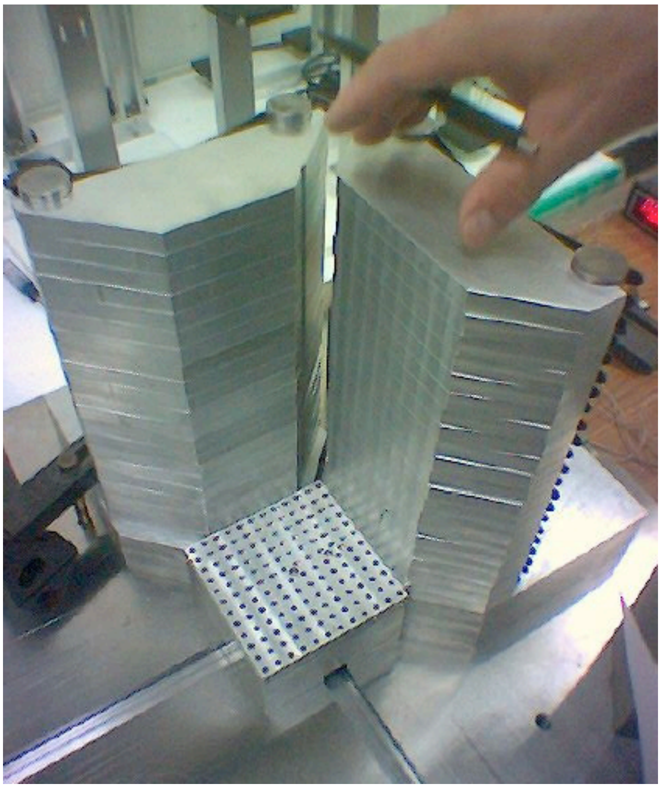
7. Back Plate : drawing 26K201_E, locate Phi and Eta sides, check geometrical dimensions (mainly width in Phi direction), check that the 5 M6x1 screws for set up of Belleville Washers turn free in threaded holes.

8. Strap : drawing 26K203_C, check on a template distance between flanges (281.2 ±0.1 mm), check overall thickness of straps is < 3.15 mm, including welding.

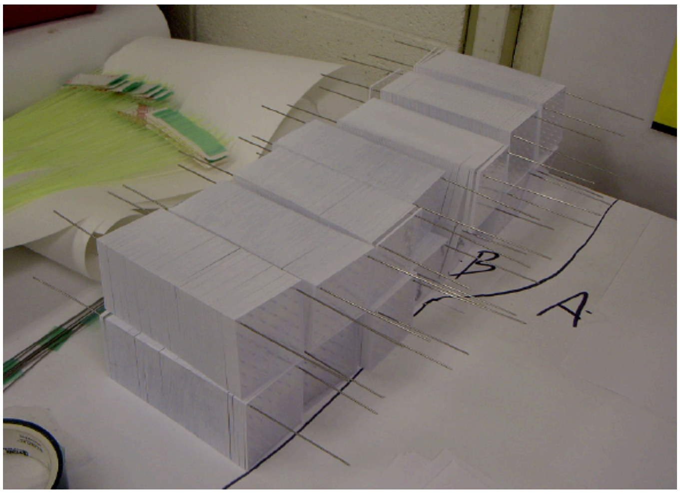
9. Mount FrontPlate on the center block first, check Phi and Eta sides, rise up the guiding rods in order to locate the first Bond Paper.



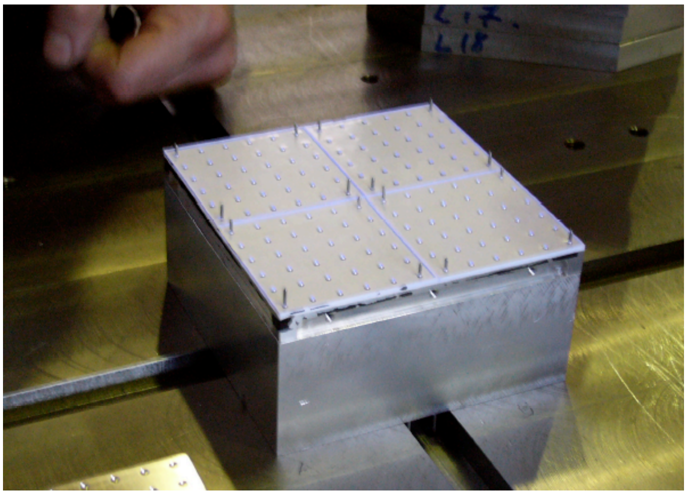




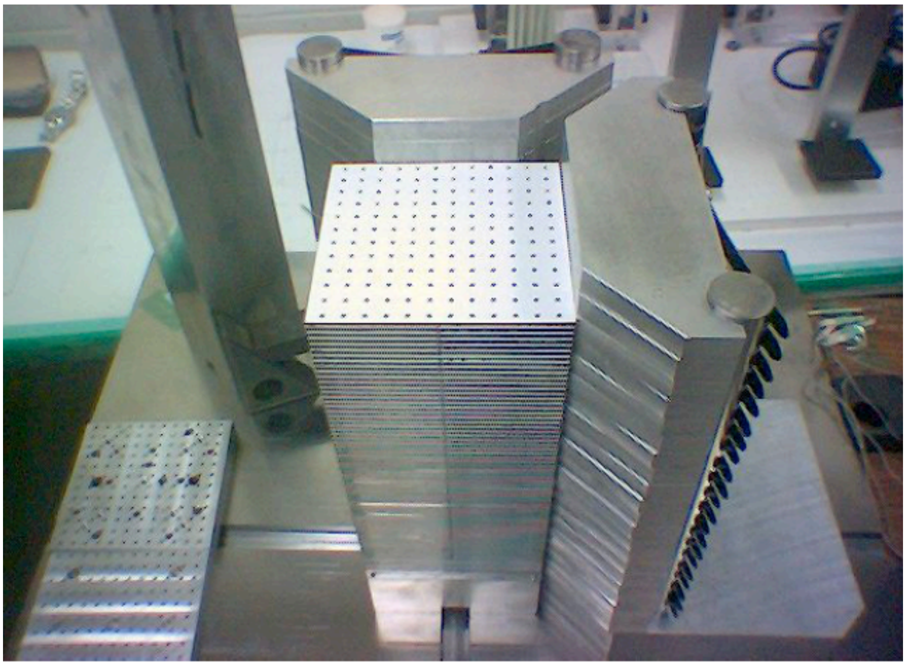
10. Check height of 4 towers of 77 scintillators. If total height is different at corners, make decision to shim.



11. Start stacking. Put one Bond paper first (drawing 26K206_B)), then Scintillator (drawing 26K205_A), then Bond Paper, then lead tile, and so on... Rise up progressively guiding rods for each layer. One operator for handling lead and bond paper, one other for handling scintillator

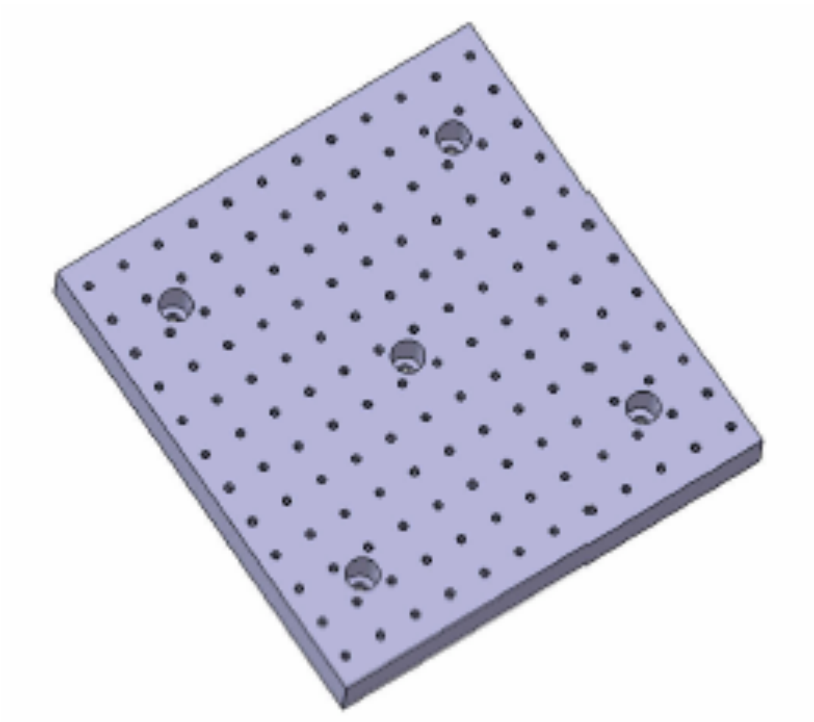


10. Stack 77 layers, finish with a Bond Paper.

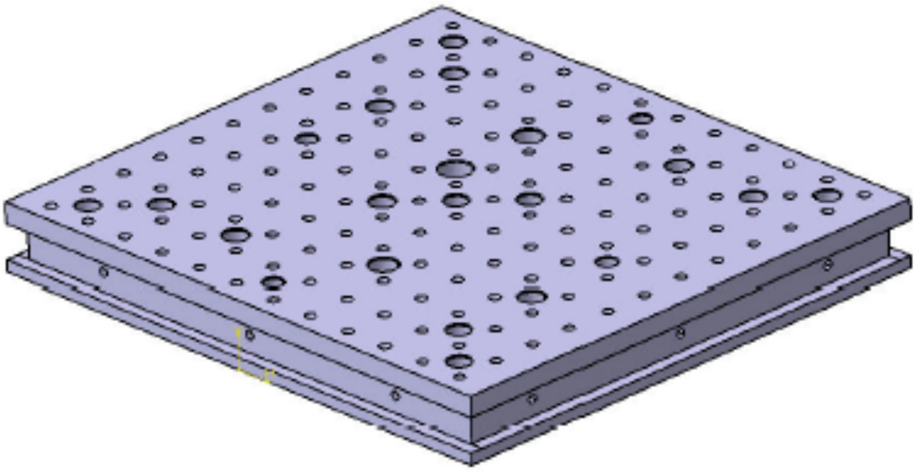


11. Put 5 sets (one set = 8 stacks of 2 washers) of Belleville washers into the 5 Ø 8 mm holes of Compression Plate, mount Belleville Washers plunger on the Belleville washers stacks.

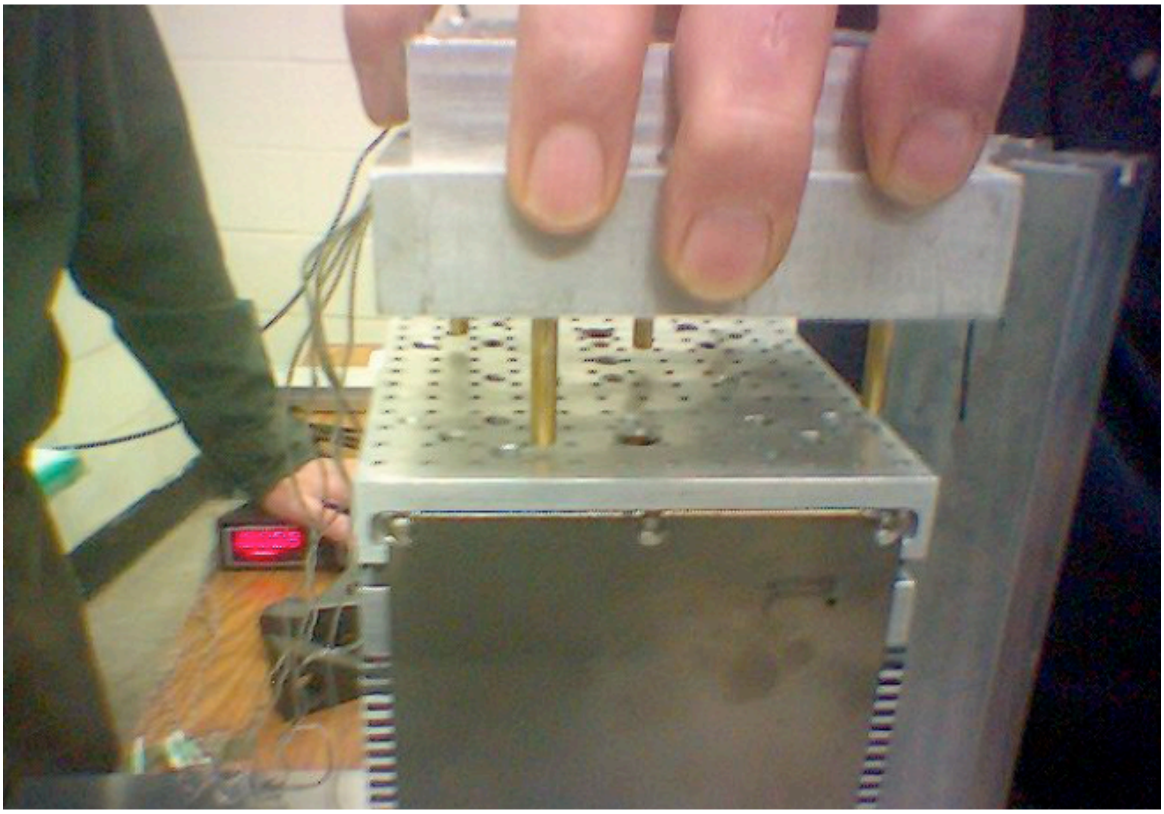
12. Mount Compression Plate on stacked module, check Phi and Eta sides before mounting.



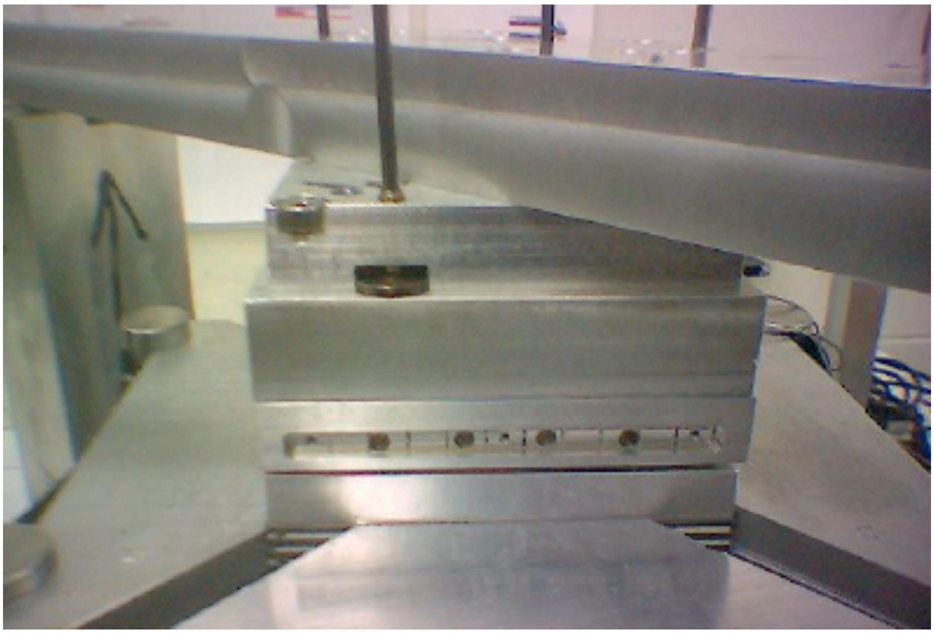
13. Mount BackPlate on module, check Phi and Eta sides before mounting.



14. Mount load cells block on Back Plate, put the 5 fastening screws



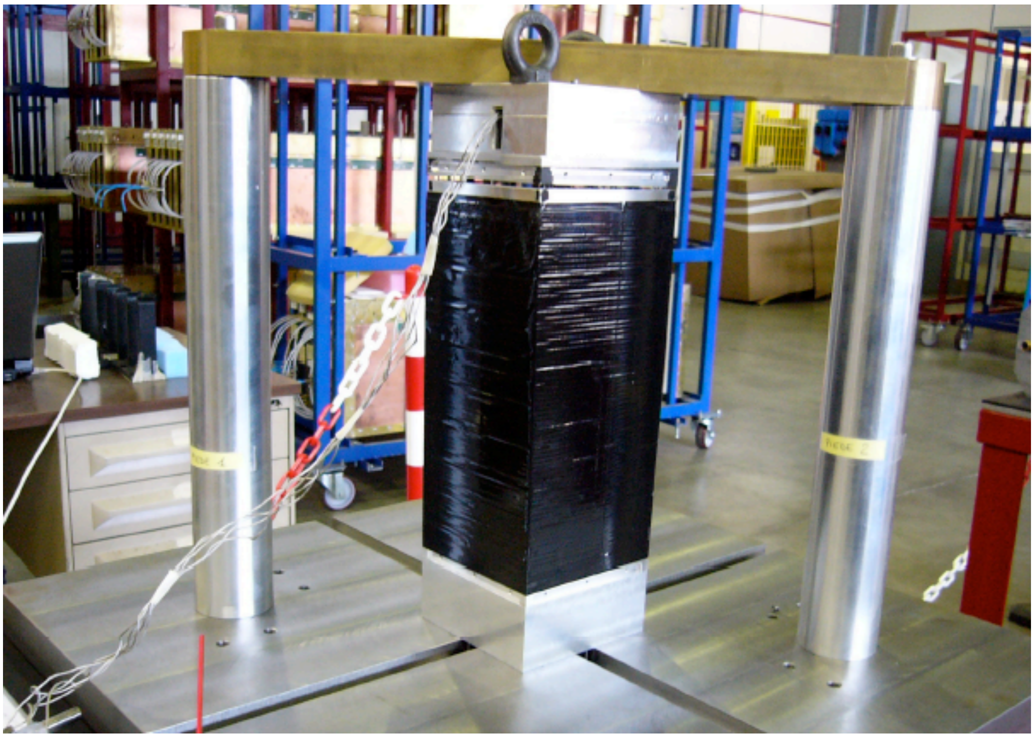
15. Put bridge on rod bars



16. Tight bridge on rod bars, check top, bottom, left and right sides of stacked module

17. Remove lateral stops

18. Start to load the load cells. Put load at corners first (one corner, then opposite corner) and finish at center. During this step Compression Plate will move down and compression load will remain at zero (or low values). Once most of flatness defaults of lead tiles are removed, Compression Plate no more shift down and compression load start to rise.

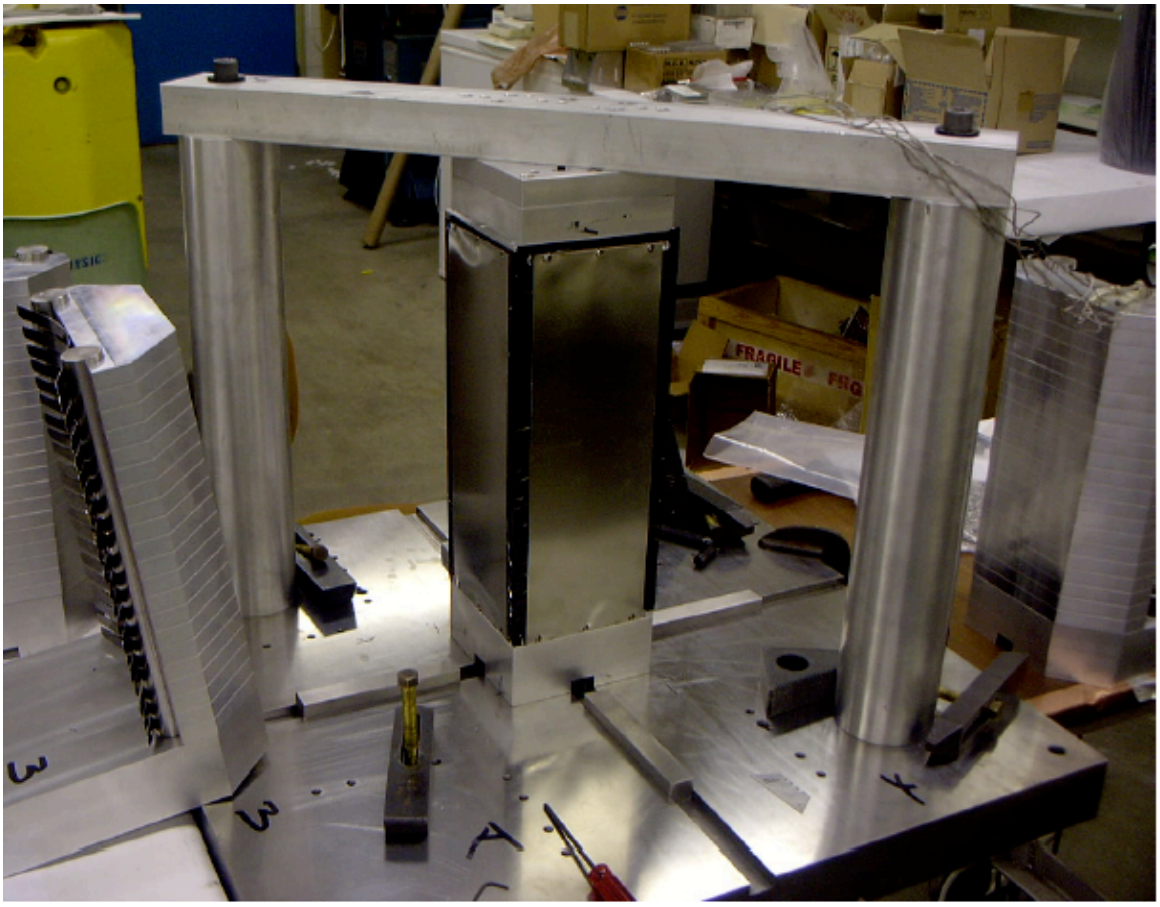


19. Mount black paper shroud on 4 lateral sides of the module.

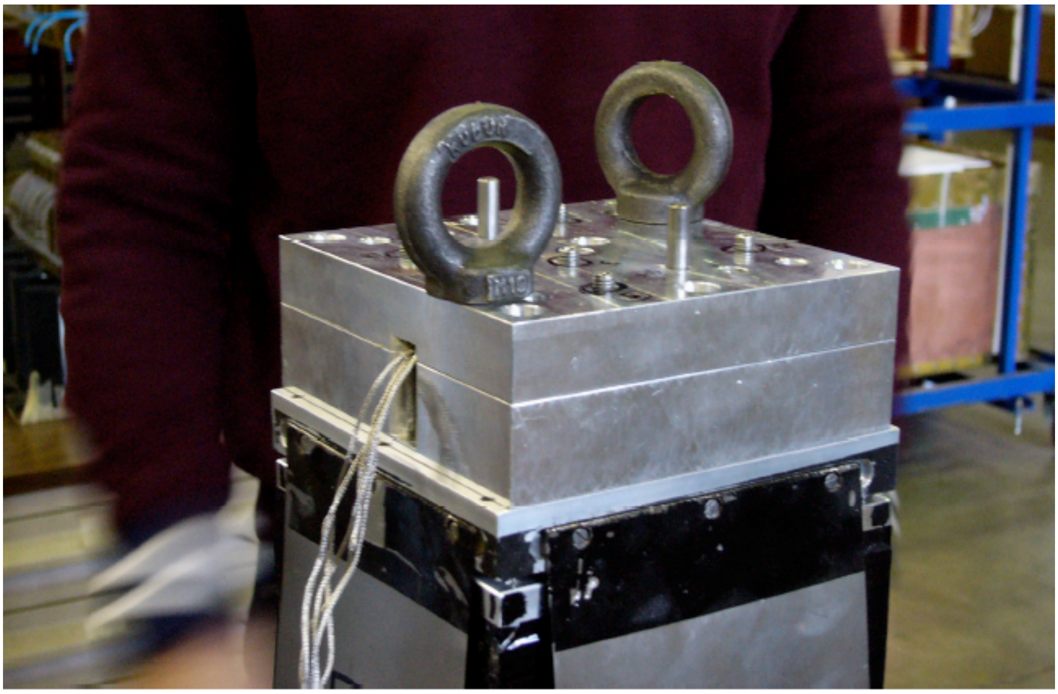
20. Cut pockets in the black paper shroud in order to be able to put flange straps into pockets of Back Plate and Front Plate.

21. Mount straps, low flange first, check that there is a correct contact between edges of flanges and edges of Front Plate and Back Plate, then put the 24 M2.5 screws without tighting them, just in order to make sure that strap flanges are in good contact with edges of Front Plate and Back Plate.

22. Set load cells at a medium value (40 kgf-88 lbs), wait 5 minutes for equilibrium of load in the 5 sets, then tight the M2.5 screws with a torque of xxN.m

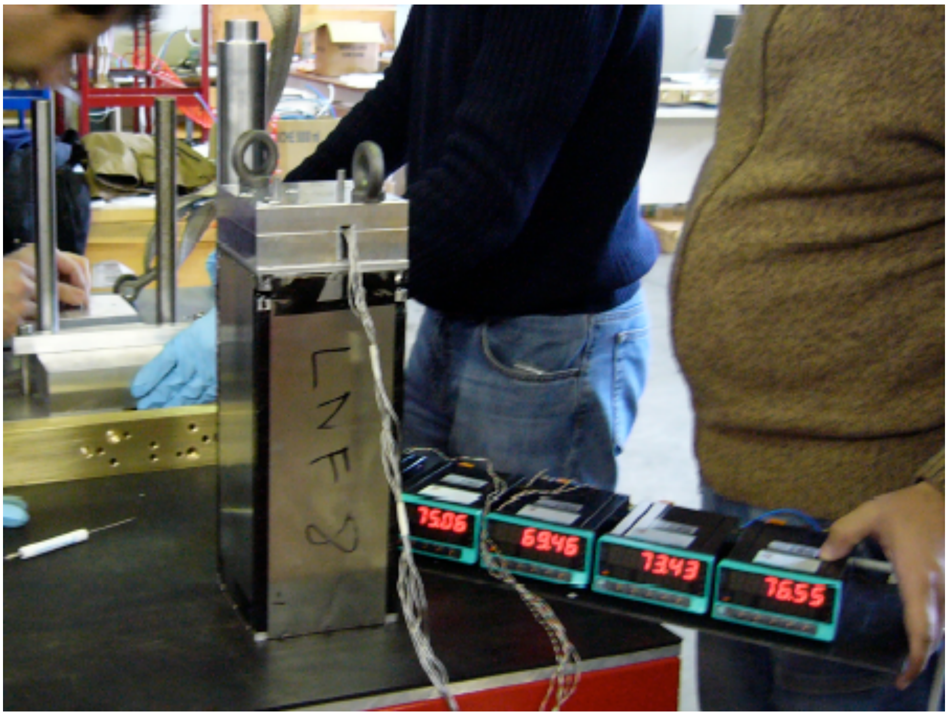


23. Set load cells at high value (64 kgf-140 lbs) in order to achieve the load for the compression time of the module. Then remove bridge of Assembly Tooling in order to be able to move the module.



24. Move down guiding rods.

25. Move module to compression place. Compression area need to be temperature controlled.



26. Check geometrical squareness of Phi sides, and outer dimensions of module.

27. If not correct, call "Chief" in order to know what to do (move back to assembly tooling for dismount-remount or store it ?).

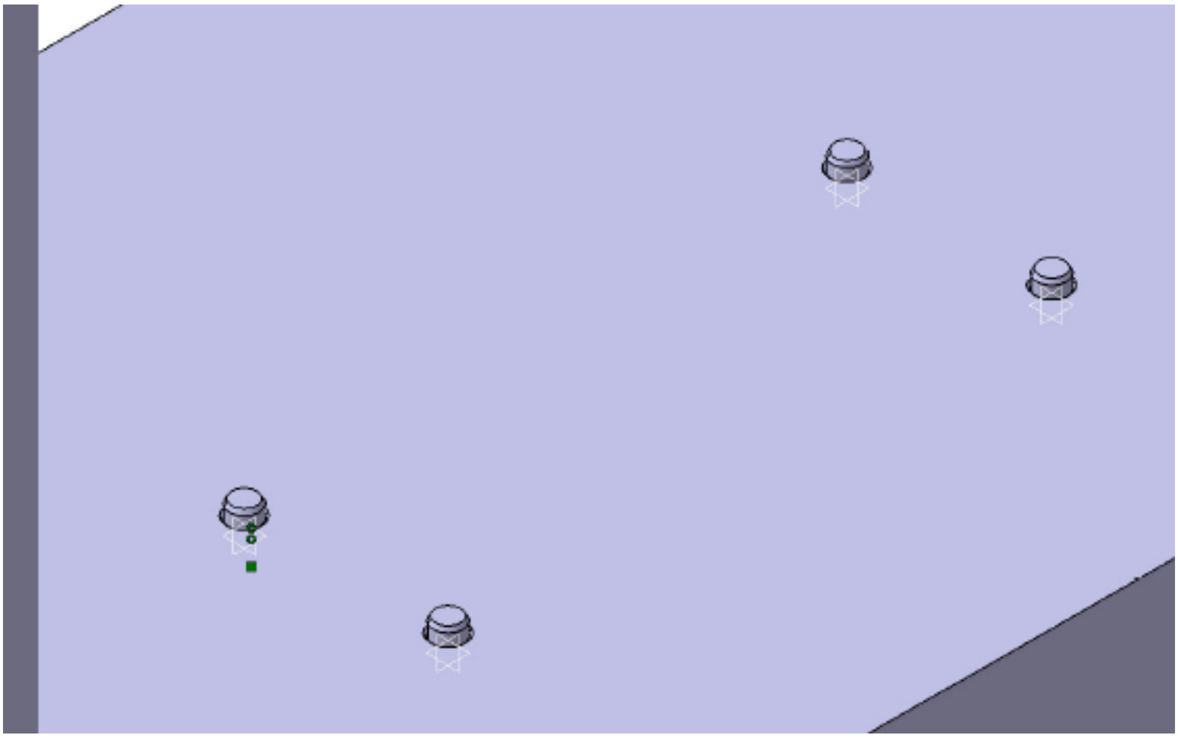
28. During compression time each 2 hours, check shortening effect of module under compression with indications of load cells (if the module shortens, compression load decreases). Set up back compression load at 80 kgf – 176 lbs if the module shortened.

29. After 3 days compression time, set compression load at nominal value : 28 kgf-62 lbs for each load cell.
    Compression time is achieved when load cell indication is quite stable.
    Check and record temperature (< 22°C). Take care of temperature in assembly area at this time, taking into account relationship between module and temperature :
    If ΔT 1°C → ΔL strap 5.1 μ
    If ΔT 1°C → ΔL module 22+90+2=11.3 μ
    If temperature in L3 is higher than temperature in assembly area by 1°C, increase of module length will be 11.3 μ, as increase of strap length will be only 5.1 μ, compression load will rise during life time.
    At the opposite, if temperature in L3 is lower than temperature in assembly area compression load will decrease during life time.

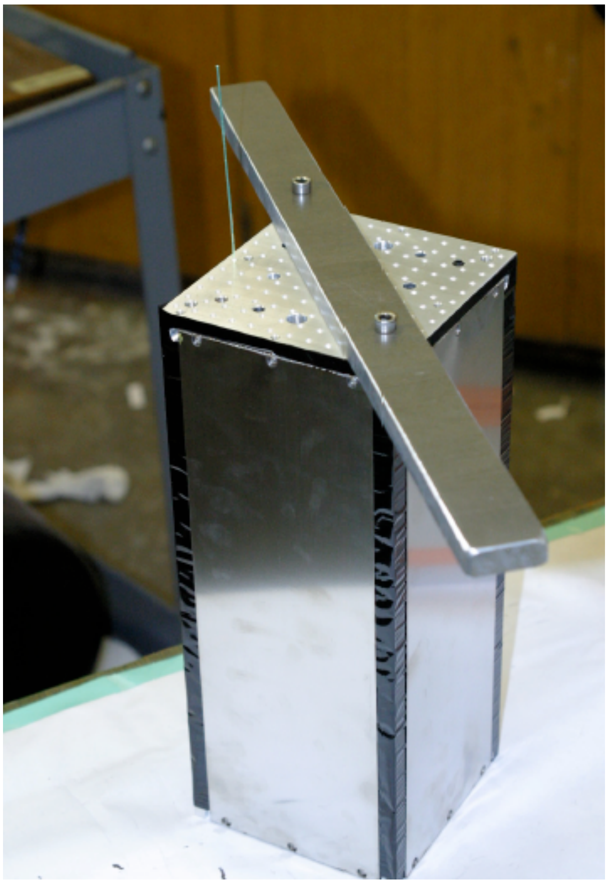
30. Put loctite glue (n° 243) on threads of M6 plunger screws, put them in their threaded holes. Then tight plunger screws for Belleville washers **progressively** (process by ½ turn on each M6 plunger screw, total ≈1.75 turns) in order to transfert progressively load from cells to Belleville Washers, at 1.75 turns load cells indication has to be zero (0),(crosscheck this information) the compression load in module is given by Belleville Washers, no more by load cells. Check gap (nominal value 3 mm) between Back Plate and Compression Plate using the Ø 7 mm inspection hole. Record this value.

31. Remove load cells from compressed module, they can now be used for next module.

32. Put 24 Ø6 locating pins on the StripModule assembly tooling. They allow to achieve location of modules with the 120 mm pitch.

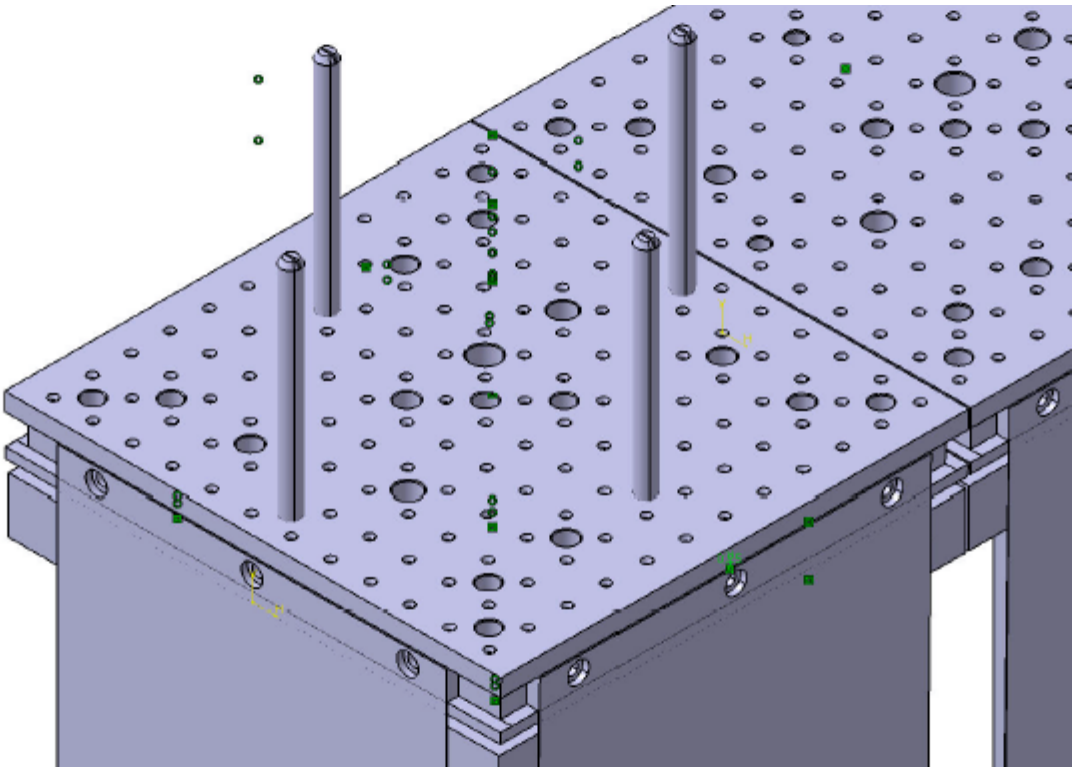


33. Move module to Strip Module assembly table,

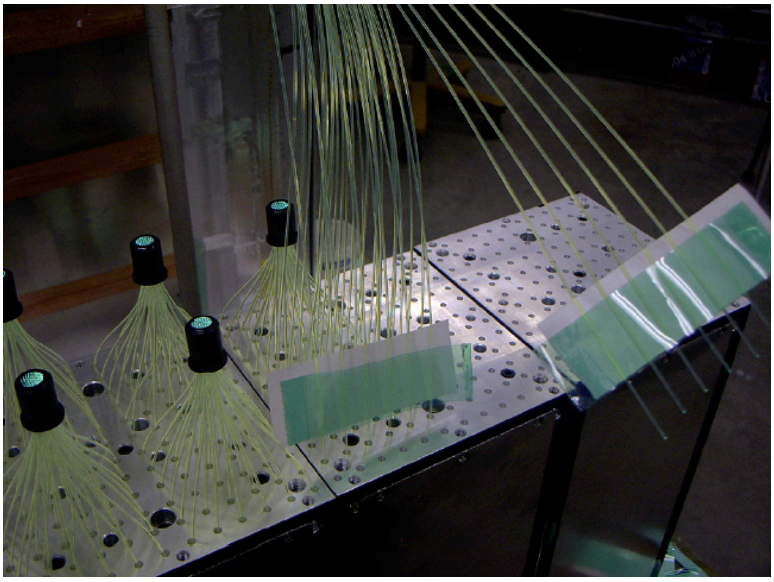


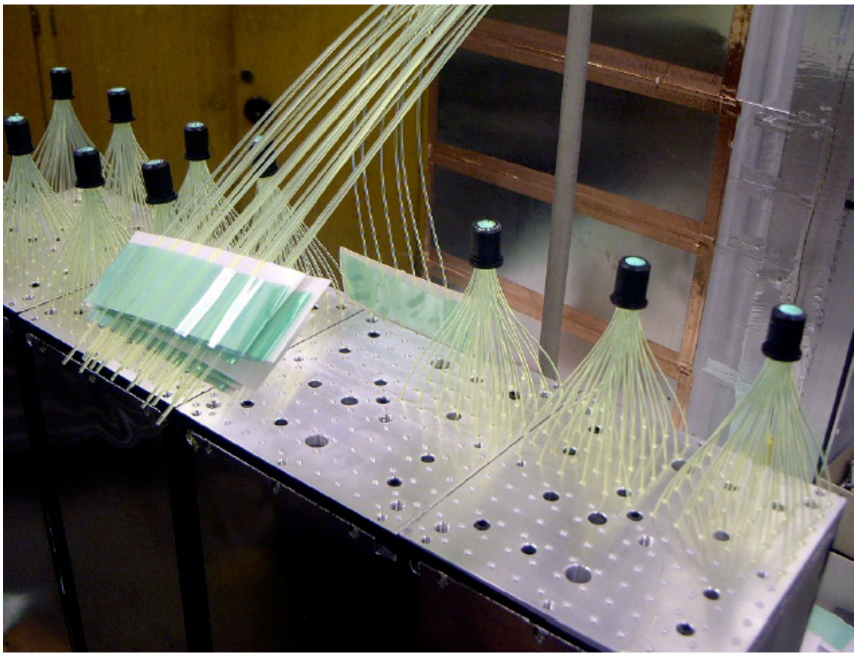
34. Locate Module using the Ø6 locating pins and Ø6 holes in Front Plate.

35. Mount 4 M5 studs (drawing 26K212_A) on Back Plate, use loctite glue (n° 243) to secure studs in Back Plate,



36. Put optic fibers in each module.





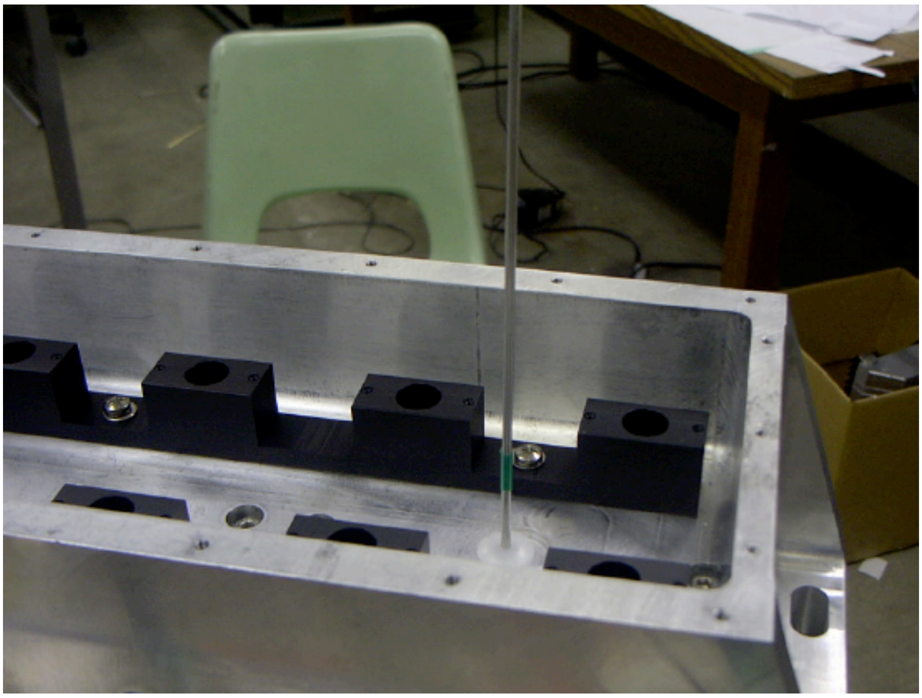
37. Repeat 34 and 35 for 11 other modules

38. Put StrongBack on elevators. Locate at best position using studs and Bundle Fiber terminators.

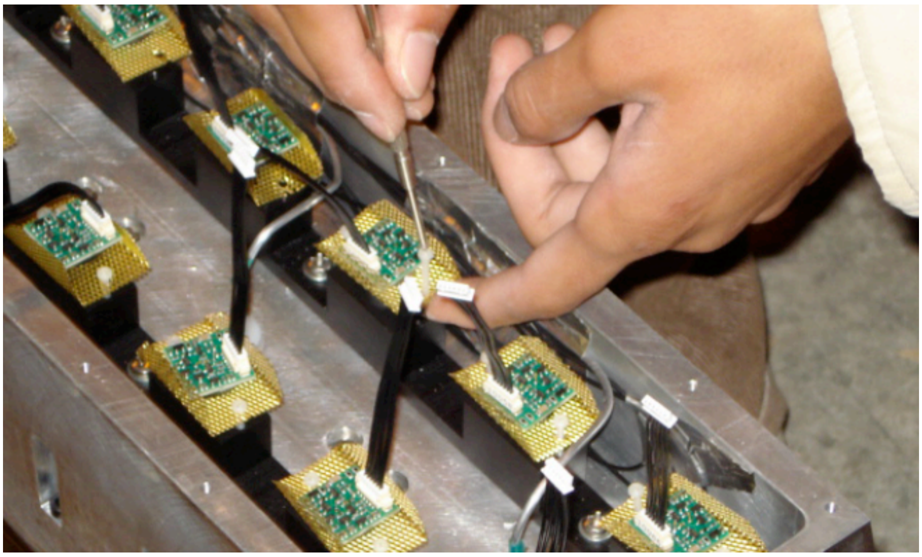
39. Move down StrongBack until contact with BackPlates.

40. Tight the M5 nuts for studs with a torque of xx N.m (use a torquemeter for this operation).

41.



42.



43. Close all holes (centering holes, guiding rods holes) with black paper on Front Plate, in order to avoid light enters in the module.

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A L I C E

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Contents

2 Detector Design

2.1 Design Overview

The overall design of the EMCal is heavily influenced by its integration within the ALICE [1] magnet. The EMCal is to be located inside the large room temperature solenoidal magnet of ALICE within a cylindrical integration volume approximately 112 cm deep in the radial direction sandwiched between the ALICE spaceframe and the ALICE magnet coils. Due to the installation of the PHOS carriage below the ALICE TPC and the HMPID above the ALICE TPC, the EMCal is limited to a region of about 110 degrees in azimuth above the TPC adjacent to the HMPID. As discussed in Section **??**,this EMCal acceptance is well matched to ALICE physics goals.

The conceptual design of the electromagnetic calorimeter for the ALICE experiment is based on the Shashlik technology as implemented in the PHENIX experiment [2] at RHIC, HERA-B at DESY or LHCb [3] at CERN. The scope and basic design parameters of the proposed calorimeter have been chosen to match the physics performance requirements of the high p_t physics program.

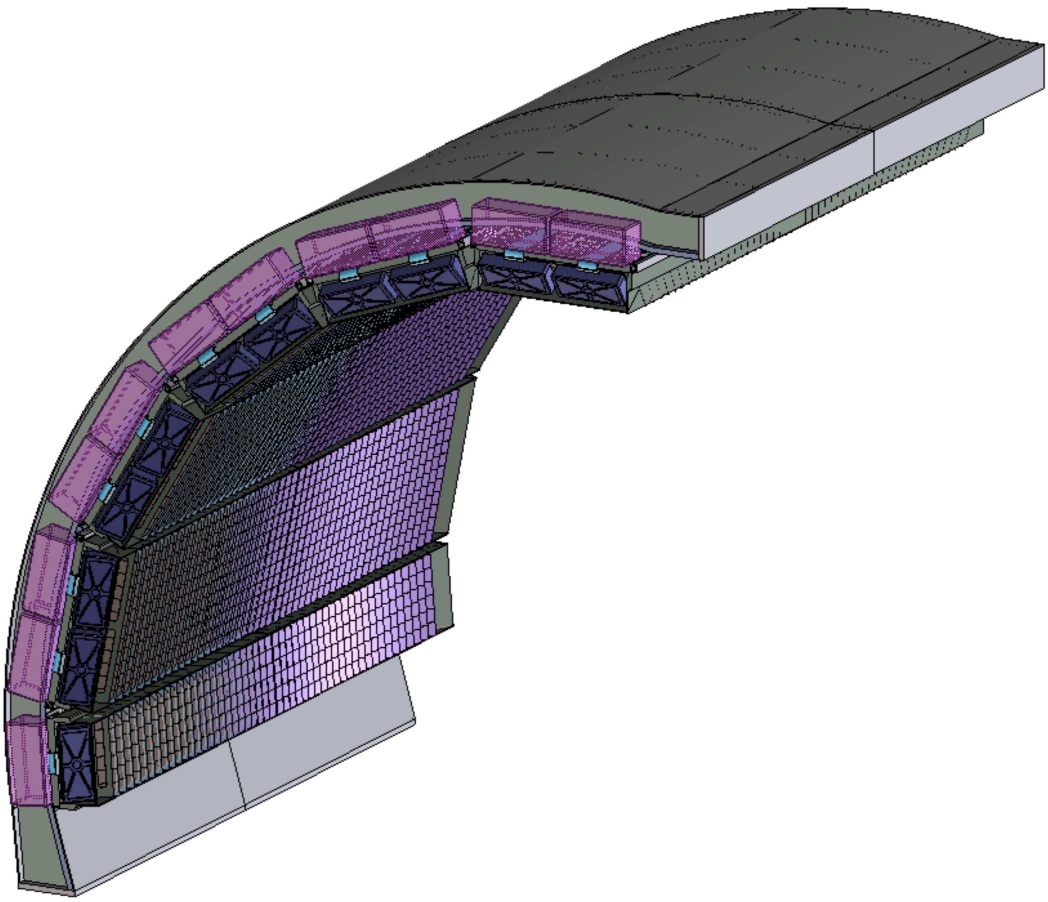


Figure 2.1: The array of super modules shown in the installed position on their support structure.

Fig. 2.1 shows the EMCal super modules mounted in the installed position on their support structure. A continuous arch of super modules, each spanning ∼20 degrees in azimuth, is indicated. The EMCal is positioned to provide partial back-to-back coverage with the ALICE Photon Spectrometer (PHOS) calorimeter. Small azimuthal gaps ($\sim$ 3.0 cm) are provided between super modules to facilitate installation and alignment. These gaps are positioned in line with the TPC sector boundaries. Along these sector boundaries, there is substantial additional structural material required for the support of the TPC and other ALICE detectors that would significantly degrade any electromagnetic measurements made in these gaps.

The chosen technology is a layered Pb-scintillator sampling calorimeter with a longitudinal pitch of 1.44 mm Pb and 1.76 mm scintillator[1] with longitudinal wavelength shifting fibre light collection (Shashlik). The full detector spans η = -0.7 to η = 0.7 with an azimuthal acceptance of $\Delta\phi$ = 110°. The detector is segmented into 12672 towers, each of which is approximately projective in η and ϕ to the interaction vertex.

The towers are grouped into super modules of two types: full size which span $\Delta\eta$ =0.7 and $\Delta\phi$ = 20°, and half size which span $\Delta\eta$ = 0.7 and $\Delta\phi$ = 10°. There are 10 full size and 2 half size super modules in the full detector acceptance (Fig. 2.1). The super module is the basic structural units of the calorimeter. These are the units handled as the detector is moved below ground and rigged during installation. Fig. 2.2 shows a super module with its external mechanical structure stripped away to illustrate the stacking of modules within the super module.

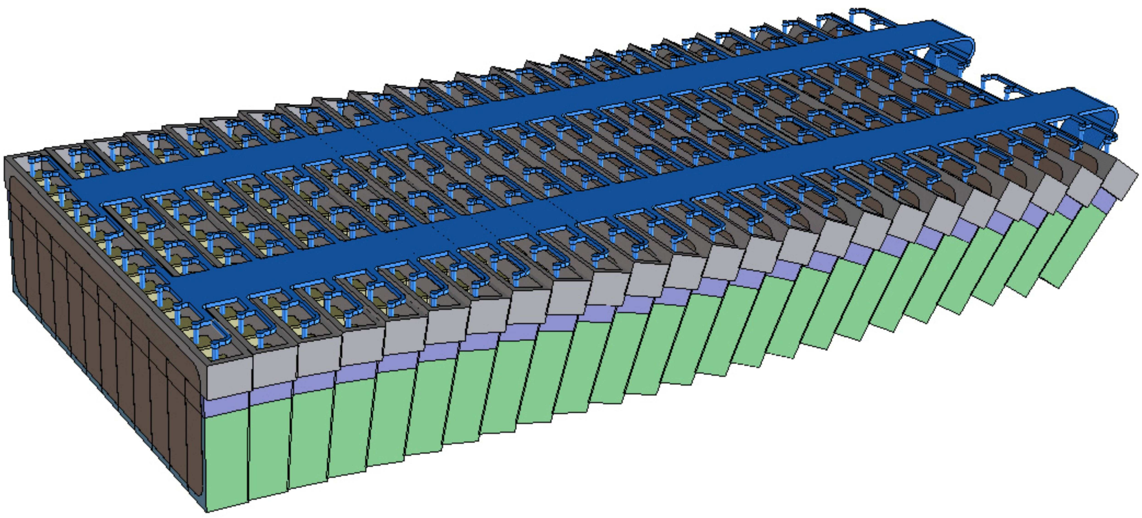


Figure 2.2: ALICE EMCal super module concept.

This figure shows a full size super module with 12×24 modules configured as 24 strip modules of 12 modules each. The supporting mechanical structure of the super module has been removed so that the strip module stacking into a nearly projective geometry can be seen. The electronics integration pathways are illustrated.

Each full size super module is assembled from $12 \times 24 = 288$ modules arranged in 24 strip modules of 12×1 modules each. Each module has a rectangular cross section in the ϕ direction and a trapezoidal cross section in the η direction with a full taper of 1.5°. The resultant assembly of stacked strip modules is approximately projective with an average angle of incidence of less than 2° in η and less than 5° in ϕ. A single module and an assembled strip module is indicated schematically in Fig. 2.3

2.2 Module Design

The smallest building block of the calorimeter is the individual module illustrated in Fig. 2.3. Each individual module contains $2 \times 2 = 4$ towers built up from 77 alternating layers of 1.44 mm Pb (1%

[1] To best account for materials in the space immediately before the calorimeter, the first layer of the detector is scintillator.

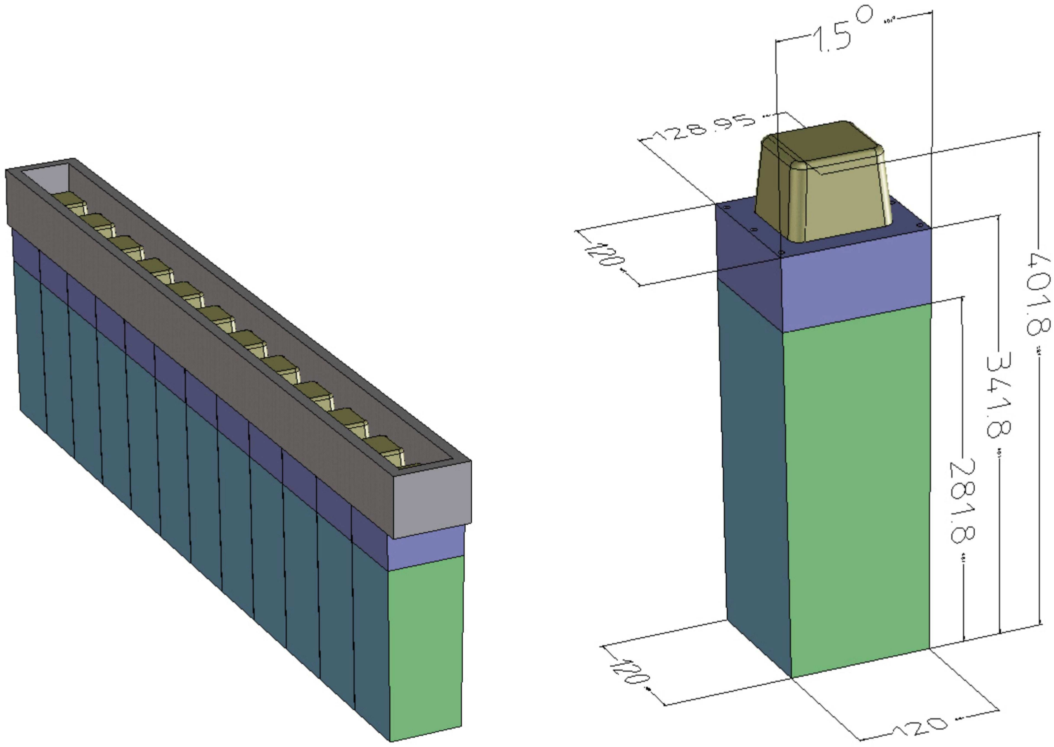


Figure 2.3: A single 1.5° taper module (right hand side) with the dimensions of the prototype shown in mm. The left hand figure shows a single strip module comprised of 12 EMCal modules integrated onto a single strong back.

Antimony Pb) and 1.76 mm polystyrene, injection moulded scintillator. White, acid free, bond paper serves as a diffuse reflector on the scintillator surfaces while the scintillator edges are treated with TiO_2 loaded reflector to provide tower to tower optical isolation and improve the transverse optical uniformity within a single tower.

The Pb-scintillator stack in a module is secured in place by the static friction between individual layers under the load of an internal pressure of ~1.3 kg/cm^2. The module is closed by a skin of 100 μm thick stainless steel welded on all four transverse surfaces to corresponding front and rear stainless steel plates. This thin stainless skin is the only inert material between the active tower volumes. The internal pressure in the module is stabilized against thermal effects, mechanical relaxation and long term flow of the Pb and/or polystyrene by a customized array of 5 non-linear spring[2] sets per module. In this way, each module is a self supporting unit with a stable mechanical lifetime of more than 20 years when held from its back surface in any orientation as when mounted in a strip module. Fig. 2.4 shows a cut away view of the back end of a single module illustrating the internal components used to sustain the module compression and a segment of the strip module strong back.

All modules in the calorimeter are mechanically and dimensionally identical. The front face dimensions of the towers are $\sim 6 \times 6$ cm^2 resulting in individual tower acceptance of $\Delta\eta \times \Delta\phi \sim 0.014 \times 0.014$ at η=0.

2.2.1 Sampling Fraction

The present conceptual design incorporates a moderate detector average active volume density of ~5.68 g/cm^3 which results from a $\sim 1 : 1.22$ Pb to scintillator ratio by volume. This results in a compact detector consistent with the EMCal integration volume at the chosen detector thickness of ~ 20.1 radiation

[2]Bellville Washers, Rolex Inc.

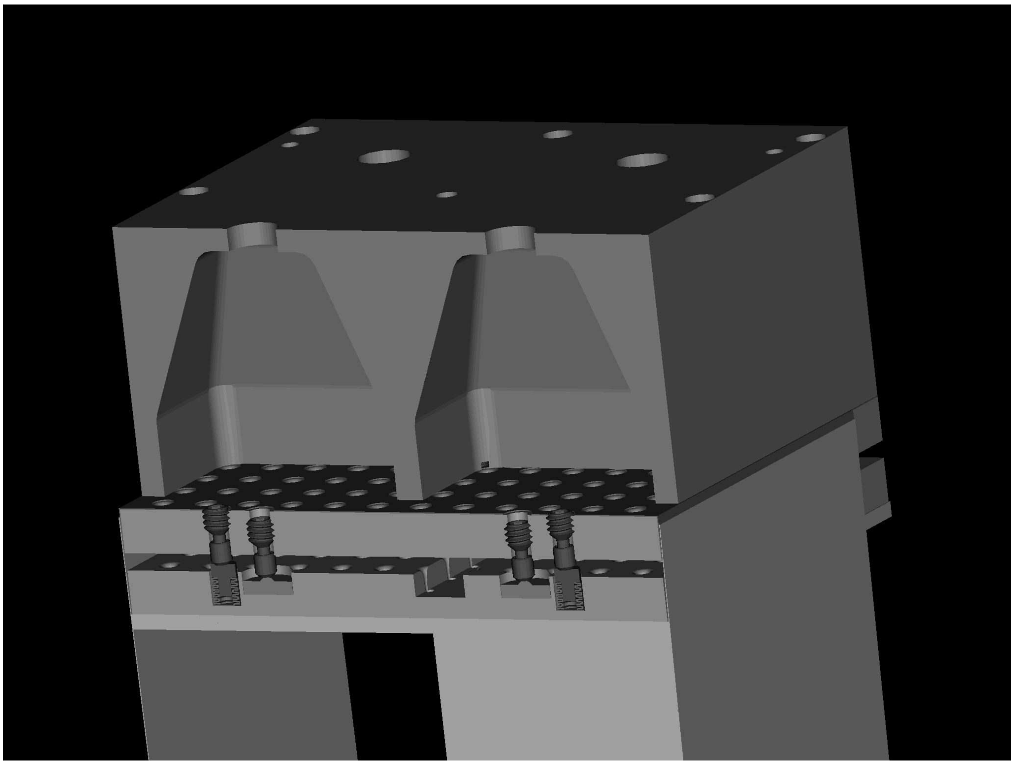


Figure 2.4: Cut away view of the back end of a single module showing the components that maintain the module's compression. A segment of the strip module strong back is also shown.

lengths ($\sim$ 20.1 X_0). In simulations, this number of radiation lengths gives a maximum deviation from linearity (due mainly to shower leakage) of $\sim$5% for the mean energy response in the range up to 100 GeV photons which is deemed acceptable.

The energy resolution of an electromagnetic calorimeter can be parameterized as

$$\sigma/E = a/\sqrt{E} \oplus b \oplus c/E \,, \tag{2.1}$$

where the first term characterized by the parameter a arises from stochastic fluctuations due to intrinsic detector effects such as energy deposit, energy sampling, light collection, etc. The constant term, b, arises from systematic effects, such as shower leakage, detector non-uniformity or channel-by-channel calibration errors. The third term, c, arises from electronic noise summed over the towers of the cluster used to reconstruct the electromagnetic shower. The three resolution contributions add together in quadrature as indicated in Eq. 2.1. Over the lower half of the energy range of interest in ALICE, the stochastic term dominates with the constant term increasing in significance at the highest energies.

The energy resolution for a given sampling frequency in a sampling electromagnetic calorimeter varies with the sampling frequency approximately as $\sigma/E \sim \sqrt{d_{\rm Sc}/f_{\rm s}}$ where $d_{\rm Sc}$ is the scintillator thickness in mm and $f_{\rm s}$ is the sampling fraction for minimum ionizing particles. For optimum resolution in a given physical space and total radiation lengths, there is thus a desire to have the highest possible sampling frequency. Practical considerations, including the total assembly labour, suggest reducing the total number of Pb/scintillator layers thus decreasing the sampling frequency. Using the 1:1.22 Pb to scintillator ratio described above as a compromise - a sampling geometry of Pb(1.44 mm)/Scint(1.76 mm) - detailed GEANT3 simulations yield $a/\sqrt{E} \oplus b\%$ with the fit results $a = (6.90 \pm 0.09)\%$ and $b = (1.44 \pm 0.03)\%$ over the range $p_{\rm t} = 5$ to 100 GeV$/c$. The simulation results are shown in Fig. 2.5. These results are based on energy deposition only and at the moment do not include photon transport efficiencies or the electronic noise contribution. Some increase in the constant a is expected from photon transport and related effects. This has been studied in test beam measurements of an early prototype of this detector with a lower sampling frequency - Pb(1.6 mm)/Scint(1.6 mm) also shown in Fig. 2.5 - and preliminary results are consistent with a small increase in a as shown in Section **??**. This will receive further study in forthcoming test beams with precisely the detector geometry described in this proposal. The value of the constant term b is dominated by shower leakage in these calculations. Other systematic effects which arise during detector fabrication and from the tower-by-tower calibration uncertainties will increase b. The latter effect is itself of the order of 1% typically. The ongoing program of test beam measurements is described in Section **??**.

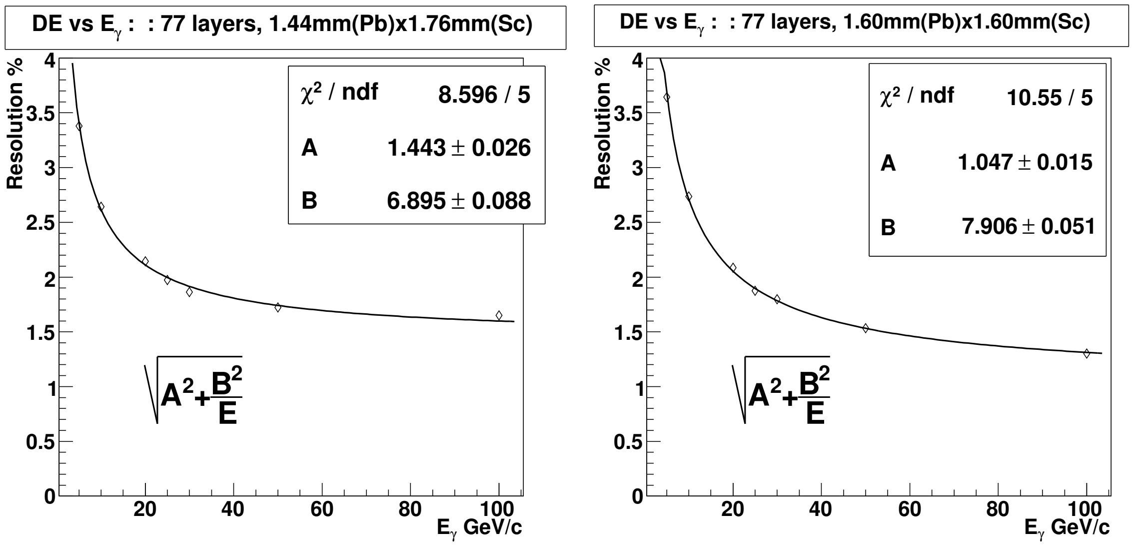


Figure 2.5: GEANT3 simulations of the EMCal module resolution. Left: Proposed production module. Right: Prototype test module.

The impact of detector energy resolution on the proposed physics program has been studied. While, given the nature of the proposed physics, there is no sharp cutoff, an energy resolution for isolated electromagnetic clusters on the order of $\sim 12\%/\sqrt{E} \oplus 2\%$ is found to be sufficient. Based on simulations and test beam results, it is expected that the EMCal performance requirements are readily met in the relevant p_t range by the proposed sampling choice. This is discussed further in connection with first test beam results in Section **??**.

The physical characteristics of the EMCal are summarized in Table 2.1.

2.2.2 Optical System and Photo Sensors

Scintillation photons produced in each tower are captured by an array of 36 Kuraray Y-11, double clad, wavelength shifting (WLS) fibres that run longitudinally through the Pb/scintillator stack. Each fibre terminates in an aluminized mirror at the front face end of the module and is integrated into a polished, circular group of 36 at the photo sensor end at the back of the module. Because the tower transverse shape deviates slightly from square as a function of longitudinal depth, we choose a fibre pattern which has exactly the same aspect ratio as the mechanical tower shape at a depth close to shower maximum. This has the effect of making the fibre pattern uniform across tower boundaries when weighted by the shower energy deposition. The properties of the selected fibres are given in Table 2.2.

The fibre bundles are pre-fabricated and inserted into the towers after the module mechanical assembly is completed. A prototype fibre bundle is shown in Fig. 2.6. The 36 individual fibres are packed into a circular array 6.8 mm in diameter and held in place inside a custom injection moulded grommet by Bicron BC-600 optical cement. An optical quality finish is applied to the assembled bundle using

Table 2.1: The EMCal Physical Parameters.

Quantity	Value
Tower Size (at η=0)	$\sim$6.0 $\times$ $\sim$6.0 $\times$ 24.6 cm^3 (active)
Tower Size	$\Delta\phi$ x $\Delta\eta$ = 0.0143 x 0.0143
Sampling Ratio	1.44 mm Pb / 1.76 mm Scintillator
Number of Layers	77
Effective Radiation Length X_o	12.3 mm
Effective Moliere Radius R_M	3.20 cm
Effective Density	5.68 g/cm^3
Sampling Fraction	10.5
Number of Radiation Lengths	20.1
Number of Towers	12,672
Number of Modules	3168
Number of Super Modules	10 full size, 2 half size
Weight of Super Module	$\sim$7.7 metric tons (full size)
Total Coverage	$\Delta\phi = 110^o$, $-0.7 < \eta < 0.7$

a diamond polishing machine. At the other end of the bundle, individual fibres are similarly polished and mirrored with a sputtered coat of aluminum and a sputtered overcoat of Al_2O_3 for protection of the mirror.

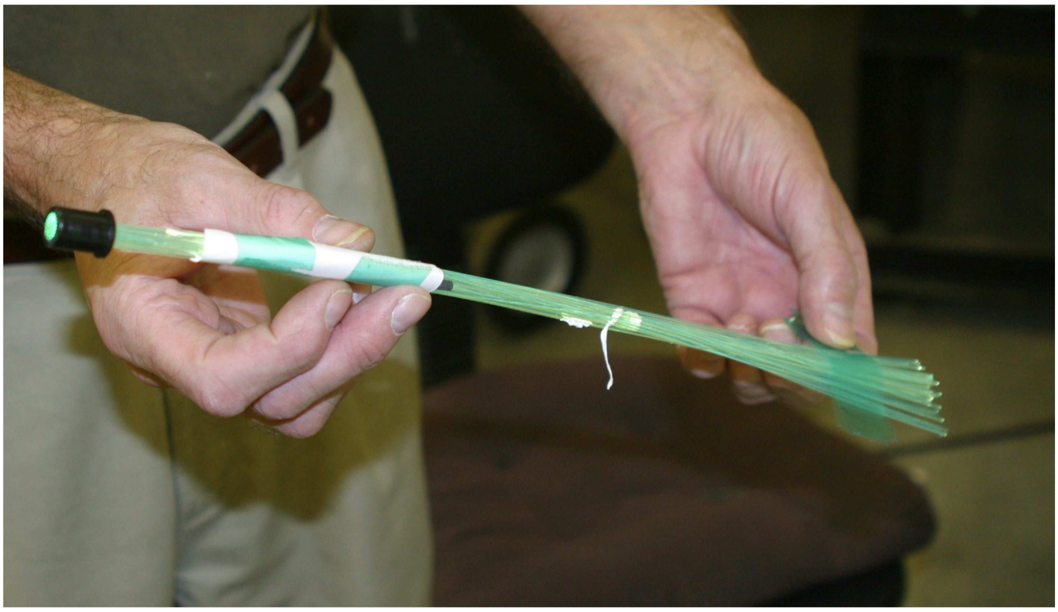


Figure 2.6: A prototype EMCal fibre bundle of 36 fibres.

A number of optical studies have been completed to assess the light transmission through individual fibres and the efficacy of the mirror applied to the fibre end at the front face of the calorimeter. In these tests, a single optical fibre connected to a UV LED light source was used to inject light of fixed amplitude at varying positions along the fibre. Tests were made with and without mirroring applied to the polished fibre end and transmitted light was recorded with an Avalanche Photo Diode (APD) photosensor as a function of position of the light injection point. Typical results are shown in Fig. 2.7. In this figure, the APD sits at zero distance and the front face of the calorimeter, in a full detector assembly, would sit at the distance of approximately 33 cm. The lower curve shows the light transmission efficiency in arbitrary units as a function of distance from the APD for a fibre without mirrored end. The upper curve shows the effect of including mirroring on the fibre end. The response is considerably flatter with an overall increase in efficiency in the range of about 25% in the vicinity of shower maximum (i.e. the location of the highest energy deposition for an electromagnetic shower). Shower maximum occurs at about 26 cm on the distance scale of Fig. 2.7. This number accounts for material immediately in front of the detector; which ranges between 0.4 and 0.8 radiation lengths, and assumes 5.5 - 6.0 radiation lengths for shower maximum for 10 GeV photons. At this depth in the detector, the mirrored fibre response is very uniform and contributes nothing significant to the non-linearity of the detector as a whole.

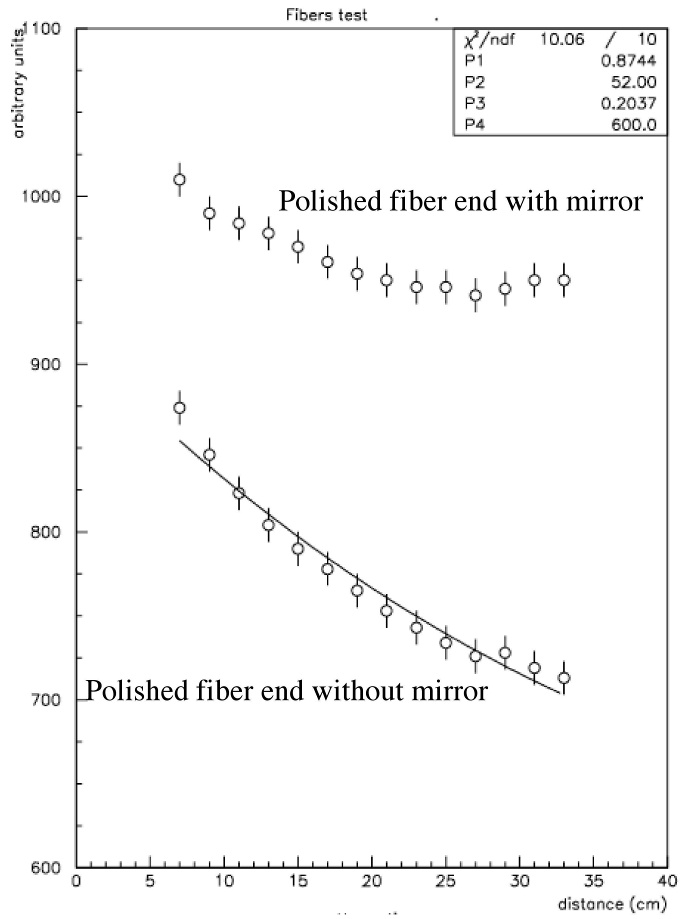


Figure 2.7: Comparison of light transmission efficiency versus distance of propagation for Kuraray Y-11 fibres with and without aluminized mirrored ends.

Other factors which can significantly impact the electromagnetic performance of the calorimeter, include scintillator edge treatment and the density of the wavelength shifting fibre readout pattern and the material chosen for the interlayer diffuse reflector. For scintillator edge treatment and fibre density, we were able to take advantage of the extensive studies made by the LHCb collaboration for their ECAL [3]. Given that we use the same scintillator with virtually identical towers size to the LHCb "middle modules", we were able to adopt their procedures for scintillator edge treatment and fibre density after a series of relatively simply checks. In particular, we have adopted a diffuse reflector edge treatment such as that obtained with Bicron Titanium Dioxide loaded white paint (BC622A) and a total fibre density of about one fibre per cm^2. In the case of the interlayer diffuse reflector, we have to deviate from LHCb and use a white, acid free, bond paper in place of the Teflon based commercial TYVEK. While TYVEK produces slightly better surface reflectivity, its coefficient of friction is too low to permit its use in this design where the module's mechanical stability depends somewhat on the interlayer friction. The white paper used in the EMCal prototypes has been previously studied for aging effects in connection with the STAR calorimeter project [4].

Table 2.2: Characteristics of the selected wavelength shifting fibres.

Quantity	Value
WLS Fibre	Y-11 (200) M-DC
Manufacturer	Kuraray
WLS Fluor	K27 200 mg
Absorbtion Peak	430 nm
Emission Peak	476 nm
Decay Time	7 ns
Core material	PS
Refractive Index	1.59
Inner Cladding	PMMA
Refractive Index	1.49
Outer Cladding	FP
Refractive Index	1.42
Long Fibre Attenuation Length	3.5 m
Fibre Diameter	1.0 mm

The 6.8 mm diameter fibre bundle from a given tower connects to the APD through a short light guide/diffuser with a square cross section of 7 mm $\times$ 7 mm that tapers slowly down to 4.5 mm $\times$ 4.5 mm as it mates (glued) to the 5 mm $\times$ 5 mm active area of the photo sensor.

Fig. 2.8 shows 4 pre-fabricated fibre bundles inserted into the towers of a single prototype module. In this picture all of the module rear enclosing and structural elements are omitted so the convergence of the wavelength shifting fibres may be seen as they converge to the light guide (inside the black plastic tube) and finally to mate with the APD and charge sensitive preamplifier. The APD and preamplifier are discussed at length in Section **??**. Here we will mention briefly their optical characteristics. The selected photo sensor is the Hamamatsu S8664-55 Avalanche Photo Diode. This photodiode has a peak spectral response at a wavelength of 585 nm compared to an emission peak of 476 nm for the Y-11 fibres. However, both the spectral response and the quantum efficiency of the APD are quite broad with the latter dropping from the maximum by only $\sim$5% at the WLS fibre emission peak. At this wavelength, the manufacturer's specification gives a quantum efficiency of 80%.

2.3 Module Integration to Strip Modules and Super Modules

As described above, the super module is the basic building block of the calorimeter. Starting with 288 individual modules which are rather compact and heavy, the main engineering task is to create a super module structure which is rigid, with small deflections in any orientation yet does not require extensive, heavy external stiffening components that would reduce the volume available for the active detector. The solution adopted for the ALICE EMCal is to develop a super module ”crate” which functions not as a box for the individual modules but rather an integrated structure in which the individual elements contribute to the overall stiffness. The super module crate is effectively a large I-beam in which the flanges are the long sides of the crate and the 24 rows of strip modules together form the web. This configuration gives to the super module good stiffness for both the 9 o'clock and 10 o'clock locations. For the 12 o'clock location, the I-beam structure of the super module is augmented by a 1 mm thick stainless steel forward sheet (traction loaded), which controls the bending moment tending to ”open” the crate main sides, and helps to limit deflection of strip modules.

Figure 2.8: Fibre bundles with attached APD and preamplifier of four towers of an EMCal module.

The super module crate concept is illustrated in Figs. 2.9 and 2.10. For the purpose of clarity in these illustrations, only 6 of the 24 strip modules are included. Ridges are provided on the interior surfaces of the crate to allow precision alignment of the strip modules at the correct angle.

The stiffness given by this I-beam concept allows the use of non-magnetic light alloys for main parts of the super module crate. Unlike austenitic stainless steels, light alloys are easy to machine, helping to limit both cost and weight. Parts of the super module crate will be made mainly from laminated 2024 aluminum alloy plates. The two main sides (flanges of the I-beam) of the crate will be assembled from 2 plates, 25 mm and 25 mm thick, bolted together and arranged so as to approximately follow the taper of the 20 degree sector boundary.

Each of the 24 rows of a super module contain 12 modules as described in Section 2.4. Each of the modules is attached to a transverse beam by 3–4 mm diameter stainless steel screws. The 12 modules and the transverse beam form a strip module.

The strip module is roughly 1440 mm long, 120 mm wide, 410 mm thick. The total weight of the strip module is approximately 300 kg and like module, it is a self supporting unit. The transverse beam, which is the structural part of the strip module, is made from cast aluminum alloy with individual cavities along its length where the fibres emerging from towers are allowed to converge. The casting process is well suited to forming these cavities and the overall structure, saving considerable raw material and machining time. Fig. 2.11 shows the overall layout and dimensions of a strip module.

In addition to functioning as a convenient structural unit which offers no interference with the active volume of the detector and forming the web of the I-beam structure of the super module, the transverse beam of the strip module provides protection for the fibres, a structural mount for the light guide, APD and charge sensitive preamplifier and a light tight enclosure for these elements.

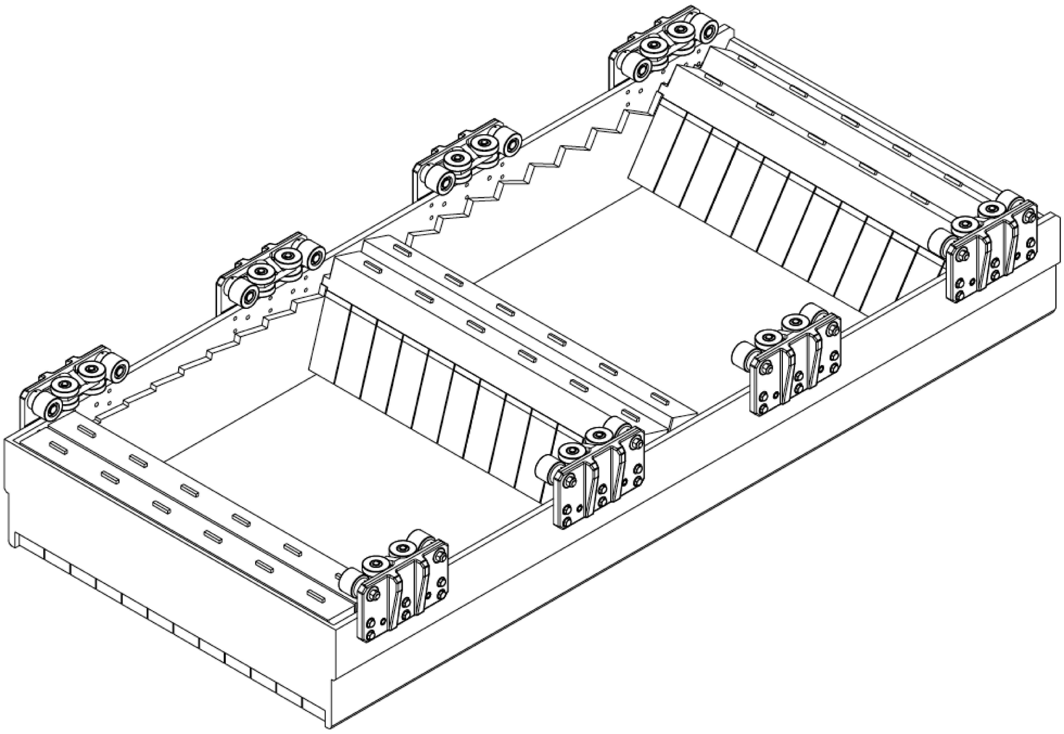


Figure 2.9: Conceptual layout of the super module crate. Only six of the 24 strip modules are inserted in this figure for clarity - two near the zero rapidity end, two near the center and two near the high rapidity end.

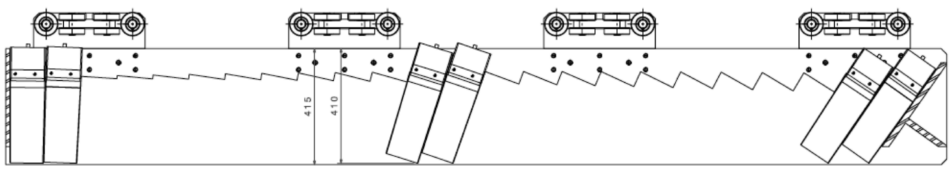


Figure 2.10: A side view of the super module crate showing the function of the ridges used to align the strip modules. Only six strip modules are shown here for clarity.

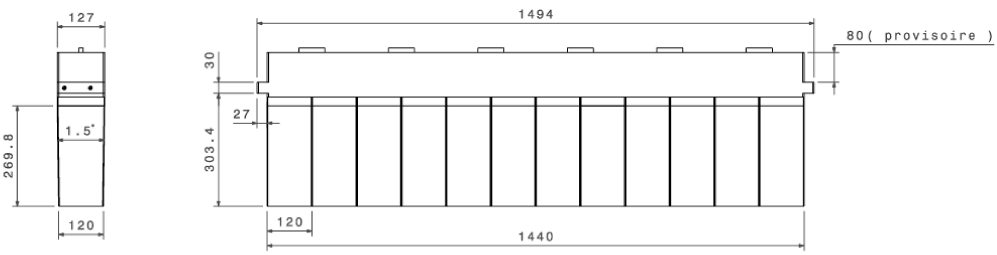


Figure 2.11: Strip module layout showing dimensions and the 1.5 degree taper.

2.4 Mechanical Analysis

Analysis of the strip modules and super modules was performed with the CATIA application for 3D modeling and Samcef Field for Finite Element analysis (FEA). All calculations were performed for a super module mass of approximately 9950 kg. This super module mass results in a total weight for the EMCal detector of 110 tons and corresponds to a detector with an active depth of 22 radiation lengths. This total weight is close to the upper limit still providing a sufficient safety factor for support surfaces in the ALICE magnet. The detector considered in this proposal actually has an active depth of 20 radiation lengths and has approximately 10% less mass than the detector modeled in the analysis. This 10% may be viewed as an extra safety factor or may be regarded as a margin to permit some increase in the active detector depth should future simulations of physics performance suggest that this is required.

2.4.1 Super Module Crate

FEA calculations show, for a load of 100 kN, a maximum stress of roughly 20 Mpa at 12 o'clock location and 120 Mpa at 9 o'clock location. These points of maximum stresses occur close to the super module mounting points at the carriages (Figs. 2.9 and 2.10). This level of stress is acceptable for the 2024 aluminum alloy which performs to a 290 Mpa yield strength. The crate features a deformation of 0.8–1.0 mm at the 9 o'clock location.

2.4.2 Strip Module

Calculations show that the cast strip module will have a maximum stress less than 15 Mpa while 42000 cast aluminum alloy performs to a yield strength of 180 Mpa. The maximum deflection of a strip module is foreseen at 0.7–0.9 mm, for the 12 o'clock location.

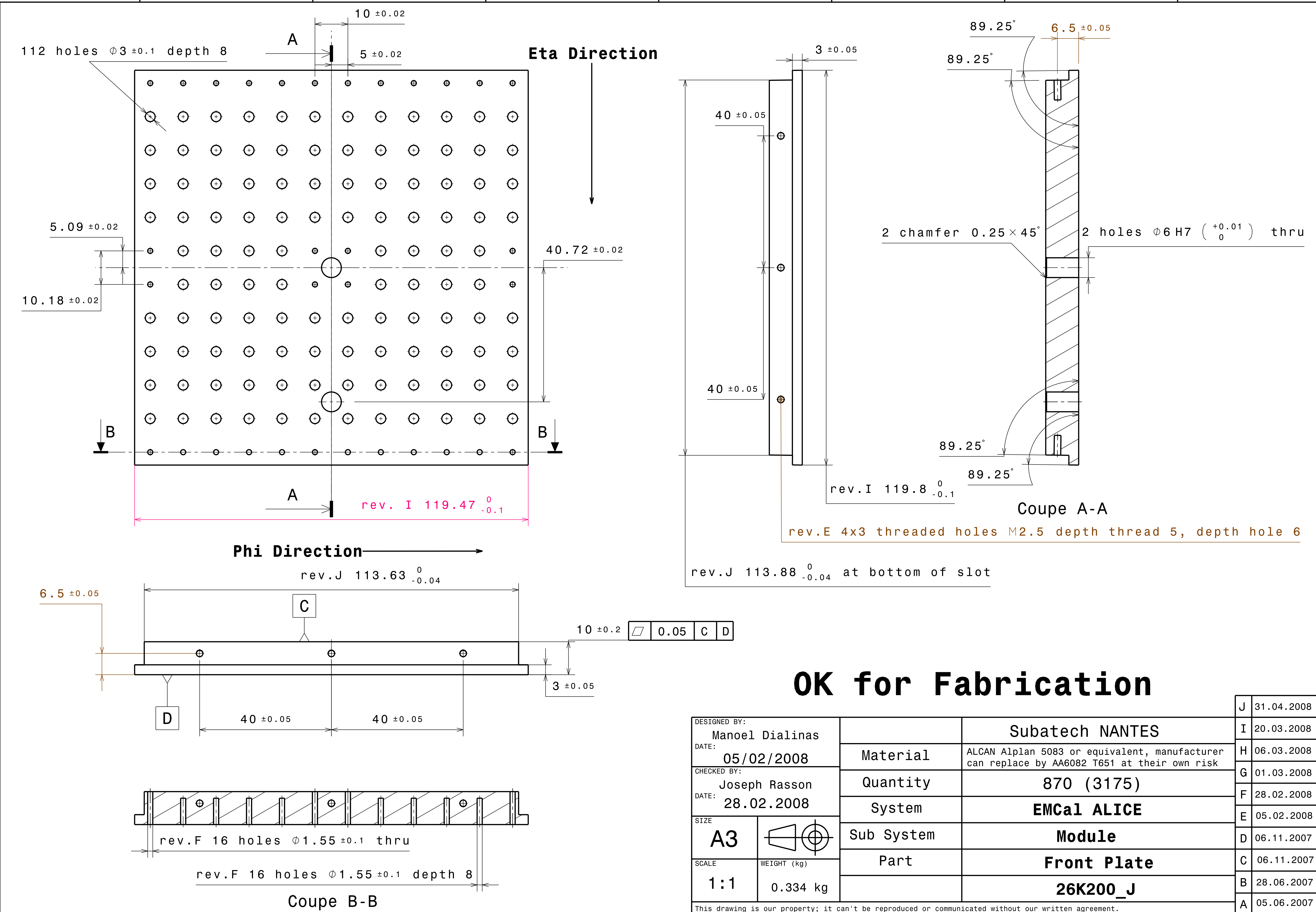
References

Chapter 2

[1] ALICE Collaboration, *A Large Ion Collider Experiment*, CERN/LHCC 95-71, 15 December 1995.
[2] L. Aphecetche *et. al.*, (PHENIX), Nucl. Instrum. Methods **A499** (2003) 521.
[3] LHCB Collaboration, *LHCb TDR2*, CERN/LHCC 2000-36, 6 September 2000.
[4] M. Beddo et al, *The STAR barrel electromagnetic calorimeter*, Nucl. Instrum. Methods **A499** (2003) 725.

Federico Ronchetti / Manoel Dialinas 2008.7.10

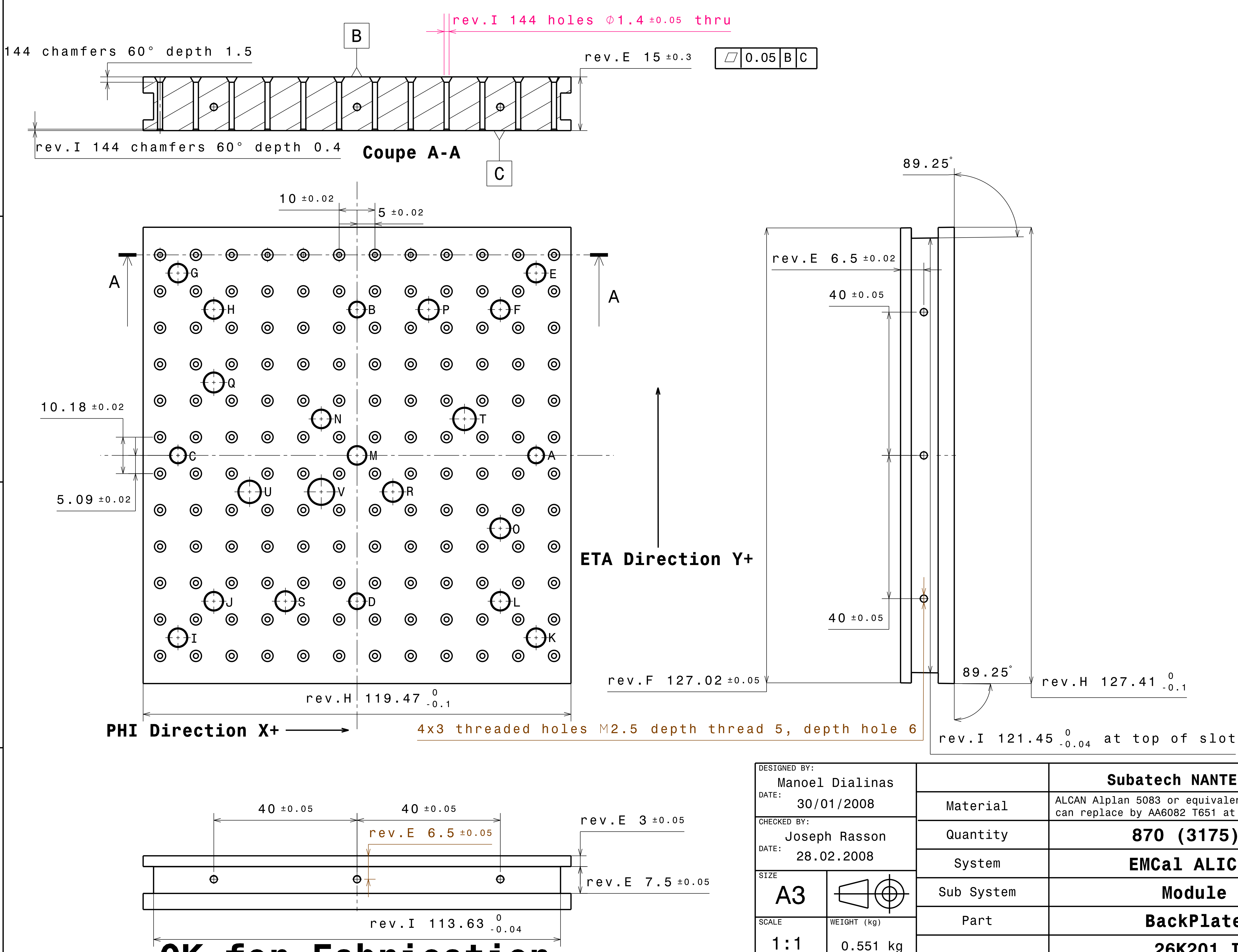
MODULE COMPONENTS	**26K2xx**	**Last Rev.**	**Rev. Time**	**Order Time**	**Company**	
Front Plate	26K200	J released	2008.4.7	2008.4.1	Mecanotecnica	Delivered
Back Plate	26K201	I released	2008.4.7	2008.4.1	Mecanotecnica	Delivered
Compression Plate	26K202	F released	2008.4.8	2008.4.1	Mecanotecnica	Delivered
Straps	26K203	E released	2008.4.4		LRA	
Lead Absorber	26K204	C released	2008.4.9		Goslar	
Scintillator Tile	26K205	A approved	2007.6.12		Uniplast	
Bond Paper	26K206	B approved			FFT	
Fiber Bundle Terminator	26K207	D released	2008.3.5			
Strap Flange	26K208	H released	2008.4.25	2008.4.10	Gardette	
Belleville Washers Plunger Pin	26K209	C released	2008.4.8		Mecanotecnica	
Dowel Pin (CP - BP)	26K210	A removed				
Black Sticker	26K211				Sony	
Stud (fixation module-strongback)	26K212	A released				
Bushing	26K213	A removed				
Strap Foil	26K214	B approved	2008.1.10	2008.4.8	LPSC	
Plunger Pin Pusher	26K215	D released	2008.4.11			
Belleville Washers					Schnorr	
STRIP MODULE COMPONENTS	**26K3xx**					
StrongBack casting	26K301	C approved	2008.3.4	2008.3.10	Renouard	
StrongBack machining	26K302	D released	2008.3.19	2008.3.10	Mecaria	
LED Ferrule	26K303	A approved	2007.12.12			
T-Card	26K304	A approved				
T-Card Fixation	26K305	B released	2008.2.18			
Central Cover Plate	26K306	A released	2008.3.17			
Preampl Fiber Manifold	26K307	B released	2008.2.19			
Light Guide	26K308	A released	2007.12.7		Uniplast	
APD mount	26K309	C released	2008.3.5			
TCardStud	26K310	A released	2008.1.15			
Bridge Cover	26K311					
Side Cover Plate	26K312	A released	2008.3.17			
SUPER MODULE COMPONENTS	**26K4xx**					
Montage Crate	26K400	E released	2008.3.27		B3	
Nomenclature	26K401					
Nomenclature	26K402					
Face inférieure gauche	26K403	G released	2008.4.1		B3	
Face inférieure droite	26K404	G released	2008.4.1		B3	
Face supérieure gauche	26K405	F released	2008.3.27		B3	
Face supérieure droite	26K406	F released	2008.3.27		B3	
Pièces arrière	26K407	E released	2008.3.27		B3	
Plaque inférieure	26K408	D released	2008.3.27		B3	
Pièce inférieure	26K409	E released	2008.3.27		B3	
Face appui arrière	26K410	E released	2008.3.27		B3	
STRIPMODULE TOOLINGS	**26K5xx**					
Base_Granit	26K501	A released	2008.4.7		MicroPlan	delivered
Support	26K502	A released	2008.4.7		Meca Atlantique	delivered
Rod	26K503					
Rib	26K504					
Lift Table	26K505					
Set Up Device 1	26K506					
Set Up Device 2	26K507					
Locating Pin	26K508					
Support	26K509					
SUPERMODULE TOLINGS	**26K6xx**					



OK for Fabrication

DESIGNED BY: Manoel Dialinas DATE: 05/02/2008		Subatech NANTES	
	Material	ALCAN Alplan 5083 or equivalent, manufacturer can replace by AA6082 T651 at their own risk	
CHECKED BY: Joseph Rasson DATE: 28.02.2008	Quantity	870 (3175)	
	System	**EMCal ALICE**	
SIZE A3	Sub System	**Module**	
	Part	**Front Plate**	
SCALE 1:1 / WEIGHT (kg) 0.334 kg		**26K200_J**	

Rev	Date
J	31.04.2008
I	20.03.2008
H	06.03.2008
G	01.03.2008
F	28.02.2008
E	05.02.2008
D	06.11.2007
C	06.11.2007
B	28.06.2007
A	05.06.2007



OK for Fabrication

4 threaded holes M5x0.8 thru ⌖ ±0.05

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A	50.00	0
B	0	40.72
C	-50.00	0
D	0	-40.72

10 threaded holes M6x1 thru ⌖ ± 0.05

	X	Y
E	50.00	50.90
F	40.00	40.72
G	-50.00	50.90
H	-40.00	40.72
I	-50.00	-50.90
J	-40.00	-40.72
K	50.00	-50.90
L	40.00	-40.72
M	0	0
N	-10.00	10.18

5 holes Φ 5.3 H9 thru ⌖ ±0.05

	X	Y
O	40.00	-20.36
P	20.00	40.72
Q	-40.00	20.36
R	10.00	-10.18
S	-20.00	-40.72

2 holes Φ 6H7 thru ⌖ 0.05

	X	Y
T	30	10,18
U	-30	-10,18

1 hole Φ 7 ±0.1 thru ⌖ 0.05

	X	Y
V	-10	-10.18

DESIGNED BY: Manoel Dialinas DATE: 30/01/2008		Subatech NANTES	I	07.04.2008
	Material	ALCAN Alplan 5083 or equivalent, manufacturer can replace by AA6082 T651 at their own risk	H	20.03.2008
CHECKED BY: Joseph Rasson DATE: 28.02.2008	Quantity	870 (3175)	G	01.03.2008
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SIZE A3	Sub System	Module	E	30.01.2008
SCALE 1:1 / WEIGHT (kg) 0.551 kg	Part	BackPlate	D	31.10.2007
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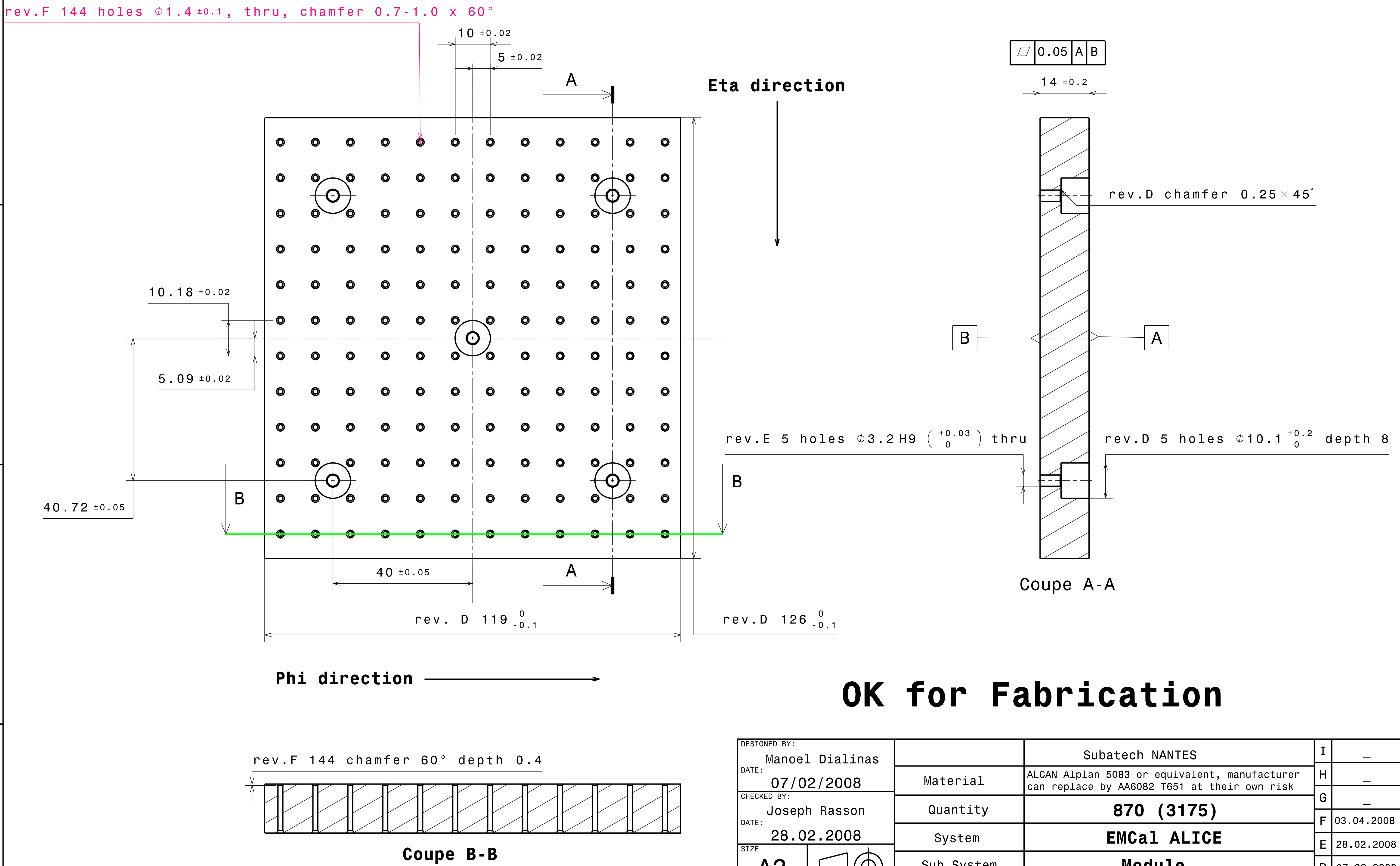
			B	28.06.2007
			A	12.06.2007



DESIGNED BY: Manoel Dialinas DATE: 07/02/2008		Subatech NANTES	I	_
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CHECKED BY: Joseph Rasson DATE: 28.02.2008	Quantity	870 (3175)	G	_
	System	EMCal ALICE	F	03.04.2008
SIZE A3	Sub System	Module	E	28.02.2008
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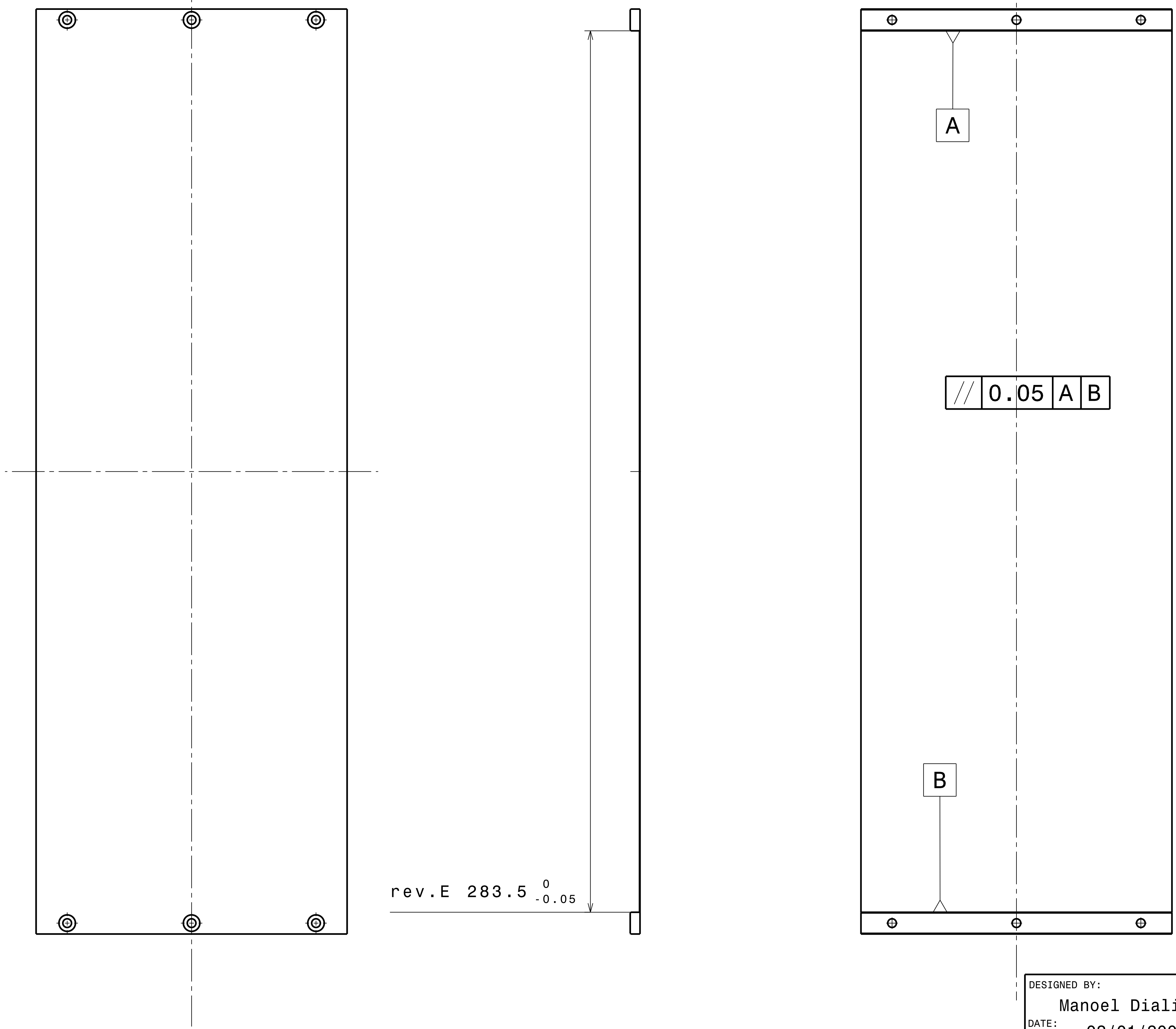
			B	10.07.2007
			A	06.06.2007



Foil is welded to Flanges by Laser Welding process.

Manufacturer is free to define the welding path and its location according to his knowledge.

Weld preparation is up to the Manufacturer.

Only internal sides of flanges need to be parallel within 0.05 mm.

Scratch allowed.

Micro-balls allowed.

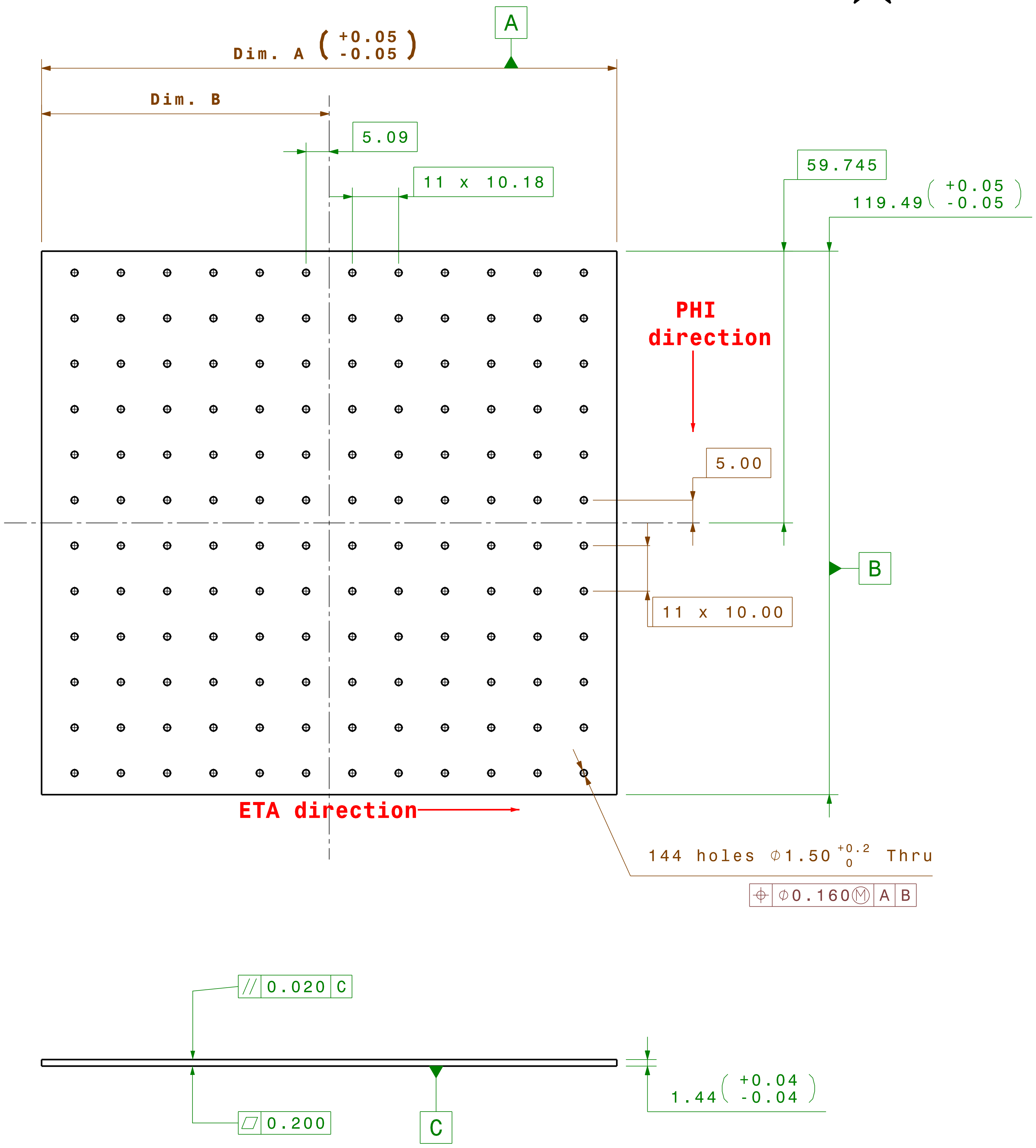
Weld is required to support a 2500 N stretching load between the 2 Flanges.

Extra thickness of weld should not excess 0.035 mm.

Rev.	Author	Date	Description
E	M. Dialinas	04.04.08	Cotation, Tolerances
D	M. Dialinas	20.03.08	Tolerance on thickness
C	M. Dialinas	21.01.08	Flanges distance & thickness
B	M. Dialinas	04.01.08	Laser welding, flanges, tolerances
A	P. Pipersky	12.06.07	Initial revision

DESIGNED BY: Manoel Dialinas DATE: 02/01/2008		Subatech NANTES
	Material	Stainless Steel 304L
CHECKED BY: Joseph Rasson DATE: 19/02/2008	Quantity	3500
	System	EMCal ALICE
SIZE A3	Sub System	Module
SCALE 2:3 / WEIGHT (kg) 0.062 kg	Part	Strap
		26K203_E

OK for fabrication



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2	119.89	59.945	27	122.12	61.060	52	124.35	62.175
3	119.98	59.990	28	122.21	61.105	53	124.44	62.220
4	120.07	60.035	29	122.30	61.150	54	124.53	62.265
5	120.16	60.080	30	122.39	61.195	55	124.61	62.305
6	120.25	60.125	31	122.48	61.240	56	124.70	62.350
7	120.34	60.150	32	122.57	61.285	57	124.79	62.395
8	120.43	60.215	33	122.65	61.327	58	124.88	62.440
9	120.52	60.260	34	122.74	61.370	59	124.97	62.485
10	120.61	60.305	35	122.83	61.415	60	125.06	62.530
11	120.70	60.350	36	122.92	61.460	61	125.15	62.575
12	120.79	60.395	37	123.01	61.505	62	125.24	62.620
13	120.87	60.435	38	123.10	61.550	63	125.33	62.665
14	120.96	60.480	39	123.19	61.595	64	125.42	62.710
15	121.05	60.525	40	123.28	61.640	65	125.51	62.755
16	121.14	60.570	41	123.37	61.685	66	125.59	62.795
17	121.23	60.615	42	123.46	61.730	67	125.68	62.840
18	121.32	60.660	43	123.55	61.775	68	125.77	62.885
19	121.41	60.705	44	123.63	61.815	69	125.86	62.930
20	121.50	60.750	45	123.72	61.860	70	125.95	62.975
21	121.59	60.795	46	123.81	61.905	71	126.04	63.020
22	121.67	60.835	47	123.90	61.950	72	126.13	63.065
23	121.76	60.880	48	123.99	61.995	73	126.22	63.110
24	121.85	60.925	49	124.08	62.040	74	126.31	63.155
25	121.94	60.970	50	124.17	62.085	75	126.40	63.200
						76	126.49	63.245

OK for production

Rev.	Author	Approver	Date	Change Description
C	Dialinas		09.04.08	Errors corrections
B	Dialinas	Dialinas	12.10.07	Tolerances, Transverse Dimensions
A	Pipersky	Pipersky	12.06.07	Initial Revision

C

Material : Pure Lead (Pb > 99.0 %) Subatech

EMCal ALICE

Module

Lead Aborber Plate

1/1 EMCal_26K204_C Rev. B

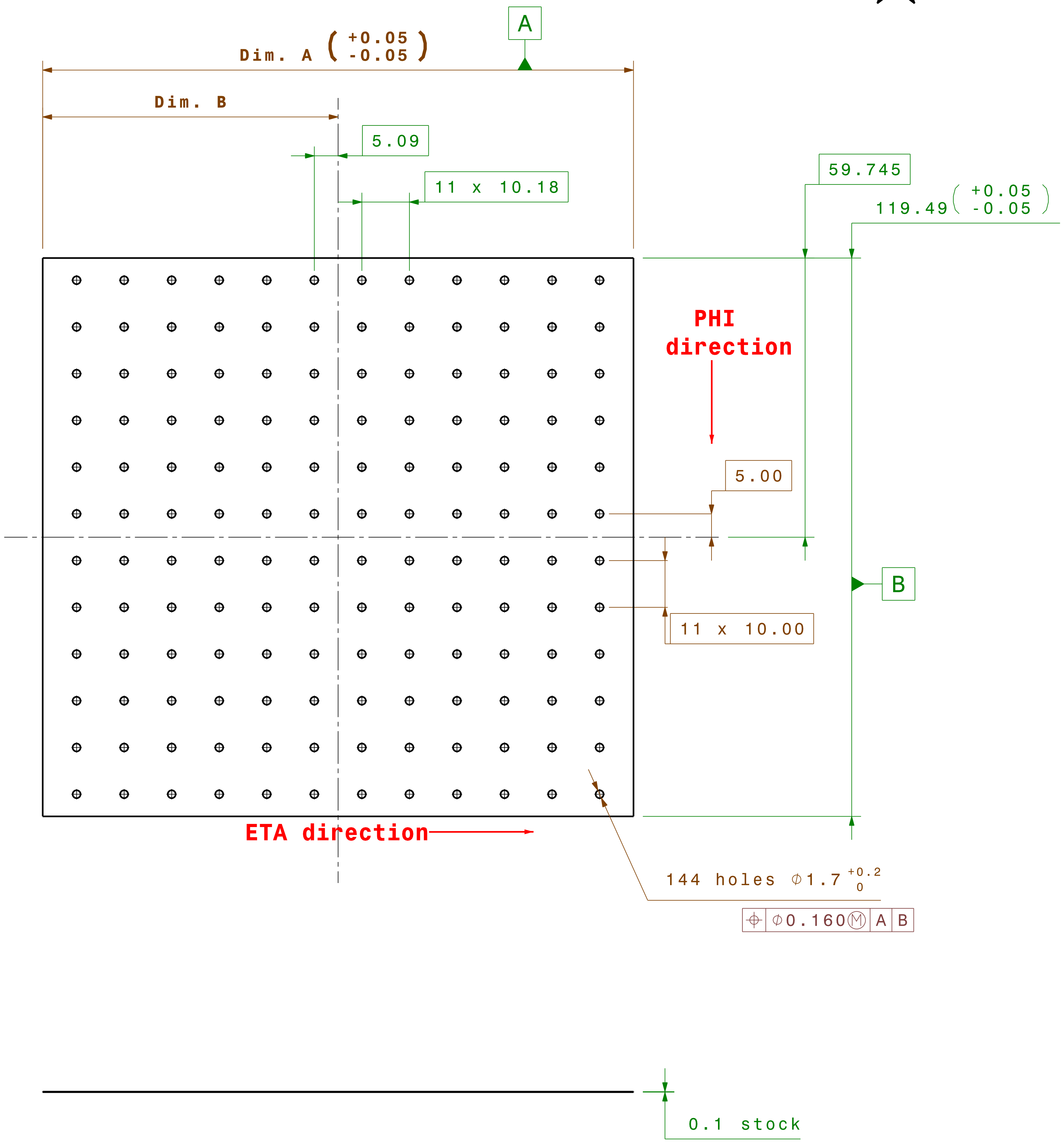


Plate	Dim. A	Dim. B	Plate	Dim. A	Dim. B	Plate	Dim. A	Dim. B
1	119.80	59.900	26	122.03	61.015	51	124.26	62.130
2	119.89	59.945	27	122.12	61.060	52	124.35	62.175
3	119.98	59.990	28	122.21	61.105	53	124.44	62.220
4	120.07	60.035	29	122.30	61.150	54	124.53	62.265
5	120.16	60.080	30	122.39	61.195	55	124.61	62.305
6	120.25	60.125	31	122.48	61.240	56	124.70	62.350
7	120.34	60.150	32	122.57	21.285	57	124.79	62.395
8	120.42	60.215	33	122.65	122.65	58	124.88	62.440
9	120.51	60.260	34	122.74	61.370	59	125.97	62.985
10	120.60	60.305	35	122.83	61.415	60	125.06	62.530
11	120.69	60.350	36	122.92	61.460	61	125.15	62.575
12	120.78	60.395	37	123.01	61.505	62	125.24	62.620
13	120.87	60.435	38	123.10	61.550	63	125.33	62.665
14	120.96	60.480	39	123.19	61.595	64	125.42	62.710
15	121.05	60.525	40	123.28	61.640	65	125.51	62.755
16	121.14	60.570	41	123.37	61.685	66	125.60	62.795
17	121.23	60.615	42	123.46	61.730	67	125.69	62.840
18	121.32	60.660	43	123.55	61.775	68	125.78	62.885
19	121.41	60.705	44	123.64	61.815	69	125.87	62.930
20	121.50	60.750	45	123.72	61.860	70	125.95	62.975
21	121.59	60.795	46	123.81	61.905	71	126.04	63.020
22	121.67	60.835	47	123.90	61.950	72	126.13	63.065
23	121.76	60.880	48	123.99	61.995	73	126.22	63.110
24	121.85	60.925	49	124.08	62.040	74	126.31	63.155
25	121.94	60.970	50	124.17	62.085	75	126.40	63.200
						76	126.49	63.245

Rev.	Author	Approver	Date	Change Description
B	Dialinas	Dialinas	05.12.07	Tolerances, Transverse Dimensions
A	Pipersky	Pipersky	12.06.07	Initial Revision

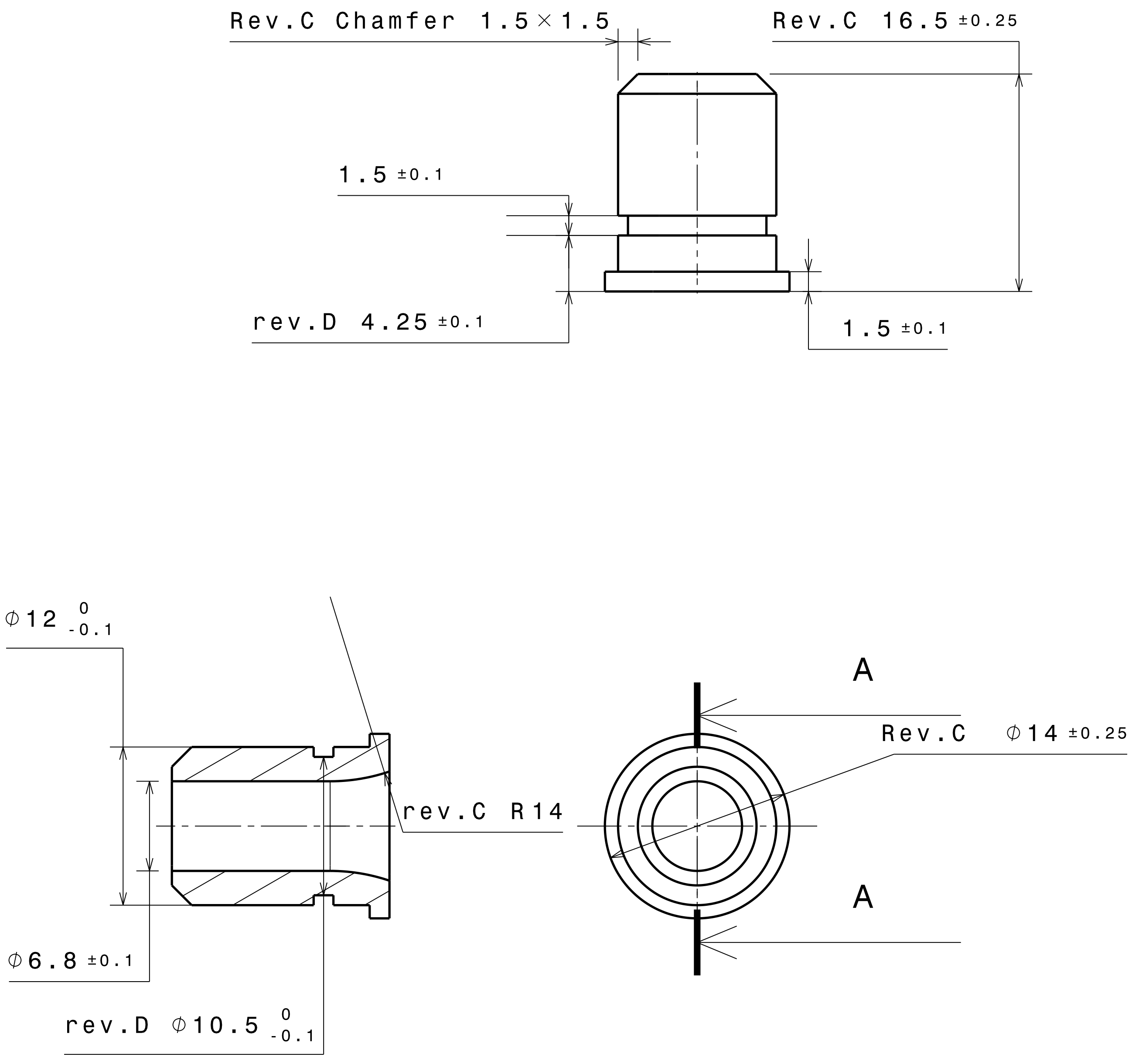
Material : 20 WT Bond Paper 0.1 mm — Subatech

EMCal ALICE

Module

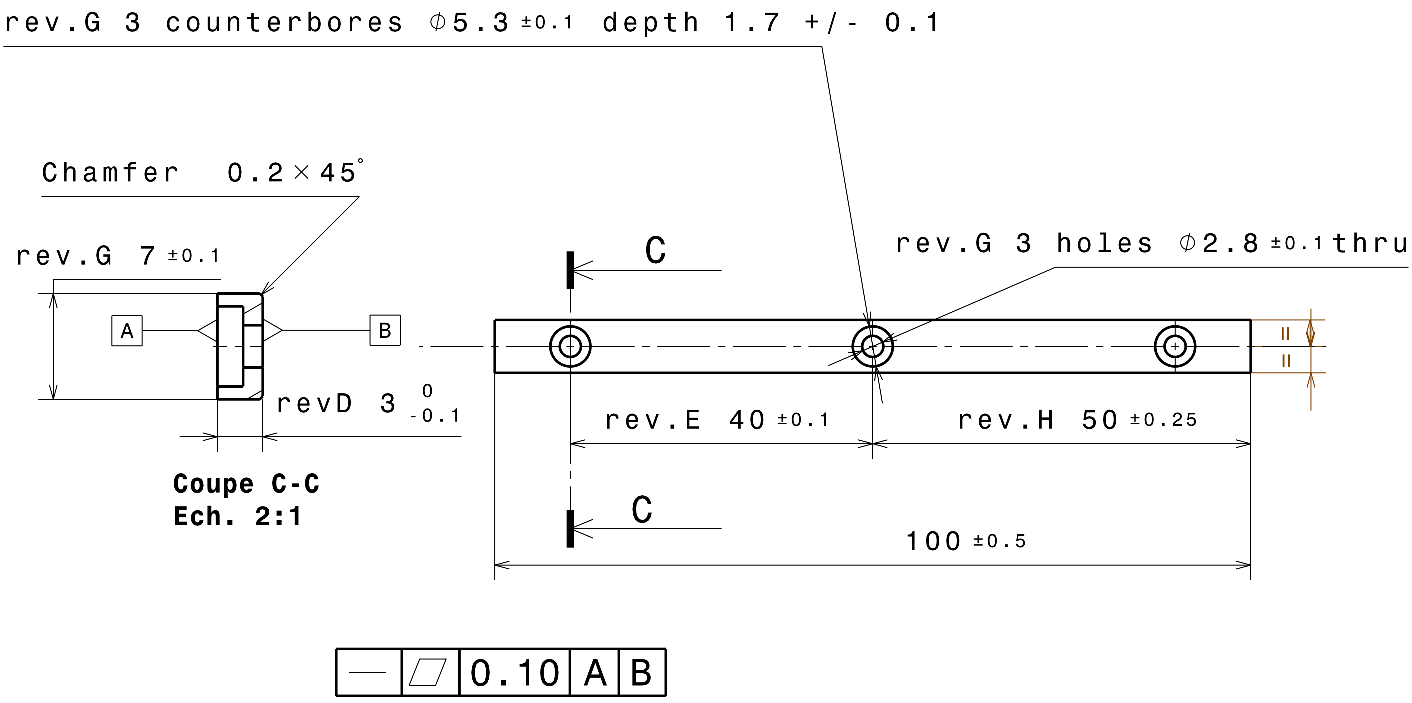
Bond Paper

1/1 — EMCal_26K206_B — Rev. B



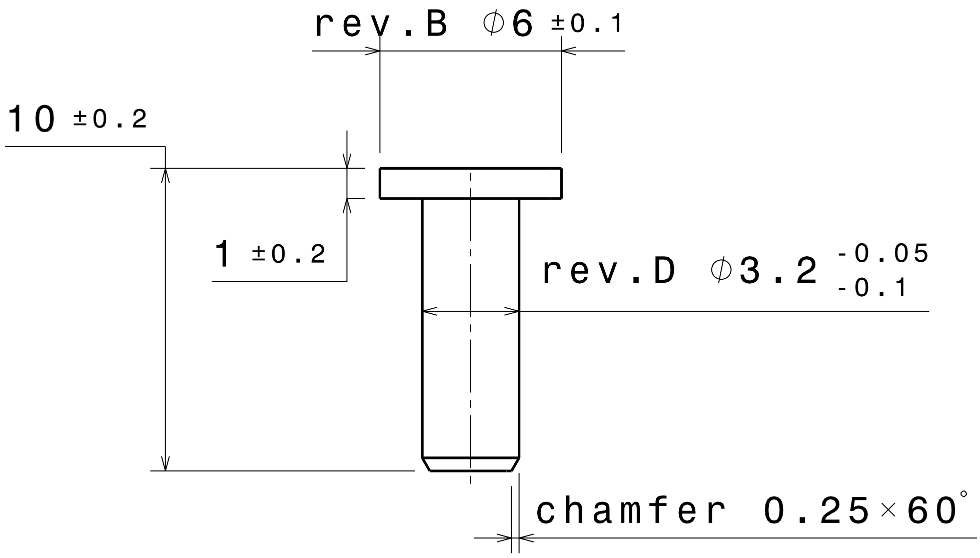
Coupe A-A

DESIGNED BY: Manoel Dialinas DATE: 18.02.2008		**Subatech NANTES**	I	_
	Material	Noryl (PPO) Fire Resistant Grade	H	_
CHECKED BY: Fred Pompei DATE: XXX	Quantity	**3460 (11680)**	G	_
	System	**EMCal ALICE**	F	_
SIZE A4	Sub System	**Module**	E	_
			D	05.03.2008
SCALE 1:1 / WEIGHT (kg) 0,0033 kg	Part	**Fiber Bundle Terminator**	C	18.02.2008
		EMCal_26K207_D	B	06.12.2008
			A	_



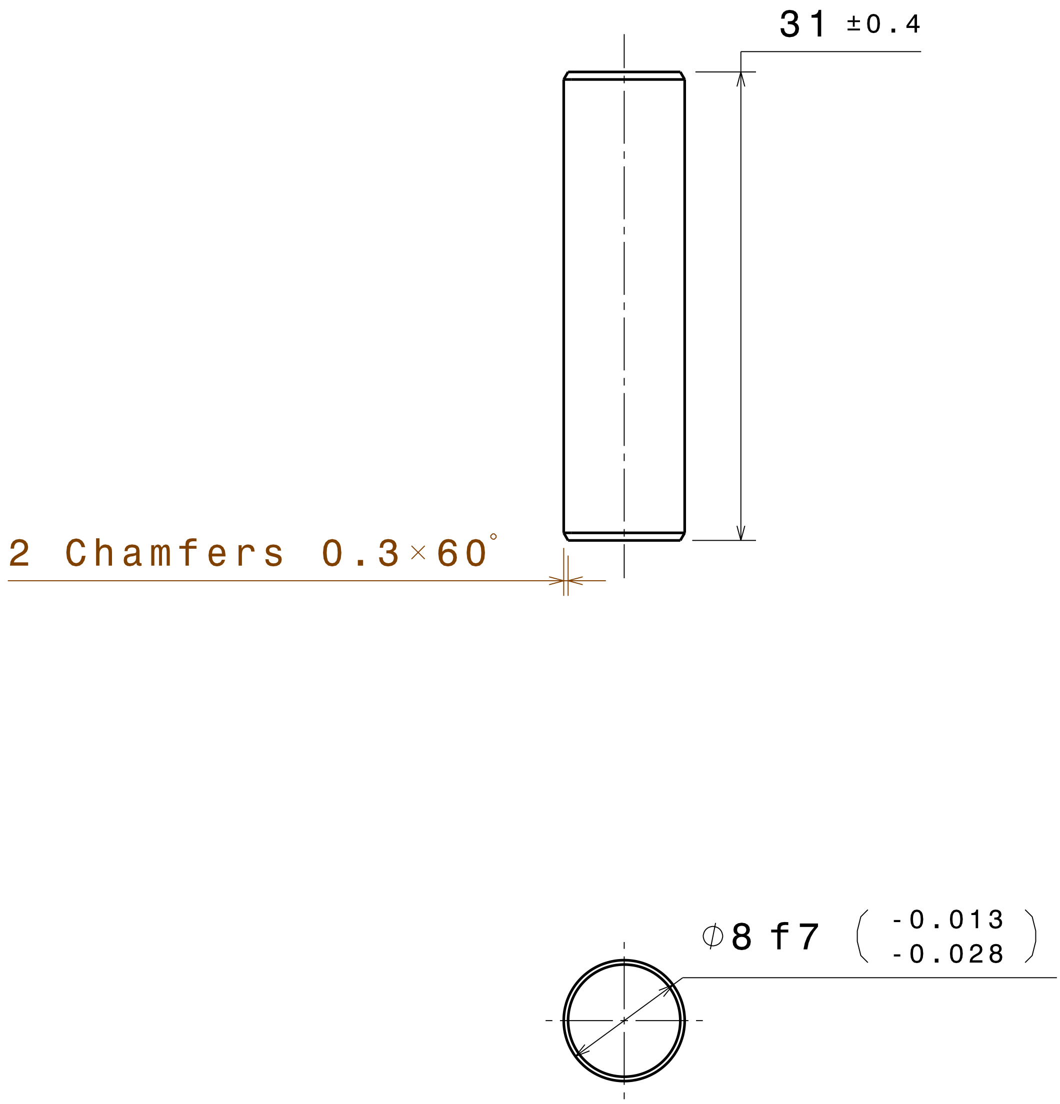
OK for fabrication

DESIGNED BY: Manoel Dialinas		Subatech NANTES	I	_
DATE: 08/01/2008	Material	Stainless Steel 304L	H	25.04.2008
CHECKED BY: Joseph Rasson	Quantity	7000	G	07.04.2008
DATE: 19/02/2008	System	EMCal ALICE	F	20.03.2008
SIZE A4	Sub System	Module	E	19.03.2008
SCALE 1:1 / WEIGHT (kg) 0.015 kg	Part	Strap Flange	D	17.03.2008
		26K208_H	C	15.02.2008
			B	08.01.2008
			A	_



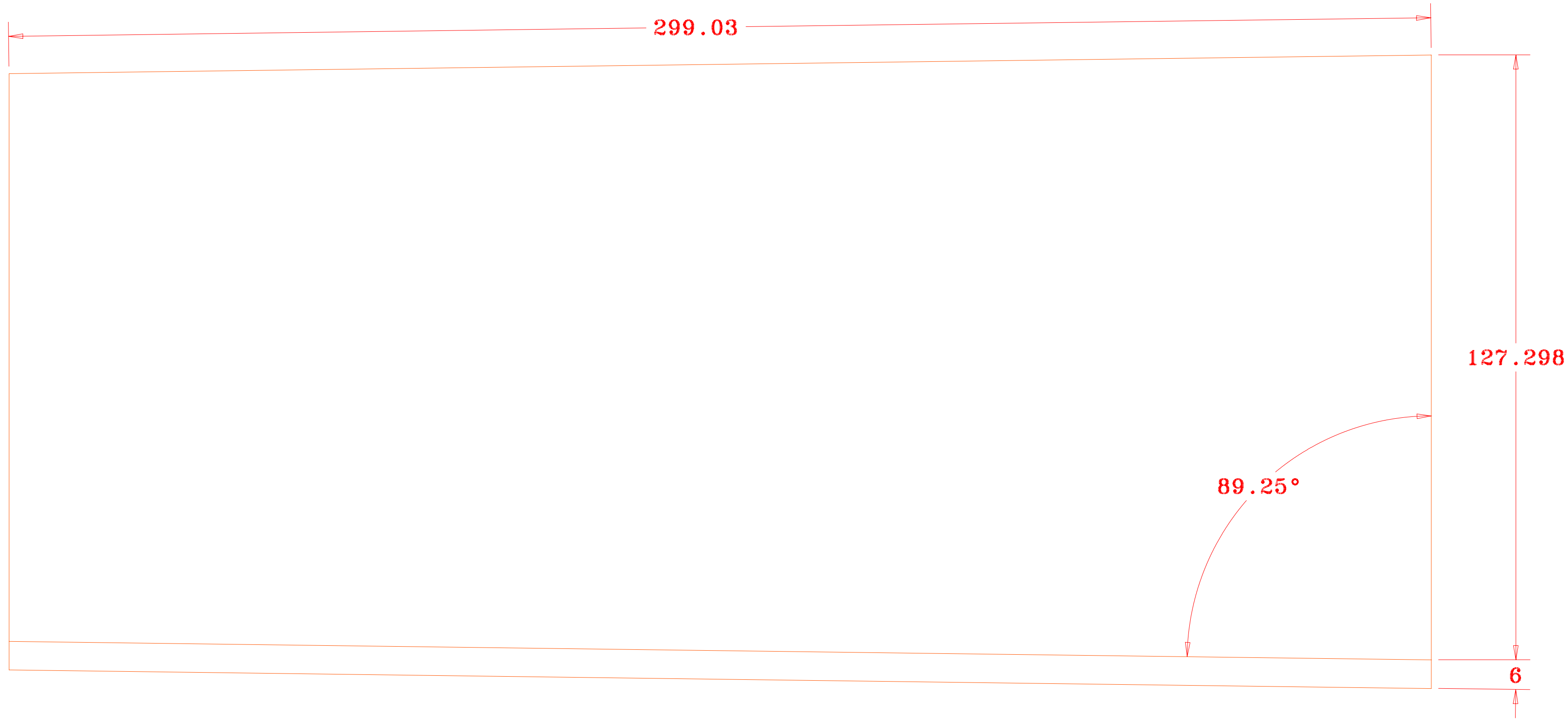
OK for Fabrication

DESIGNED BY: Manoel Dialinas DATE: 21/02/2008		Subatech NANTES	I	_
	Material	Bronze or Brass	H	_
CHECKED BY: Joseph Rasson DATE: XXX	Quantity	**4350 (EU) - 11600 (US)**	G	_
	System	**EMCal ALICE**	F	_
SIZE A4	Sub System	**Module**	E	_
	Part	**Plunger Pin**	D	11.04.2008
SCALE 4:1 / WEIGHT (kg) 0.0009 kg		**26K209_D**	C	09.04.2008
			B	05.03.2008
			A	21.02.2008



DESIGNED BY: M. Dialinas		Subatech NANTES	I	_
DATE: 04/01/2008	Material	Stainless Steel 304L	H	_
CHECKED BY: XXX	Quantity	**1750 (6350)**	G	_
DATE: XXX	System	**EMCal ALICE**	F	_
SIZE A4	Sub System	**Module**	E	_
SCALE 2:1 / WEIGHT (kg) 0.012 kg	Part	**Dowel Pin**	D	_
		26K210_A	C	_
			B	_
			A	_

REVISIONE		DRAWN / APPROV.	DATE
A			
B			



QTY REQD	FSCM NO	PART OR IDENTIFYING NO	NOMENCLATURE OR DESCRIPTION	MATERIAL SPECIFICATION	ITEM NO

PARTS LIST

Tolleranze generali di lavorazione UNI 5307-63

Dimensioni	< 6	> 6-30	>30-120	>120-315	>315-1000	>1000-2000	>2000-4000	> 4000
Toll.lineari	±0.1	± 0.2	±0.3	±0.5	±0.8	±1.2	± 2	±3
Toll.angolari	±1	± 30'	± 20'	+ 10' riferito al lato piu' corto				

ISTITUTO NAZIONALE DI FISICA NUCLEARE
Sezione di Catania

UNLESS OTHERWISE SPECIFIED DIMENSIONS ARE IN MILLIMITERS TOLERANCES ARE:
FRACTIONS ± DECIMALS .XX= .XXX= ANGLES ±
DO NOT SCALE DRAWING

TREATMENT

FINISH

SIMILAR TO | ACT. WT | CALC WT

CONTRACT NO.

APPROVALS	DATE
DRAWN Francesco Noto	16-5-08
CHECKED	

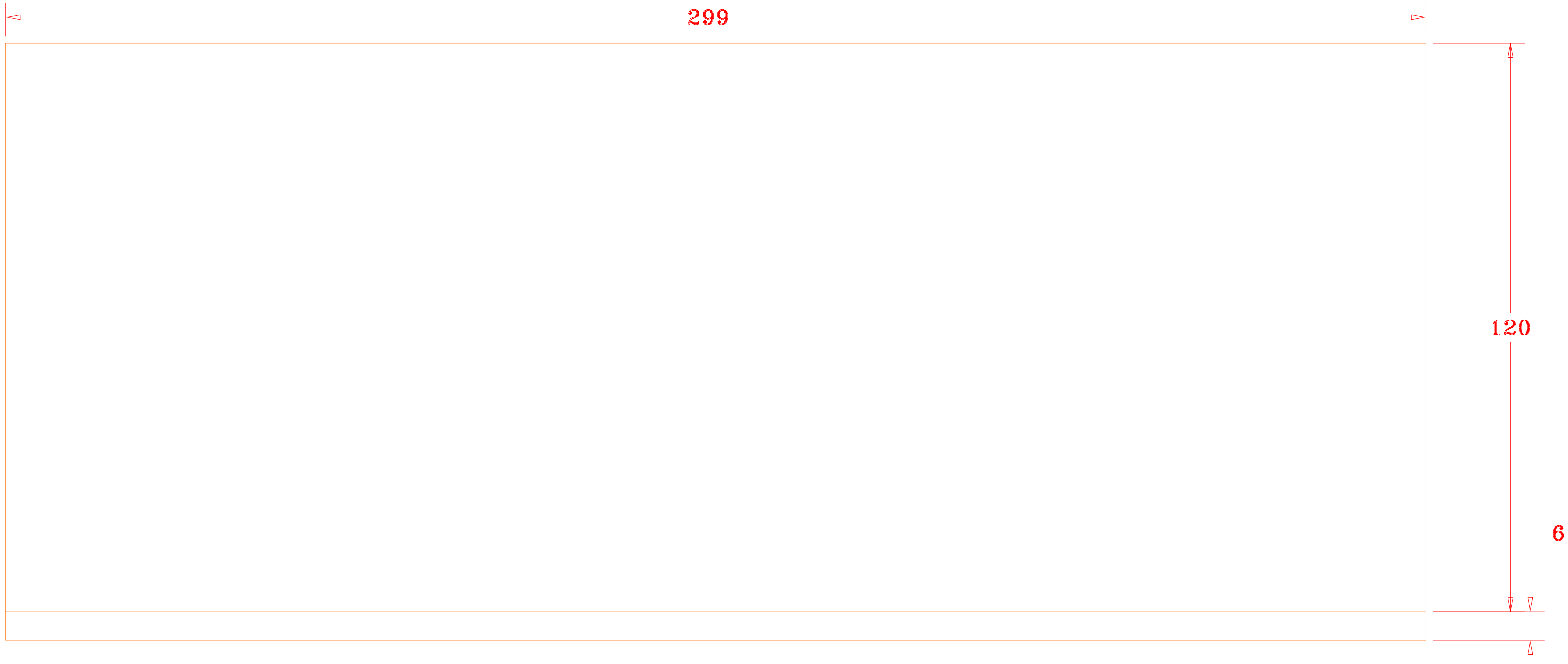
Alice EMCAL

TITLE
Black Adesive Rastremato

SIZE A3 | FSCM NO. | DWG NO. 26K211-R

SCALE 1:1 | SHEET

REVISIONE	DRAWN	DATE
	APPROV.	
A		
B		



QTY REQD	FSCM NO	PART OR IDENTIFYING NO	NOMENCLATURE OR DESCRIPTION	MATERIAL SPECIFICATION	ITEM NO

PARTS LIST

Tolleranze generali di lavorazione UNI 5307-63

Dimensioni	< 6	> 6-30	>30-120	>120-315	>315-1000	>1000-2000	>2000-4000	> 4000
Toll.lineari	±0.1	± 0.2	±0.3	±0.5	±0.8	±1.2	± 2	±3
Toll.angolari	±1	± 30'	± 20'	+ 10' riferito al lato piu' corto				

ISTITUTO NAZIONALE DI FISICA NUCLEARE
Sezione di Catania

UNLESS OTHERWISE SPECIFIED
DIMENSIONS ARE IN MILLIMITERS
TOLERANCES ARE:
FRACTIONS ± DECIMALS .XX= .XXX= ANGLES ±
DO NOT SCALE DRAWING

CONTRACT NO.

APPROVALS	DATE
DRAWN Francesco Noto	26-5-08
CHECKED	

TREATMENT

FINISH

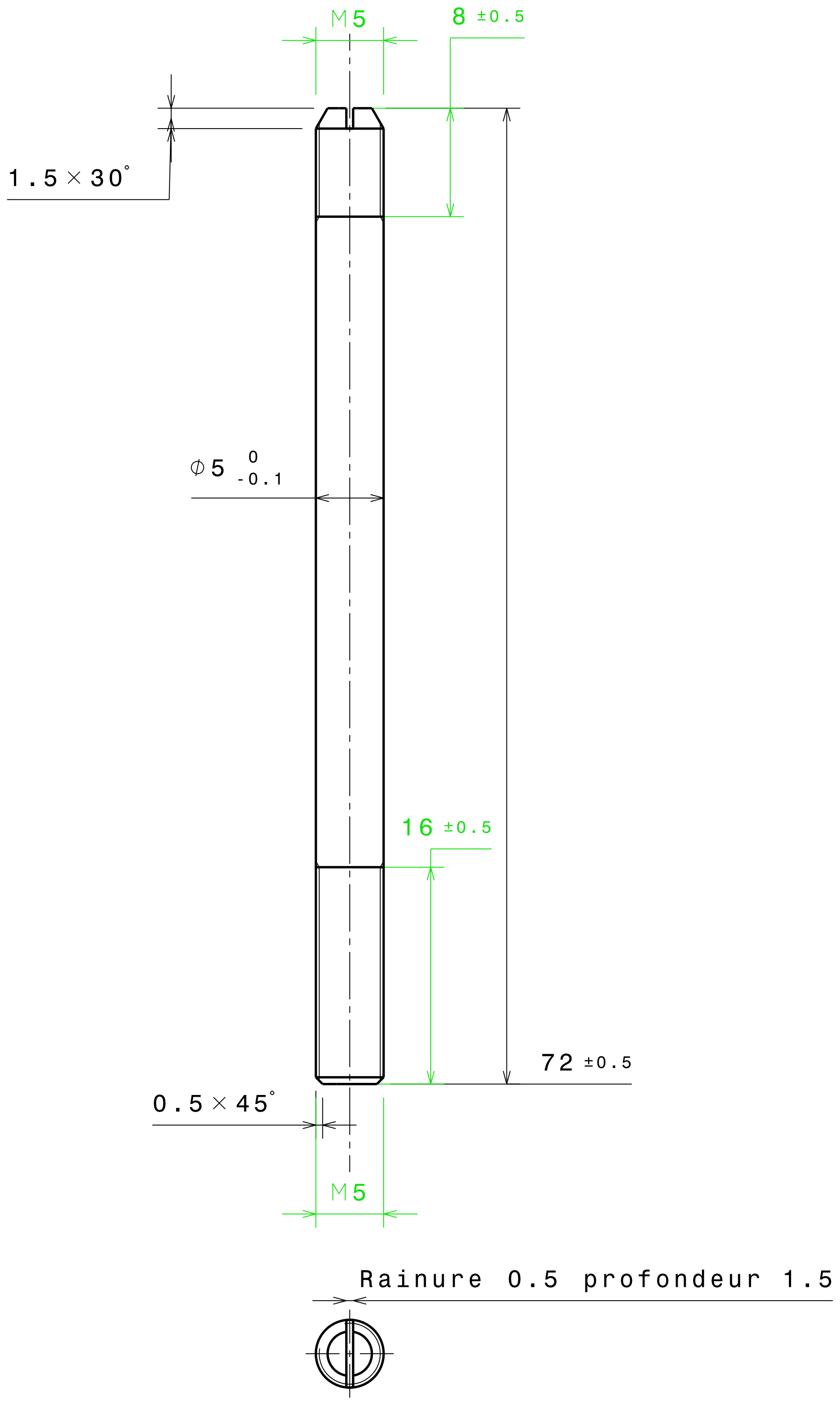
SIMILAR TO | ACT. WT | CALC WT

Alice EMCAL

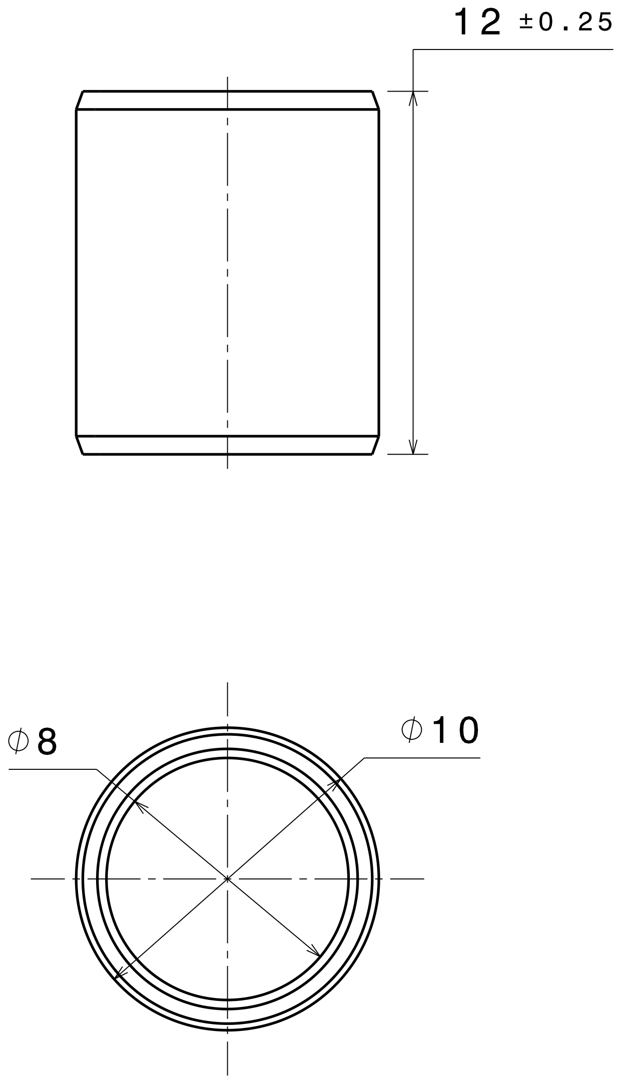
TITLE Black Adesive Dritto

SIZE A3 | FSCM NO. | DWG NO. 26K211-D

SCALE 1:1 | SHEET

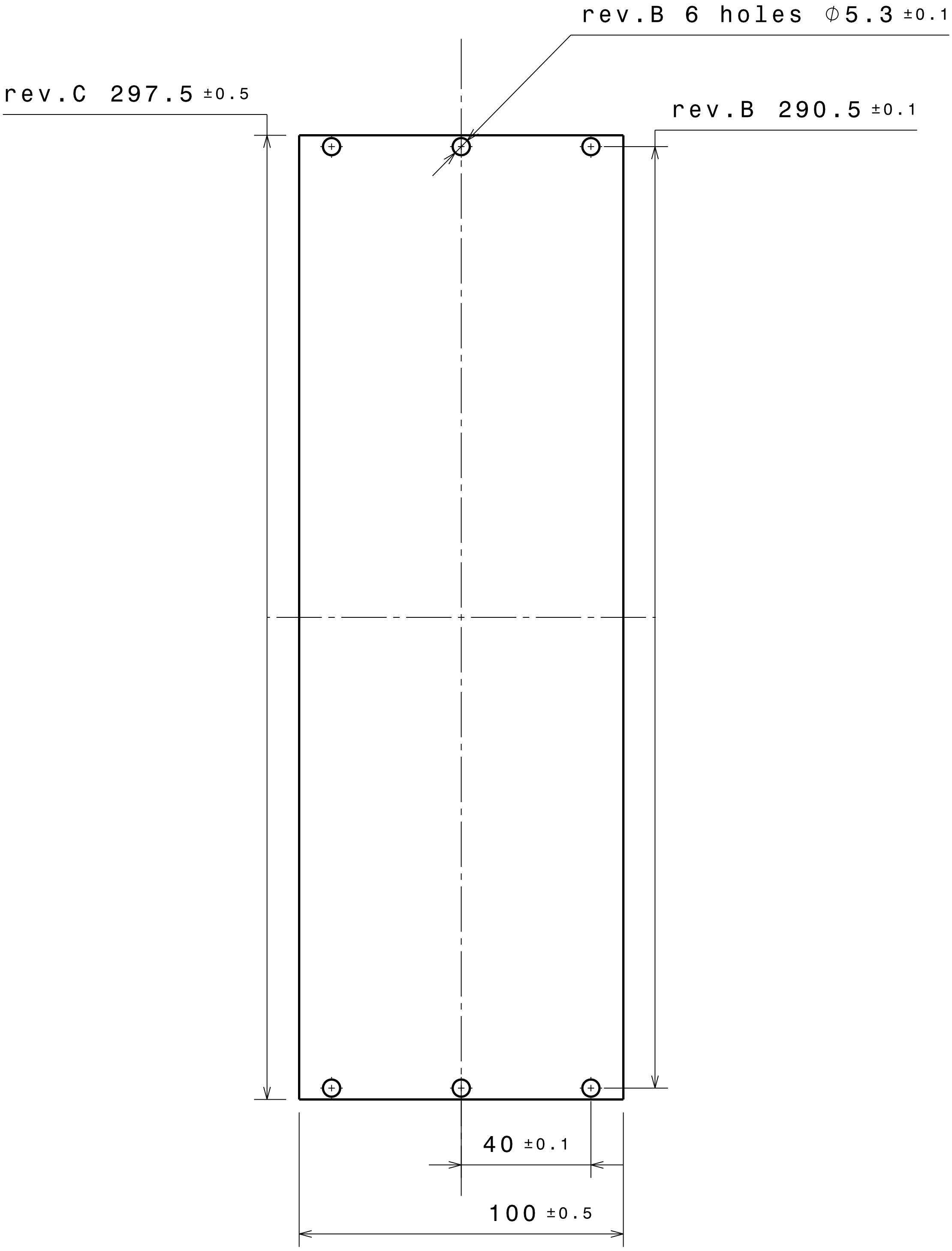


DESIGNED BY: M. Dialinas DATE: 19/12/2007		**Subatech NANTES**	I	_
	Material	304L or 316L	H	_
CHECKED BY: XXX DATE: XXX		**3460 (12700)**	G	_
		EMCal ALICE	F	_
SIZE A4		**Module**	E	_
SCALE 2:1 / WEIGHT (kg) 0.011 kg	Part	**Stud**	D	_
		EMCal_26K212_A	C	_
			B	_
			A	_



Shaft max 7.981 mm, min 7.972 mm
Housing max 10.015 mm, min 10.000 mm

DESIGNED BY: M. Dialinas DATE: 09/01/2008		**Subatech NANTES**	I	_
	Material	DU Cylindrical Bush Part N° 0812DU	H	_
CHECKED BY: XXX DATE: XXX	Quantity	**1730 (6350)**	G	_
			F	_
	System	**EMCal ALICE**	E	_
SIZE A4	Sub System	**Module**	D	_
SCALE 4:1 WEIGHT (kg)	Part	**Bushing**	C	_
		26K213_A	B	_
			A	_



OK for Fabrication

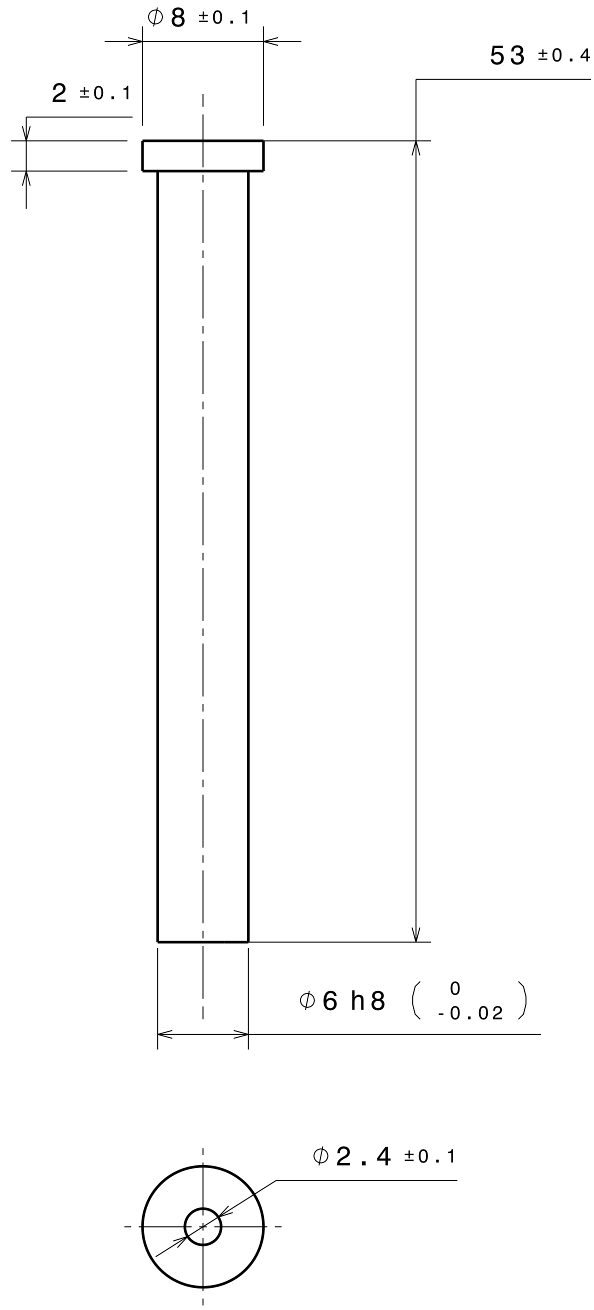
DESIGNED BY: Manoel Dialinas DATE: 10/01/2008		Subatech NANTES	I	_
	Material	Stainless Steel 304L 0.150 mm thick	H	_
CHECKED BY: Joseph Rasson DATE: 19/02/2008	Quantity	**3500 (8100)**	G	_
	System	**EMCal ALICE**	F	_
SIZE A4	Sub System	**Module**	E	_
			D	_
SCALE 1:2 / WEIGHT (kg) 0.035 kg	Part	**Strap Foil**	C	27.02.2008
		26K214_C	B	10.01.2008
			A	_

détail C
A
A
rev.B pente 25% (14.04°)
Dépouille int. 2.5% (1.43°)
Dépouille int. 2.86° (2.86°)
60 ±1
50 ±1
48 ±1
58 ±1
Coupe A-A
Dépouille ext. 2.5% (1.43°)
108 ±2
54 ±1
Dépouille ext. 2.5% (1.43°)
rev.C largeur au plan de joint 135 ±2
1500 ±3
Bon pour Fabrication
R5
110.6 ±1
132.3 ±1
105 +2 0
Pente 20% (11.31°)
R5
35 ±1
4.5 ±0.5
Dépouille 10% (5.71°)
1435 ±2
rev.D 54 +1 0
rev.D 54 +1 0
rev.C 15 ±0.5
rev.C 15 ±0.5
Tous congés de raccordement dans la cavité R5
Détail C
690 ±1.5
630 ±1.5
570 ±1.5
510 ±1.5
450 ±1.5
390 ±1
330 ±1
270 ±1
210 ±1
150 ±1
90 ±0.5
30 ±0.5
R5
R5
R5
Dépouille int. 2.5% (1.46°)
28 ±1
85 ±1
Coupe B-B
rev.D 48 poches deviennent 54 x 54
rev.C suppression trous ⌀13, tous congés raccordement R5
rev.B pente 20% sommet cavités devient 25%
DESIGNED BY: Manoel Dialinas
DATE: 21/02/2008
CHECKED BY: Joseph Rasson
DATE: 27.02.2008
SIZE A1
SCALE 1:3
WEIGHT (kg) 17.74 kg
Subatech NANTES
Material EN AC-4200 ST6 (A-S7G)
Quantity 75 + 175
System EMCal ALICE
Sub System StripModule
Part StrongBack (casting)
26K301_D
I _
H _
G _
F _
E _
D 20.05.2008
C 26.02.2008
B 14.01.2008
A 03.12.2007
This drawing is our property; it can't be reproduced or communicated without our written agreement.

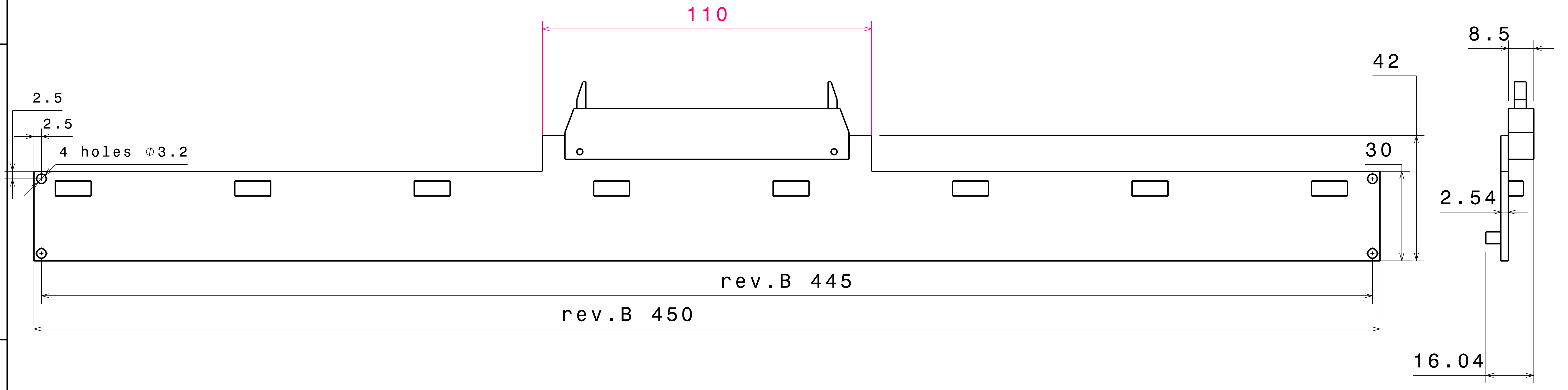
rev.E	48 trous Φ 5.6 devient Φ 5.2, profondeur position taraudages M3, marquage
rev.D	48 lamages Φ12 aulieu de Φ12.5
rev.C	position taraudages M3
rev.B	48 trous Φ12, 48 lamages prof. 6 (au lieu 5), 16 taraudages M3 (au lieu 12)
rev.A	révision initiale

DESIGNED BY: Manoel Dialinas DATE: 22/02/2008		**Subatech NANTES**	I	_
	Material	pièce fonderie 26K301_C	H	_
CHECKED BY: Joseph Rasson DATE: 20.02.2008	Quantity	**75 (+ 175 Cde US)**	G	_
	System	**EMCal ALICE**	F	_
SIZE A1	Sub System	**StripModule**	E	20.05.2008
	Part	**StrongBack (machining)**	D	19.03.2008
SCALE 1:3 — WEIGHT (kg) 14.79 kg		**26K302_E**	C	17.03.2008
			B	23.01.2008
			A	03.12.2007

Bon pour Fabrication

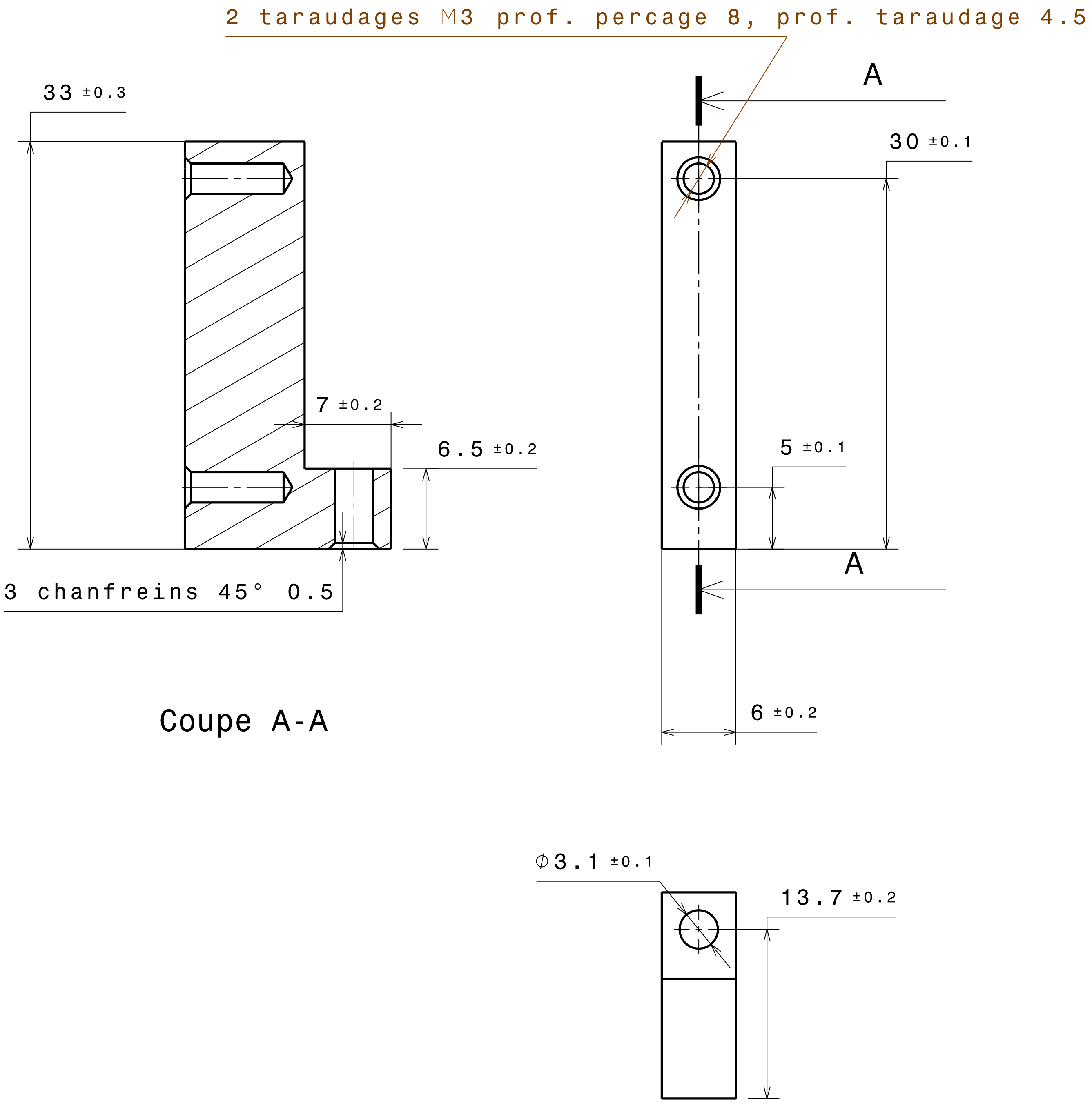


DESIGNED BY: M. Dialinas DATE: 12/12/2007		Subatech NANTES	I	_
	Material	Noryl (PPO) fire resistant grade	H	_
CHECKED BY: XXX DATE: XXX	Quantity	**870 (3180)**	G	_
	System	**EMCal ALICE**	F	_
SIZE A4			E	_
	Sub System	**StripModule**	D	_
SCALE 2:1 / WEIGHT (kg) 0,0032 kg	Part	**LED Ferrule**	C	_
		EMCal_26K303_A	B	_
			A	_

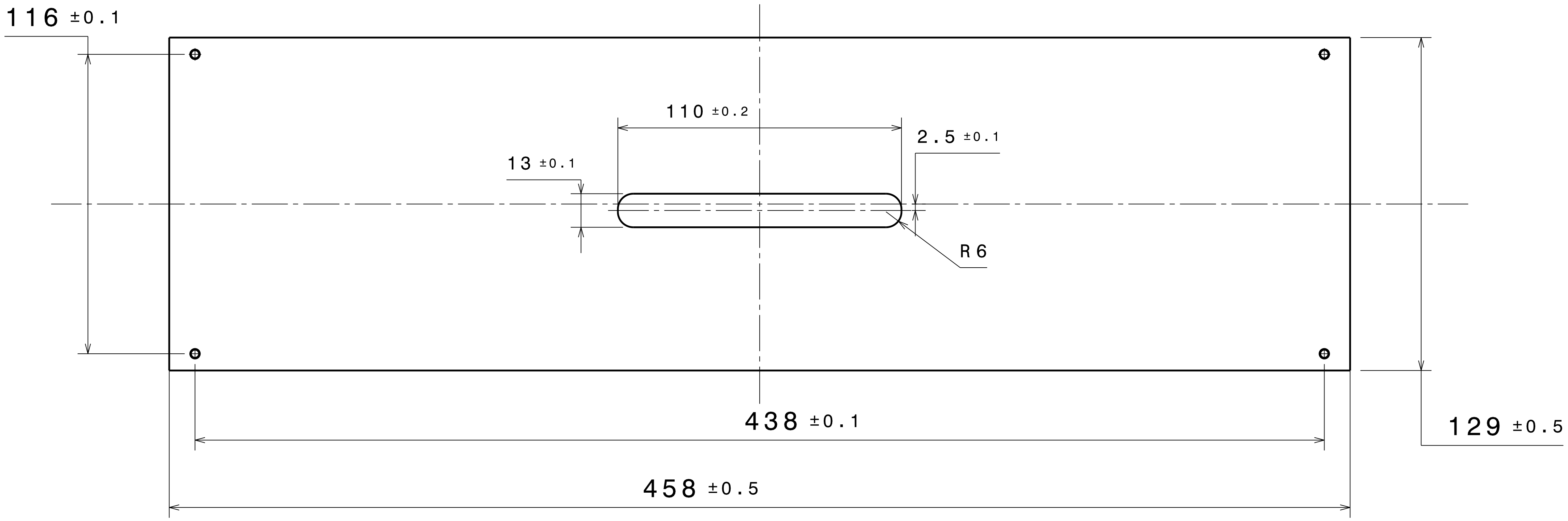


DESIGNED BY: M. Dialinas		Subatech NANTES
DATE: 21/12/2007	Material	Halogen free PCB
CHECKED BY: XXX	Quantity	**220 (580)**
DATE: XXX	System	**EMCal ALICE**
SIZE: A3	Sub System	**StripModule**
SCALE: 3:4 / WEIGHT (kg): XXX	Part	**T-Card**
		EMCal_26K304_B

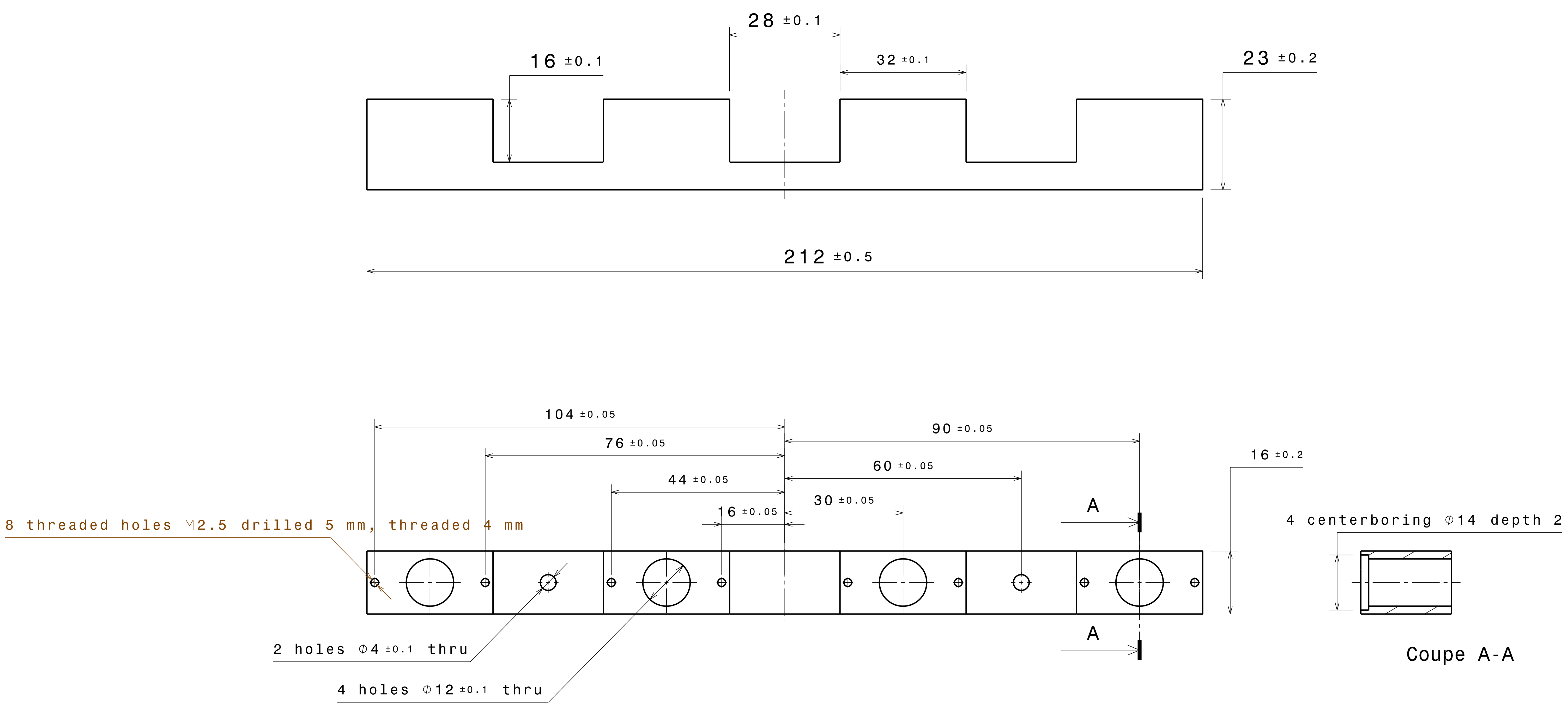
I	_
H	_
G	_
F	_
E	_
D	_
C	_
B	29.05.2008
A	21.12.2007



DESIGNED BY: M. Dialinas DATE: 10/01/2008		Subatech NANTES	I	_
	Material	Aluminium 5083 or 5086 or 6082 or 6061	H	_
CHECKED BY: Joseph Rasson DATE: xx.xx.2008	Quantity	**450 (1600)**	G	_
	System	**EMCal ALICE**	F	_
SIZE A4	Sub System	**Module**	E	_
	Part	**T-Card Fixation**	D	_
SCALE 2:1 / WEIGHT (kg) 0,006 kg		**26K305_B**	C	_
			B	18.02.2008
			A	10.01.2008

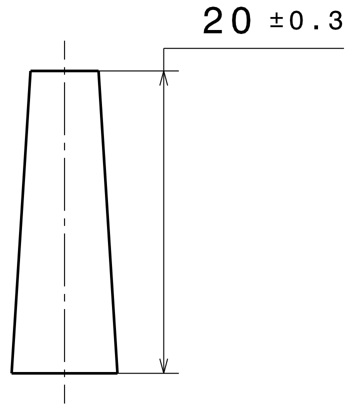


DESIGNED BY: M. Dialinas		Subatech NANTES	I	_
DATE: 18/01/2008	Material	Alliage aluminium épaisseur 2 mm	H	_
CHECKED BY: XXX	Quantity	72	G	_
DATE: XXX	System	**EMCal ALICE**	F	_
SIZE A3	Sub System	**Strip Module**	E	_
	Part	**Central Cover Plate**	D	_
SCALE 1:2 / WEIGHT (kg) XXX		**26K306_A**	C	
			B	_
			A	17.03.2008

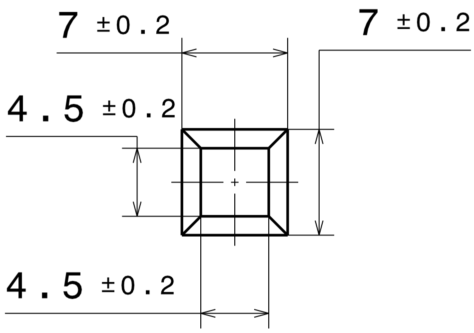


For Quotation Only

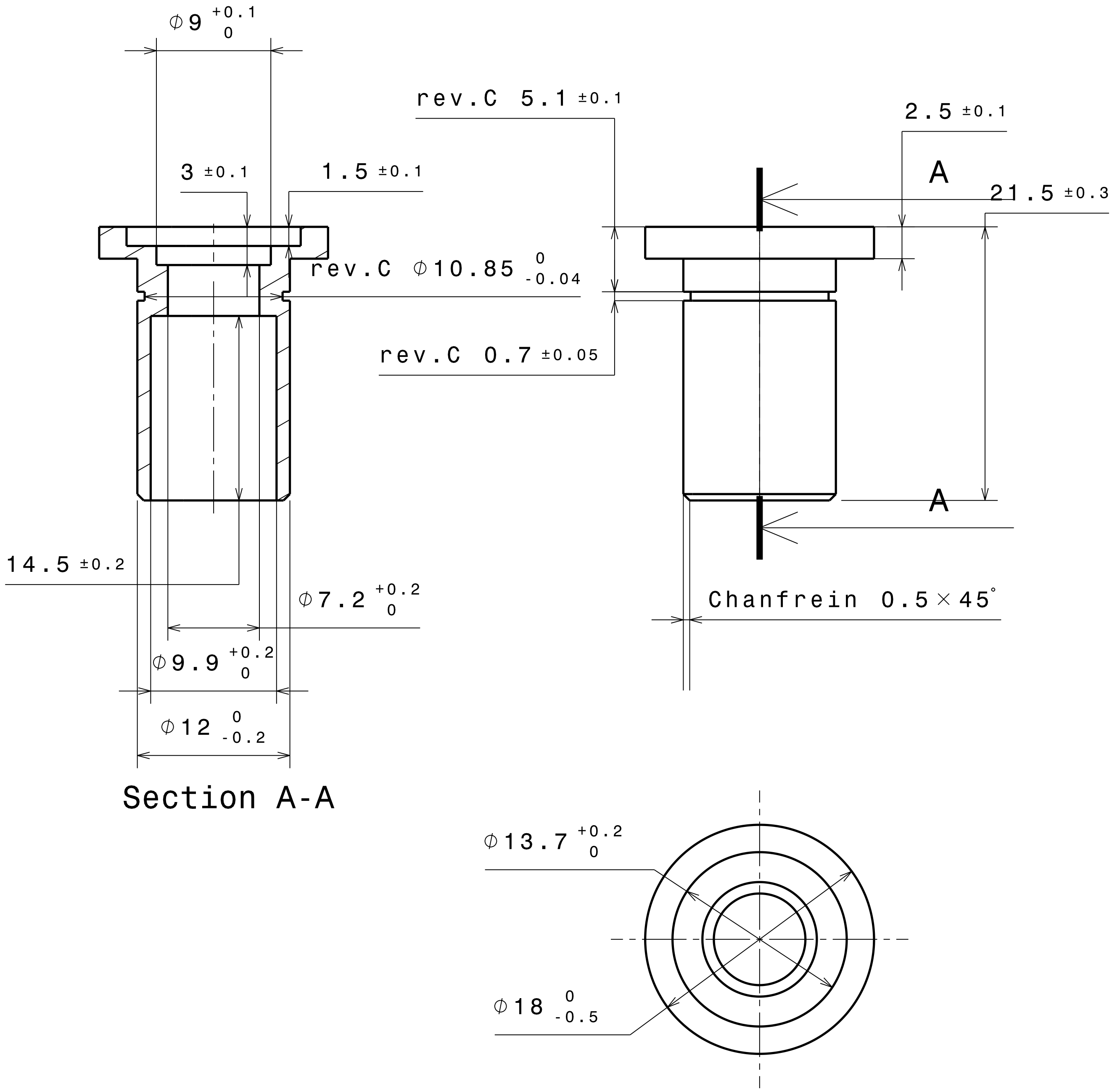
DESIGNED BY: Manoel Dialinas DATE: 19/02/2008		Subatech NANTES	I	_
	Material	Noryl PPO fire resistant grade	H	_
CHECKED BY: XXX DATE: XXX	Quantity	**440 (1600)**	G	_
	System	**EMCal ALICE**	F	_
SIZE A3	Sub System	**StripModule**	E	_
	Part	**Preamplifier Fiber Manifold**	D	_
SCALE 1:1 / WEIGHT (kg) 0.048 kg		**EMCal_26K307_B**	C	_
			B	19.02.2008
			A	07.12.2008



All faces optically polished

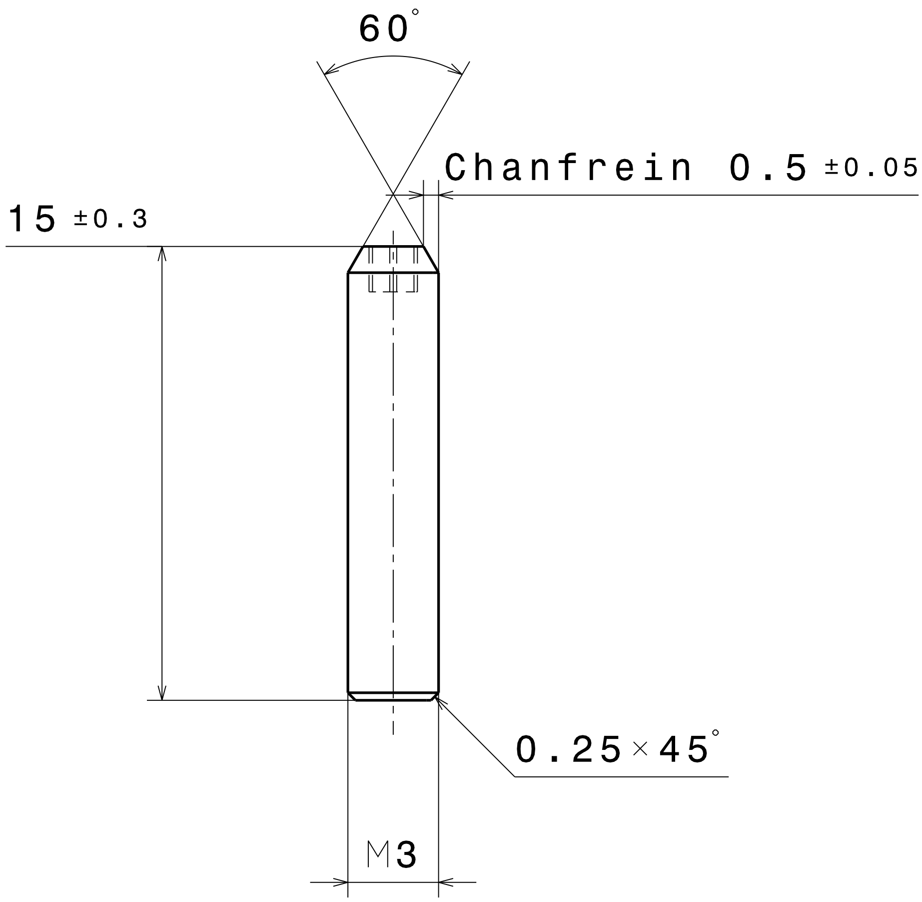


DESIGNED BY: M. Dialinas DATE: 07/12/2007		**Subatech NANTES**	I	_
	Material	Lucite / Styrene Optical Grade	H	_
CHECKED BY: XXX DATE: XXX	Quantity	**3460 (12700)**	G	_
	System	**EMCal ALICE**	F	_
SIZE A4	Sub System	**Module**	E	_
	Part	**Light Guide**	D	_
SCALE 2:1 / WEIGHT (kg) 0.0008 kg		**EMCal_26K209_A**	C	_
			B	_
			A	_

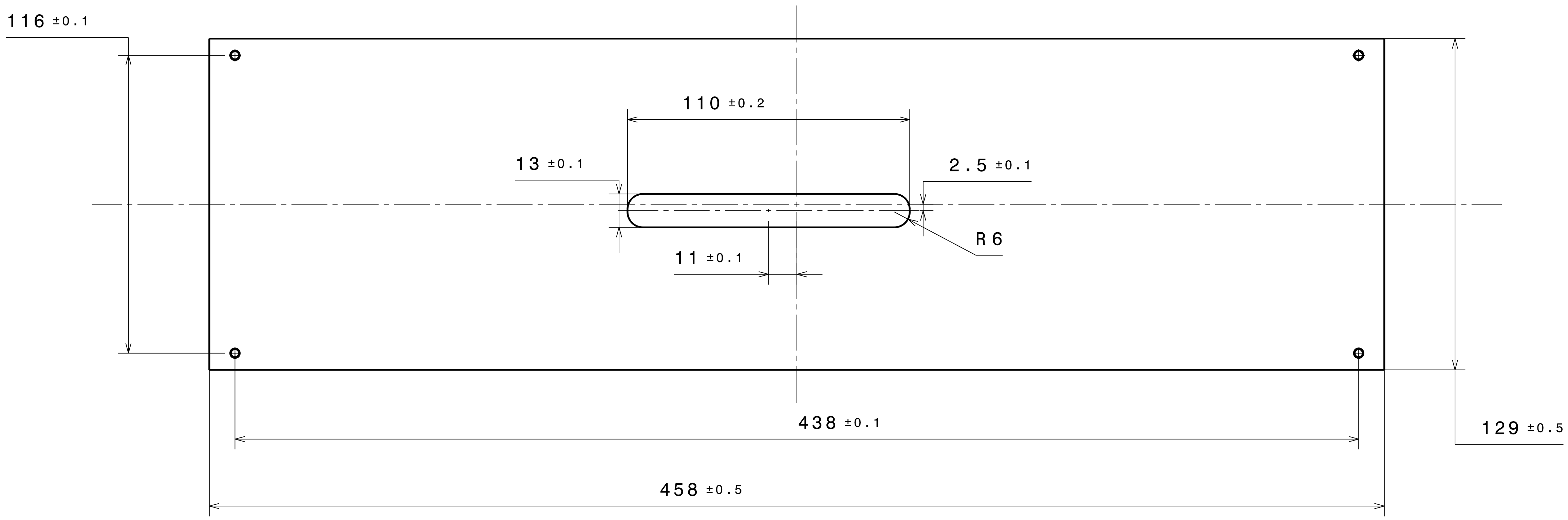


For Quotation only

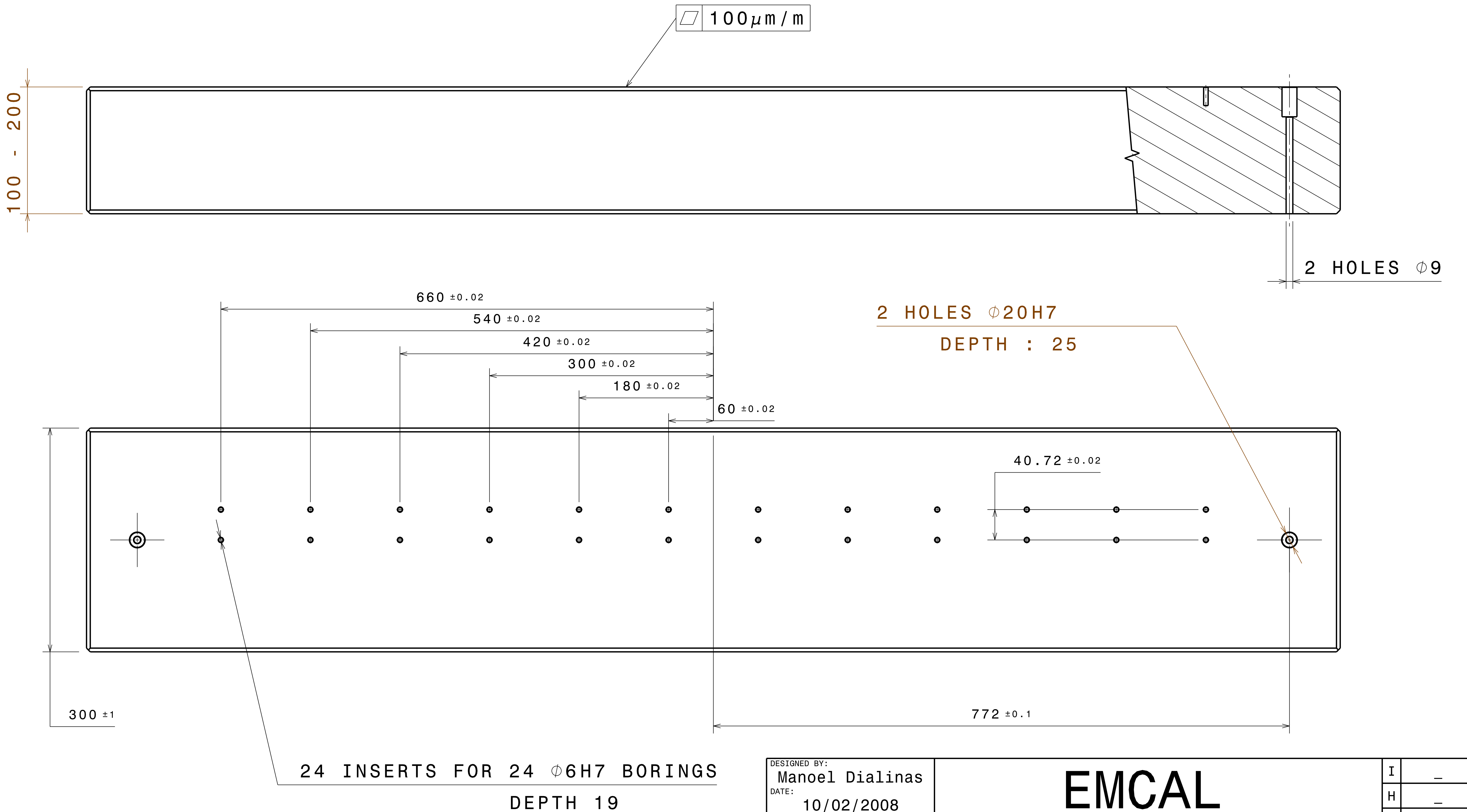
DESIGNED BY: Manoel Dialinas DATE: 07/12/2007		Subatech NANTES	I	_
	Quantity	**3460 (11680)**	H	_
CHECKED BY: Fred Pompei DATE: XXX	Material	Noryl (PPO) fire resistant grade	G	_
	System	**EMCal ALICE**	F	_
SIZE A4			E	_
	Sub System	**Module**	D	_
SCALE 2:1	WEIGHT (kg) 0,0028 kg	Part: **APD Mount**	C	05.03.2008
		EMCal_26K309_C	B	18.02.2008
			A	_



DESIGNED BY: M. Dialinas DATE: 15/01/2008		Subatech NANTES	I	_
	Material	Stainless Steel M3 HC screw	H	_
CHECKED BY: XXX DATE: XXX	Quantity	**1160**	G	_
	System	**EMCal ALICE**	F	_
SIZE A4	Sub System	**StripModule**	E	_
SCALE 4:1 / WEIGHT (kg) 0.0008 kg	Part	**Stud for TCard fixation**	D	_
		26K310_A	C	_
			B	_
			A	15.01.2008



DESIGNED BY: M. Dialinas DATE: 18/01/2008		**Subatech NANTES**	I	_
	Material	Alliage aluminium épaisseur 2 mm	H	_
CHECKED BY: XXX DATE: XXX	Quantity	145	G	_
	System	**EMCal ALICE**	F	_
SIZE A3	Sub System	**Strip Module**	E	_
	Part	**Side Cover Plate**	D	_
SCALE 1:2 / WEIGHT (kg) XXX			C	
		26K312_A	B	_
			A	17.03.2008



DESIGNED BY: Manoel Dialinas DATE: 10/02/2008		EMCAL MARBRE D'ASSEMBLAGE	
CHECKED BY: XXX DATE: XXX			
SIZE A3		MODULES	
SCALE 1:5	WEIGHT (kg) XXX	26K501_A	SHEET 1/1

I	_
H	_
G	_
F	_
E	_
D	_
C	_
B	_
A	_


6 FLATS 170x50x5
6 FLATS 50x50x8
4 FLATS 135x110x8
Détail B
Scale : 1:2
4 HOLES ∅11
120
15
15
95
5×45°
B
110
135
1700
300
300
5×45°
110
170
50
1580
320
135
110
(198,5)
175
175
60°
390
480
Détail C
Scale : 1:2
3 x M30X1 THREADED HOLES THRU
C
D
20
37,5
10
35
35
25
25
765
3 X M20 THREADED HOLES THRU
Détail D
Scale : 1:2
WELDED 60x60x5 TUBES SYSTEM
Rep.
N° plan
Designation
Modification
N°
Rep
Designation
Dessinateur
Date
EMCal ALICE
SUPPORT MARBRE
Format : A0
Dessinateur 03/08 Ph.LALOUX
Verifie par --/-- ---
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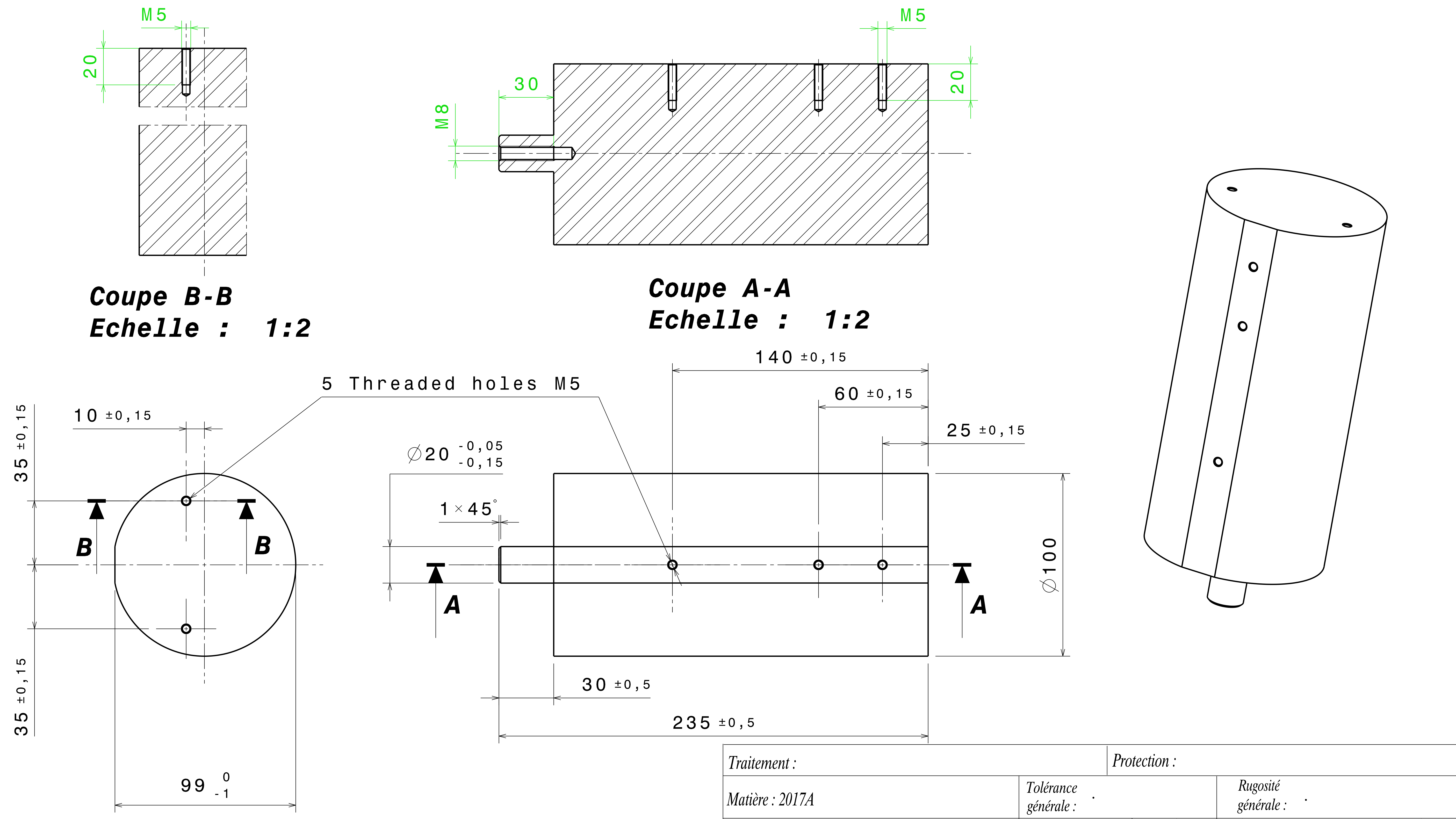
26K502
Revision A
1/1



BREAK ALL SHARP CORNER

Traitement :

Protection :

Matière : 2017A

Tolérance générale : .

Rugosité générale : .

ALICE - EMCAL
OUTILLAGE STRIPMODULE
COLONNE

Indice	Date	Modifications	Dess

Dessiné par Ph.LALOUX

Date 21/05/2008

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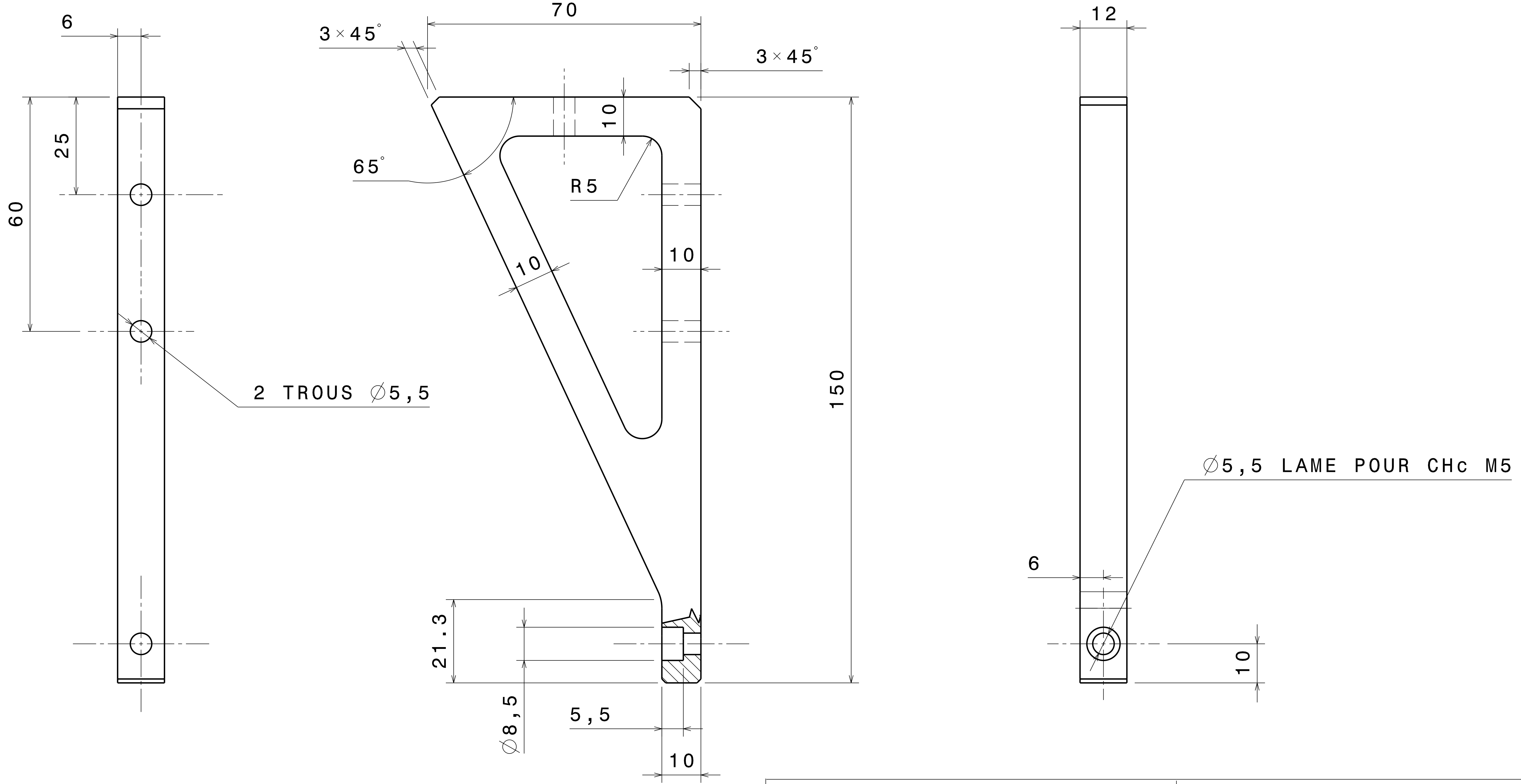
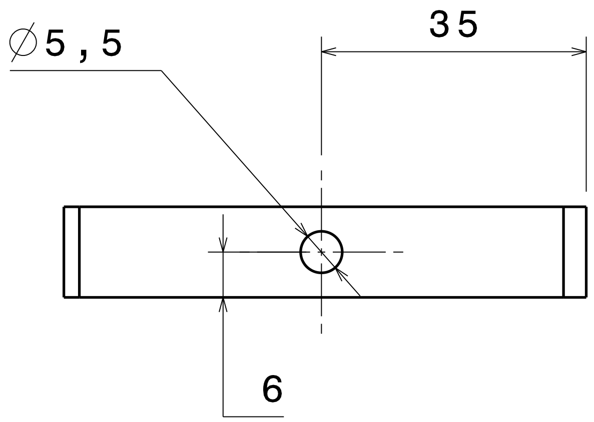
La Chantrerie 44307 NANTES Cedex 03
Tel: 02 51 85 81 00 Fax 02 51 85 84 79

Ech : 1/2

26K503

Indice A





Traitement :		Protection :	
Matière : 5083 (ALPLAN)	Tolérance générale : ± 0,2	Rugosité générale : .	

ALICE - EMCAL
OUTILLAGE STRIPMODULE RENFORT

Indice	Date	Modifications	Dess

Dessiné par	Date
Ph.LALOUX	30-04-2008

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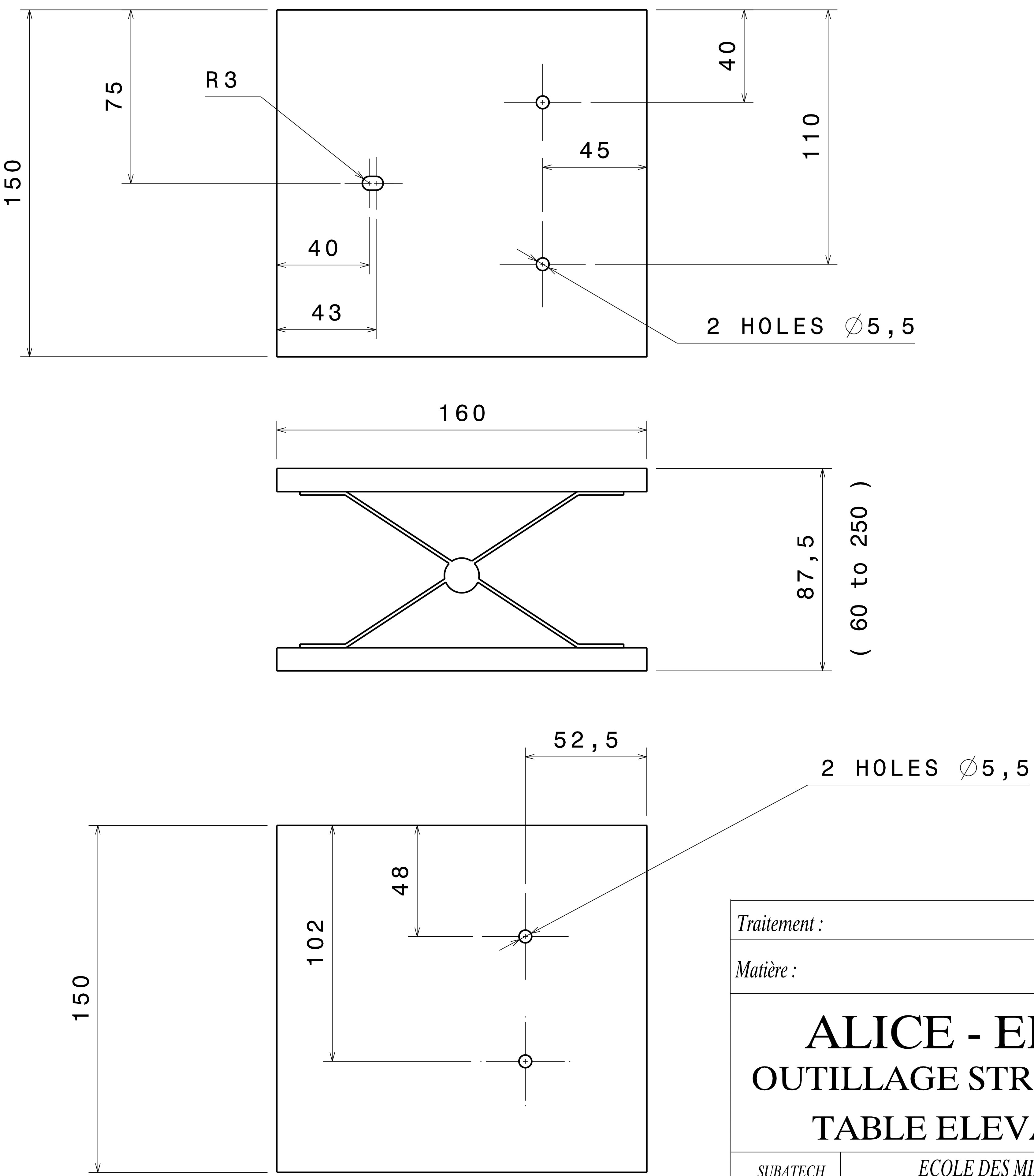
Tel: 02 51 85 81 00 Fax 02 51 85 84 79

Ech :		Indice
1	26K505	A



Traitement :		Protection :	
Matière :	Tolérance générale : ± 0,2	Rugosité générale :	

ALICE - EMCAL
OUTILLAGE STRIPMODULE
TABLE ELEVATRICE

Indice	Date	Modifications	Dess

Dessiné par	Date
Ph.LALOUX	23/05/2008

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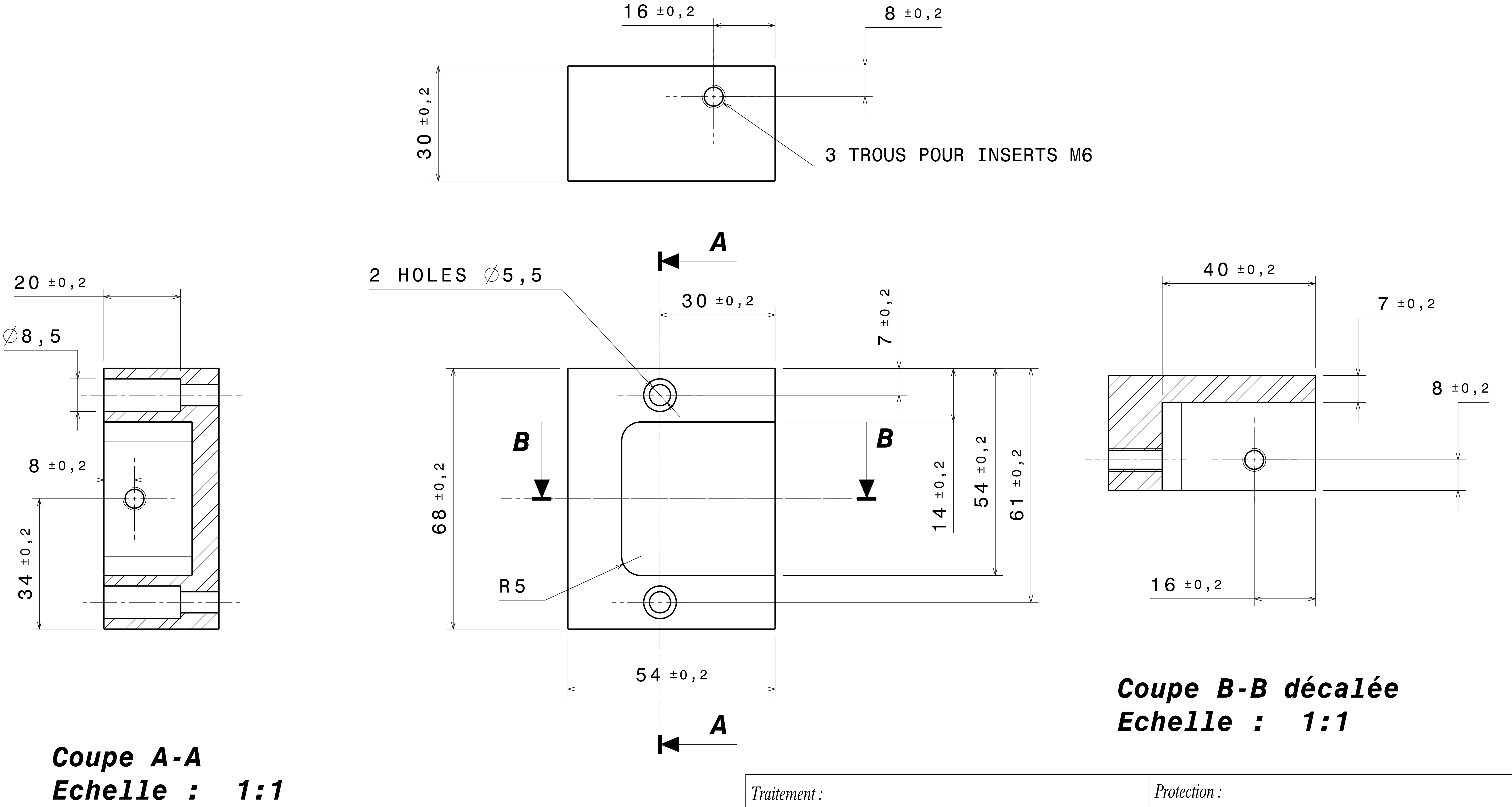
Ech : 1/2

26K505

Indice A



Traitement : | Protection :

Matière : 2017A | Tolérance générale : . | Rugosité générale : .

ALICE - EMCAL
OUTILLAGE STRIPMODULE
REGLAGE

Indice	Date	Modifications	Dess

Dessiné par: Ph.LALOUX | Date: 22/05/2008

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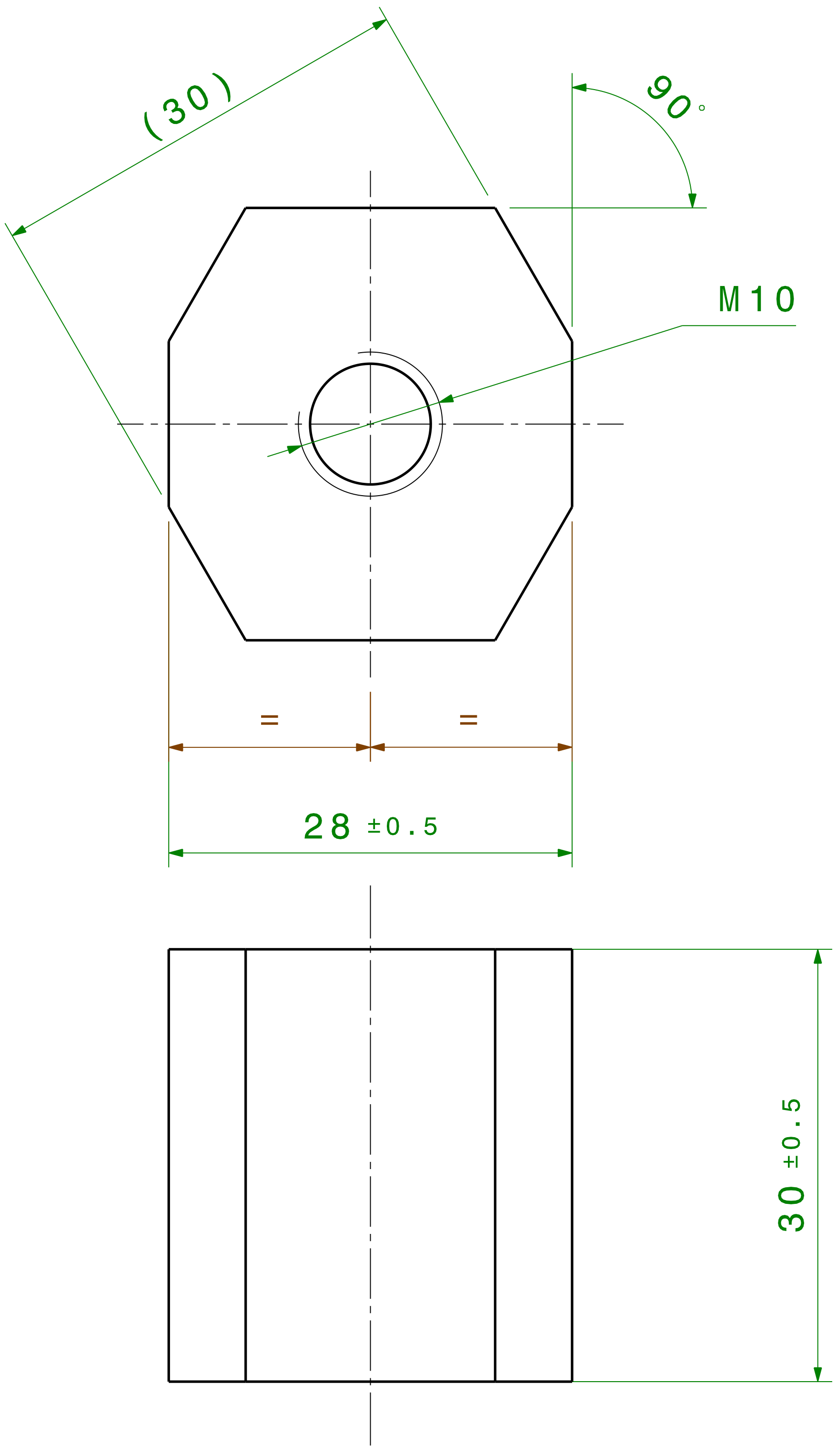
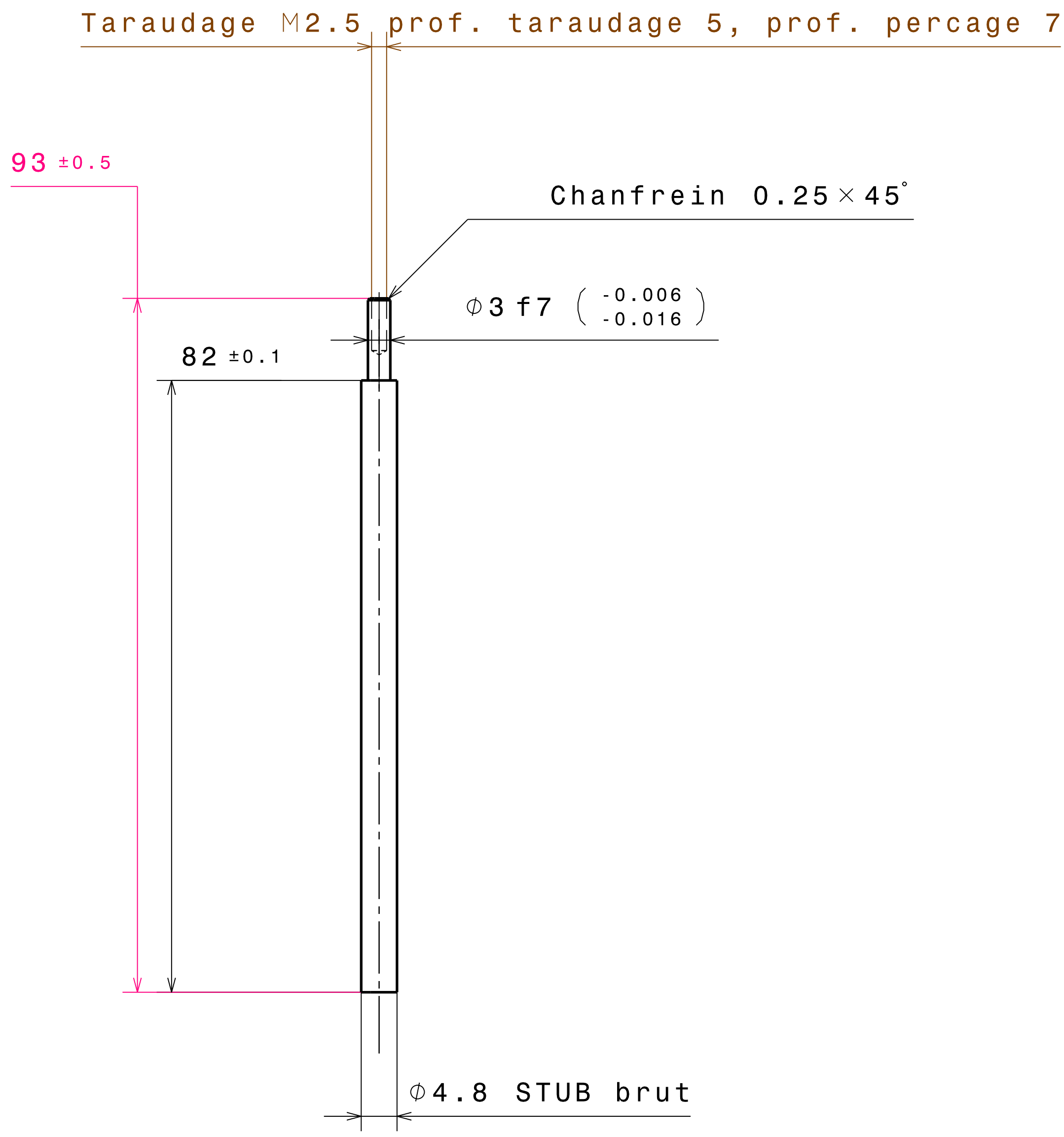
Tel: 02 51 85 81 00 Fax 02 51 85 84 79

Ech : 1/1 | 26K506 | Indice A

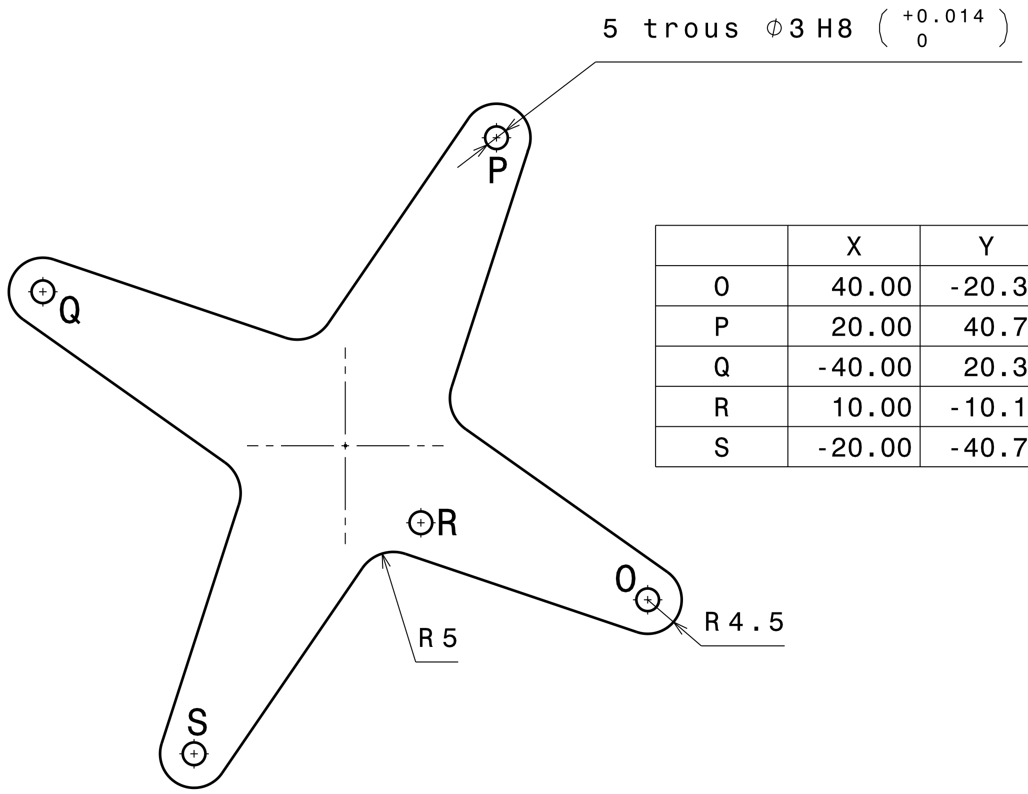


DESIGNED BY: Ph.LALOUX DATE: 30-04-2008	ALICE - EMCAL OUTILLAGE STRIPMODULE NOIX		
matiere CW614N six pans de 30			
SIZE A4		SUBATECH IN2P3-EMN UNIVERSITE	ECOLE DES MINES 4 rue Alfred Kastler La Chantrerie 44307 NANTES Cedex 03 tel 02 51 85 81 00 -fax 02 51 85 84 38
SCALE 2/1	WEIGHT (kg)	DRAWING NUMBER 26K507	SHEET 1/1

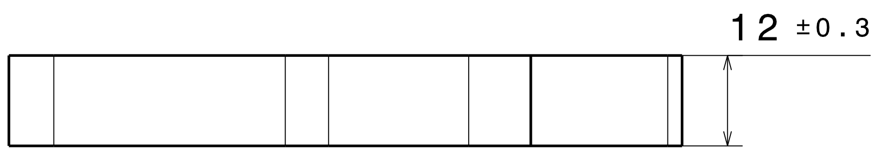
Rev	
I	_
H	_
G	_
F	_
E	_
D	_
C	_
B	_
A	_



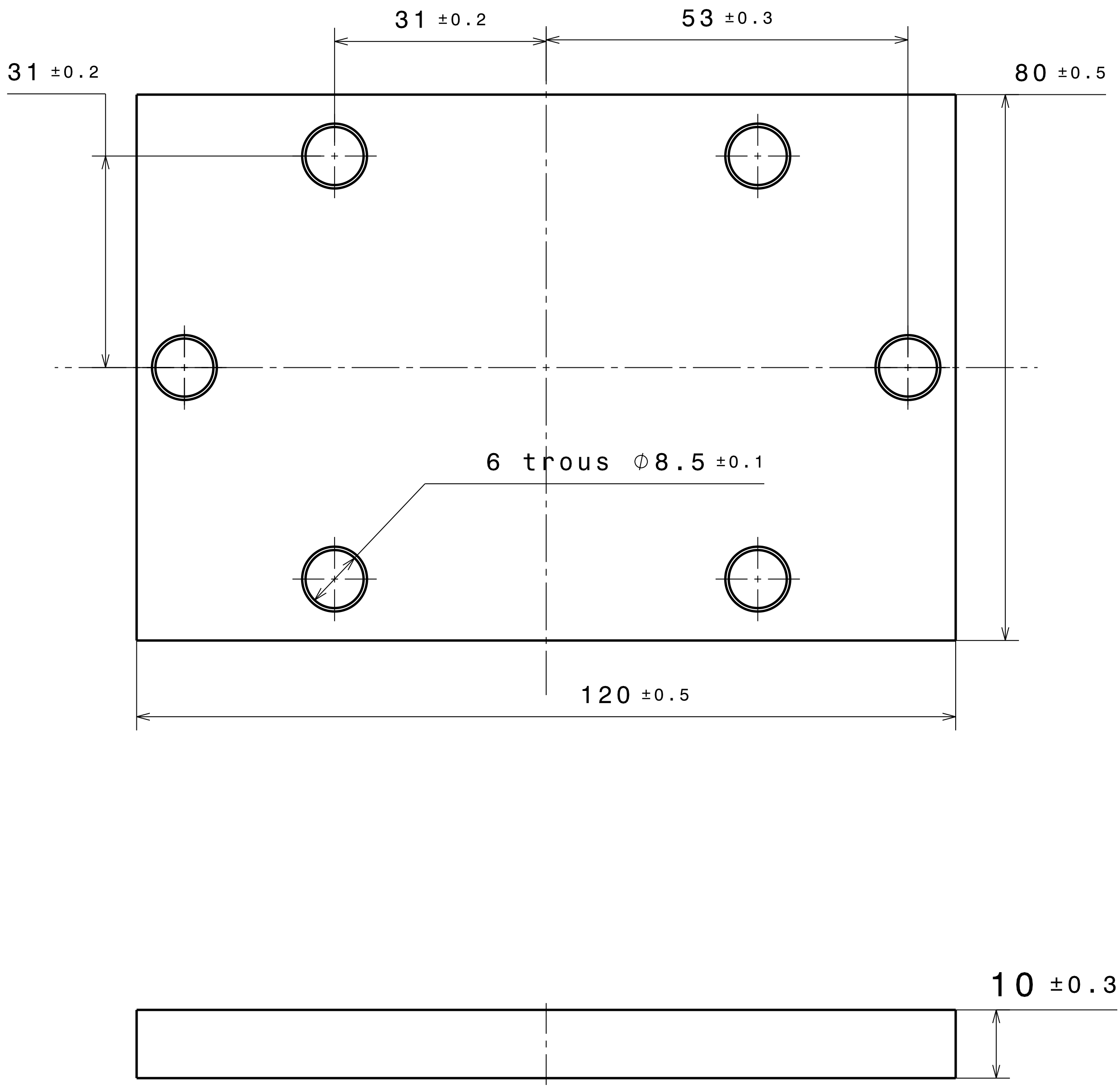
DESIGNED BY: Manoel Dialinas DATE: 10/06/2008		Subatech NANTES	I	_
	Material	Acier STUB Φ 4.8 mm	H	_
CHECKED BY: XXX DATE: XXX	Quantity	5	G	_
	System	EMCal ALICE	F	_
SIZE A4	Sub System	Module Assembly Tooling	E	_
SCALE 1:1 / WEIGHT (kg) 0.012	Part	Compression Finger	D	_
		26K701	C	_
			B	_
			A	11.06.2008



	X	Y
O	40.00	-20.36
P	20.00	40.72
Q	-40.00	20.36
R	10.00	-10.18
S	-20.00	-40.72

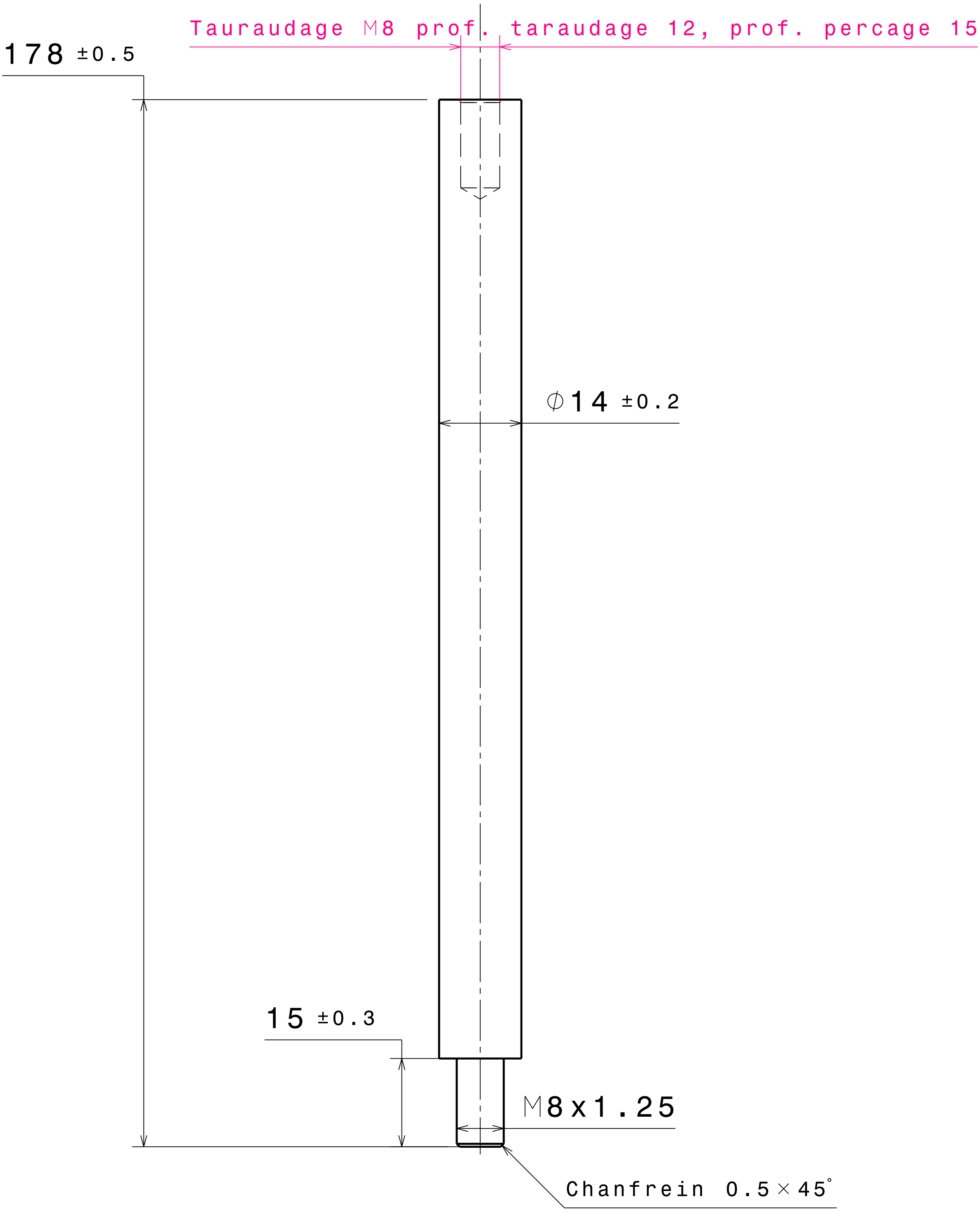


DESIGNED BY: Manoel Dialinas DATE: 10/06/2008		Subatech NANTES	I	_
	Material	Carré 100x100x12 Acier inoxydable 304L	H	_
CHECKED BY: XXX DATE: XXX	Quantity	2	G	_
	System	EMCal ALICE	F	_
SIZE A4	Sub System	Module Assembly Tooling	E	_
SCALE 1:1 / WEIGHT (kg) 0.237	Part	Compression Cross	D	_
		26K702	C	_
			B	_
			A	11.06.2008

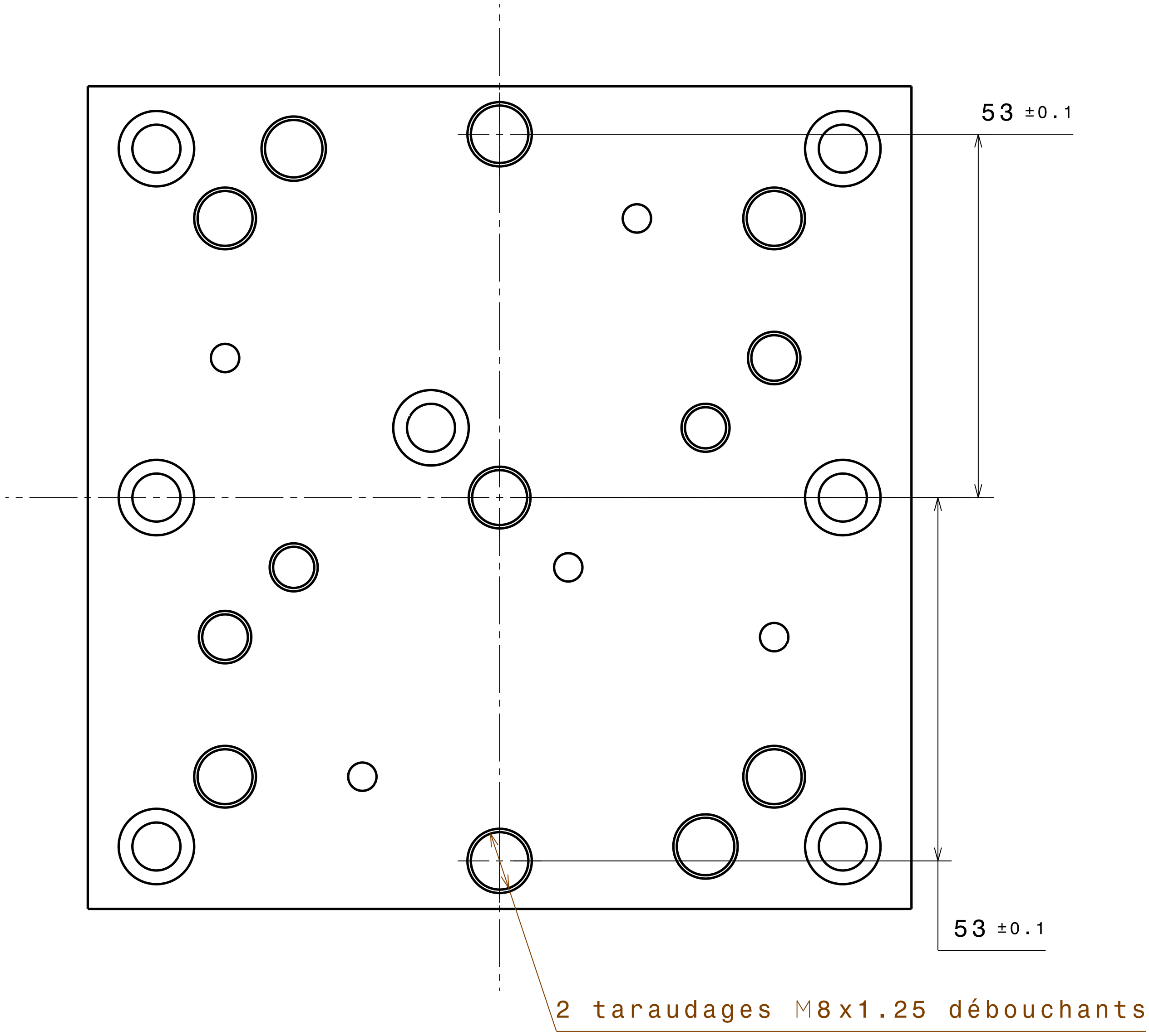


Chanfreins 0.5 x 45° entrée et sortie trous ∅8

DESIGNED BY: Manoel Dialinas DATE: 10/06/2008		Subatech NANTES	I	_
	Material	Alplan 5083 ép. 10 mm	H	_
CHECKED BY: XXX	Quantité	2	G	_
DATE: XXX	System	EMCal ALICE	F	_
SIZE: A4	Sub System	Modules Assembly Tooling	E	_
			D	_
SCALE: 1:1 / WEIGHT (kg): 0.260	Part	Plate	C	_
		26K703	B	_
			A	12.06.2008



DESIGNED BY: Manoel Dialinas DATE: 10/06/2008		Subatech NANTES	I	_
	Material	2017 (6082)	H	_
CHECKED BY: XXX DATE: XXX	Quantity	4	G	_
	System	EMCal ALICE	F	_
SIZE A4	Sub System	Module Assembly Tooling	E	_
			D	_
SCALE 1:1 / WEIGHT (kg) XXX	Part	Rod	C	_
		26K704	B	_
			A	16.06.2008



DESIGNED BY: Manoel Dialinas DATE: 16/06/2008		Subatech NANTES	I	_
	Material	Usinage complémentaire	H	_
CHECKED BY: XXX DATE: XXX	Quantity	1	G	_
	System	EMCal ALICE	F	_
SIZE A4	Sub System	Modules Assembly Tooling	E	_
SCALE 1:1 / WEIGHT (kg) XXX	Part	Load Cell Plate	D	_
		26K705	C	_
			B	_
			A	_

Rep	N° Plan	Nb	Désignation	Observations
108		2	Vis CHC M10-80 - Inox A2-70	
8	26K407 / Q_EMCAL_4.2_D_ST_005	2	RENFORT ARRIERE INFERIEURE	
7	26K407 / Q_EMCAL_4.2_D_ST_005	2	RENFORT ARRIERE SUPERIEURE	
~~107~~		~~6~~	~~Goupille Standard Inox D 10 Lg 70 - HPC DP10,0-70/B~~	
106		4	Goupille Standard Inox D 10 Lg 40 - HPC DP10,0-40/B	
6	26K407 / Q_EMCAL_4.2_D_ST_005	1	FACE RENFORT ARRIERE	
105		18	Vis CHC M10-30 - Inox A2-70	
104		4	Goupille Standard Inox D 10 Lg 40 - HPC DP10,0-40/B	
5	26K410 / Q_EMCAL_4.2_D_ST_007	1	FACE APPUI ARRIERE	
103		32	Vis CHC 10-40 - Inox A2-70	
4	26K406 / Q_EMCAL_4.2_D_ST_004	1	FACE SUPERIEURE DROITE	
102		32	Vis CHC 10-40 - Inox A2-70	
3	26K405 / Q_EMCAL_4.2_D_ST_003	1	FACE SUPERIEURE GAUCHE	
101		8	Vis CHC M10-30 - Inox A2-70	
2	26K404 / Q_EMCAL_4.2_D_ST_002	1	FACE INFERIEURE DROITE	
100		8	Vis CHC M10-30 - Inox A2-70	
1	26K403 / Q_EMCAL_4.2_D_ST_001	1	FACE INFERIEURE GAUCHE	

Observations

Modification

N°	Rep	Designation	designer	Date
F	-	modification nombre de pieces : 7, 8, 102, 103 & 108	STUTZMANN.JS	01/04/08
	-	piece 107 eliminee, changement piece 108 & 109	STUTZMANN.JS	27/03/08
E	-	renumerotation plan	STUTZMANN.JS	27/03/08

EMCAL

MONTAGE CRATE

Format : A3

designer	06/06	STUTZMANN.JS
checkng	--/--	---

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26K401 / Q_EMCAL_4.1_N_ST_001

Revision F

1/2

Rep	N° Plan	Nb	Désignation	Observations
121		18	Vis CHC M5-20 - Inox A2-70	
12	26K407 / Q_EMCAL_4.1_D_ST_005	1	FACE APPUI ARRIERE GLISSANTE	
110		8	Vis CHC M6-60 - Inox A2-70	
11	26K410 / Q_EMCAL_4.1_D_ST_007	4	POINT ANCRAGE	
109		42	Vis FHS M5-16 - Inox A2-70	
10	26K410 / Q_EMCAL_4.1_D_ST_007	42	PINCE PLAQUE INFERIEURE	
9	26K408-26K409 / Q_EMCAL_4.1_D_ST_006	1	PLAQUE INFERIEURE	

Observations

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Modification

N°	Rep	Designation	designer	Date
F	-	modification nombre de pieces : 7, 8, 102, 103 & 108	STUTZMANN.JS	01/04/08
	-	piece 107 eliminee, changement piece 108 & 109	STUTZMANN.JS	27/03/08
E	-	renumerotation plan	STUTZMANN.JS	27/03/08

EMCAL

MONTAGE CRATE

Format : A3

designer	06/06	STUTZMANN.JS
checkng	--/--	---

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26K402 / Q_EMCAL_4.1_N_ST_001

Revision F

2/2

BON POUR FABRICATION

Rep.	N° plan	Designation
---	---	---
12	26K407 / Q_EMCAL_4.1_D_ST_005	FACE APPUI ARRIERE GLISSANTE
11	26K410 / Q_EMCAL_4.1_D_ST_007	POINT ANCRAGE
10	26K410 / Q_EMCAL_4.1_D_ST_007	PINCE PLAQUE INFERIEURE
9	26K408-26K409 / Q_EMCAL_4.1_D_ST_006	PLAQUE INFERIEURE
8	26K407 / Q_EMCAL_4.1_D_ST_005	RENFORT ARRIERE INFERIEUR
7	26K407 / Q_EMCAL_4.1_D_ST_005	RENFORT ARRIERE SUPERIEUR
6	26K407 / Q_EMCAL_4.1_D_ST_005	FACE RENFORT ARRIERE
5	26K410 / Q_EMCAL_4.1_D_ST_007	FACE APPUI ARRIERE
4	26K406 / Q_EMCAL_4.1_D_ST_004	FACE SUPERIEURE DROITE
3	26K405 / Q_EMCAL_4.1_D_ST_003	FACE SUPERIEURE GAUCHE
2	26K404 / Q_EMCAL_4.1_D_ST_002	FACE INFERIEURE DROITE
1	26K403 / Q_EMCAL_4.1_D_ST_001	FACE INFERIEURE GAUCHE

Modification

N°	Rep	Designation	designer	Date
F	-	---	---	--/--/--
E	-	renumerotation plan	STUTZMANN.JS	27/03/08
D	-	mise à jour	STUTZMANN.JS	06/11/06
C	-	mise à jour	STUTZMANN.JS	22/09/06
B	-	mise à jour	STUTZMANN.JS	11/09/06
A	-	creation	STUTZMANN.JS	08/06/06

EMCAL
MONTAGE CRATE

designer	06/06	STUTZMANN.JS
checkng	--/--	---

Format : A0

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26K400 / Q_EMCAL_4.1_E_ST_001

Revision E — 1/1

Rep	N° Plan	Nb	Désignation	Observations
108		2	Vis CHC M10-80 - Inox A2-70	
8	26K407 / Q_EMCAL_4.2_D_ST_005	2	RENFORT ARRIERE INFERIEURE	
7	26K407 / Q_EMCAL_4.2_D_ST_005	2	RENFORT ARRIERE SUPERIEURE	
~~107~~		~~6~~	~~Goupille Standard Inox D 10 Lg 70 - HPC DP10,0-70/B~~	
106		4	Goupille Standard Inox D 10 Lg 40 - HPC DP10,0-40/B	
6	26K407 / Q_EMCAL_4.2_D_ST_005	1	FACE RENFORT ARRIERE	
105		18	Vis CHC M10-30 - Inox A2-70	
104		4	Goupille Standard Inox D 10 Lg 40 - HPC DP10,0-40/B	
5	26K410 / Q_EMCAL_4.2_D_ST_007	1	FACE APPUI ARRIERE	
103		32	Vis CHC 10-40 - Inox A2-70	
4	26K406 / Q_EMCAL_4.2_D_ST_004	1	FACE SUPERIEURE DROITE	
102		32	Vis CHC 10-40 - Inox A2-70	
3	26K405 / Q_EMCAL_4.2_D_ST_003	1	FACE SUPERIEURE GAUCHE	
101		8	Vis CHC M10-30 - Inox A2-70	
2	26K404 / Q_EMCAL_4.2_D_ST_002	1	FACE INFERIEURE DROITE	
100		8	Vis CHC M10-30 - Inox A2-70	
1	26K403 / Q_EMCAL_4.2_D_ST_001	1	FACE INFERIEURE GAUCHE	

Observations

Modification

N°	Rep	Designation	designer	Date
F	-	modification nombre de pieces : 7, 8, 102, 103 & 108	STUTZMANN.JS	01/04/08
	-	piece 107 eliminee, changement piece 108 & 109	STUTZMANN.JS	27/03/08
E	-	renumerotation plan	STUTZMANN.JS	27/03/08

EMCAL

MONTAGE CRATE

Format : A3

designer	06/06	STUTZMANN.JS
checkng	--/--	---

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26K401 / Q_EMCAL_4.1_N_ST_001

Revision F

1/2

Rep	N° Plan	Nb	Désignation	Observations
121		18	Vis CHC M5-20 - Inox A2-70	
12	26K407 / Q_EMCAL_4.1_D_ST_005	1	FACE APPUI ARRIERE GLISSANTE	
110		8	Vis CHC M6-60 - Inox A2-70	
11	26K410 / Q_EMCAL_4.1_D_ST_007	4	POINT ANCRAGE	
109		42	Vis FHS M5-16 - Inox A2-70	
10	26K410 / Q_EMCAL_4.1_D_ST_007	42	PINCE PLAQUE INFERIEURE	
9	26K408-26K409 / Q_EMCAL_4.1_D_ST_006	1	PLAQUE INFERIEURE	

Observations

Modification

N°	Rep	Designation	designer	Date
F	-	modification nombre de pieces : 7, 8, 102, 103 & 108	STUTZMANN.JS	01/04/08
	-	piece 107 eliminee, changement piece 108 & 109	STUTZMANN.JS	27/03/08
E	-	renumerotation plan	STUTZMANN.JS	27/03/08

EMCAL

MONTAGE CRATE

Format : A3

designer	06/06	STUTZMANN.JS
checkng	--/--	---

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26K402 / Q_EMCAL_4.1_N_ST_001

Revision F

2/2

N°	Rep	Designation	Designer	Date
13	-	---	---	--/--/--
12	-	ajout usinage de degagement angle à 90°	STUTZMANN.JS	16/04/08
11	-	changement trou Ø10g6 en Ø10H7	STUTZMANN.JS	01/04/08
10	-	rajout de 2 trous M10	STUTZMANN.JS	27/03/08
9	-	usinage suplementaire	STUTZMANN.JS	27/03/08
8	-	retrait trous de fixation boites electroniques	STUTZMANN.JS	27/03/08
7	-	retrait plan 2/2 : trous retires	STUTZMANN.JS	27/03/08
6	-	modification longueur platine	STUTZMANN.JS	27/03/08
5	-	modification des tolerances generales	STUTZMANN.JS	14/11/06
4	1	ajout trous de fixation boites electroniques	STUTZMANN.JS	06/11/06
3	-	modification des tolerances generales	STUTZMANN.JS	22/09/06
2	-	ajout de notes	STUTZMANN.JS	22/09/06
1	-	mise à jour	STUTZMANN.JS	07/09/06

Material	2024 T351	Scale	1/4	creation date	08/06/06
object name	Crate - Face Inferieure Gauche v10	Mass	67 Kg	max He leak rate	---
Specification	debur edges			General Tolerances JS/js	11
heat treatment	---			angular tol	± 0°10'
cleaning	---			Roughness	3.2
surface protection	---				

FACE INFERIEURE GAUCHE

26K403 / Q_EMCAL_4.1_D_ST_001 — 1

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Rep.	N° plan	Designation
---	---	---
1	26K403 / Q_EMCAL_4.1_D_ST_001	FACE INFERIEURE GAUCHE

N°	Rep	Designation	designer	Date
I	1	---	---	--/--/--
H	1	ajout usinage de degagement angle à 90°	STUTZMANN.JS	16/04/08
G	1	changement trou Ø10g6 en Ø10H7	STUTZMANN.JS	01/04/08
	1	rajout de 2 trous M10	STUTZMANN.JS	27/03/08
	1	usinage suplementaire	STUTZMANN.JS	27/03/08
	1	retrait trous de fixation boites electroniques	STUTZMANN.JS	27/03/08
	1	retrait plan 2/2 : trous retires	STUTZMANN.JS	27/03/08
	1	modification longueur platine	STUTZMANN.JS	27/03/08
F	-	renumerotation plan	STUTZMANN.JS	27/03/08
E	1	modification des tolerances generales	STUTZMANN.JS	14/11/06
D	1	ajout trous de fixation boites electroniques	STUTZMANN.JS	06/11/06
	1	modification des tolerances generales	STUTZMANN.JS	22/09/06
C	1	ajout de notes	STUTZMANN.JS	22/09/06
B	1	mise à jour	STUTZMANN.JS	07/09/06
A	-	creation	STUTZMANN.JS	08/06/06

EMCAL

MONTAGE CRATE

Format : A0

designer	06/06	STUTZMANN.JS
checkng	--/--	---

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26K403 / Q_EMCAL_4.1_D_ST_001 — Revision H — 1/1

BON POUR FABRICATION

Dimensions valables pour une hauteur de de module de 302.61 mm

Modif. N°	Rep	Designation	Designer	Date
13	-	---	---	--/--/--
12	-	ajout usinage de degagement angle à 90°	STUTZMANN.JS	16/04/08
11	-	changement trou Ø10g6 en Ø10H7	STUTZMANN.JS	01/04/08
10	-	rajout de 2 trous M10	STUTZMANN.JS	27/03/08
9	-	usinage suplementaire	STUTZMANN.JS	27/03/08
8	-	retrait trous de fixation boites electroniques	STUTZMANN.JS	27/03/08
7	-	retrait plan 2/2 : trous retires	STUTZMANN.JS	27/03/08
6	-	modification longueur platine	STUTZMANN.JS	27/03/08
5	-	modification des tolerances generales	STUTZMANN.JS	14/11/06
4	-	ajout trous de fixation boites electroniques	STUTZMANN.JS	06/11/06
3	-	modification des tolerances generales	STUTZMANN.JS	22/09/06
2	-	ajout de notes	STUTZMANN.JS	22/09/06
1	-	mise à jour	STUTZMANN.JS	07/09/06

Material	2024 T351	Scale	1/4	creation date	08/06/06
object name	Crate - Face Inferieure Gauche v10	Mass	67 Kg	max He leak rate	---
Specification	debur edges			General Tolerances JS/js	11
heat treatment	---			angular tol	± 0°10'
cleaning	---			Roughness	3.2
surface protection	---				

Roughness: N 2 3 4 5 6 7 8 9 10 / Ra 0.05 0.1 0.2 0.4 0.8 1.6 3.2 6.3 12.5

FACE INFERIEURE DROITE

26K404 / Q_EMCAL_4.1_D_ST_002 | 2

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Rep.	N° plan	Designation
---	---	---
2	26K404 / Q_EMCAL_4.1_D_ST_002	FACE INFERIEURE DROITE

Modification N°	Rep	Designation	designer	Date
I	-	---	---	--/--/--
H	-	ajout usinage de degagement angle à 90°	STUTZMANN.JS	16/04/08
G	-	changement trou Ø10g6 en Ø10H7	STUTZMANN.JS	01/04/08
	2	rajout de 2 trous M10	STUTZMANN.JS	27/03/08
	2	usinage suplementaire	STUTZMANN.JS	27/03/08
	2	retrait trous de fixation boites electroniques	STUTZMANN.JS	27/03/08
	2	retrait plan 2/2 : trous retires	STUTZMANN.JS	27/03/08
	2	modification longueur platine	STUTZMANN.JS	27/03/08
F	-	renumerotation plan	STUTZMANN.JS	27/03/08
E	2	modification des tolerances generales	STUTZMANN.JS	14/11/06
D	2	ajout trous de fixation boites electroniques	STUTZMANN.JS	06/11/06
	2	modification des tolerances generales	STUTZMANN.JS	22/09/06
C	2	ajout de notes	STUTZMANN.JS	22/09/06
B	2	mise à jour	STUTZMANN.JS	07/09/06
A	-	creation	STUTZMANN.JS	08/06/06

EMCAL

MONTAGE CRATE

Format : A0

designer	06/06	STUTZMANN.JS
checkng	--/--	---

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26K404 / Q_EMCAL_4.1_D_ST_002 Revision H 1/1

BON POUR FABRICATION

Dimensions valables pour une hauteur de de module de 302.61 mm

Modif. N°	Rep	Designation	Designer	Date
10	-	---	---	--/--/--
9	-	ajout 3 trous Ø20 et trou oblong	STUTZMANN.JS	16/04/08
8	-	modification position trous	STUTZMANN.JS	27/03/08
7	-	rajout de 2 trous lamés ∅11	STUTZMANN.JS	27/03/08
6	-	modification longueur platine	STUTZMANN.JS	27/03/08
5	-	retrait trous de fixarion boites electroniques	STUTZMANN.JS	27/03/08
4	-	modification des tolerances generales	STUTZMANN.JS	14/11/06
3	-	ajout trous de fixarion boites electroniques	STUTZMANN.JS	06/11/06
2	-	modification des tolerances generales	STUTZMANN.JS	22/09/06
1	-	mise à jour	STUTZMANN.JS	07/09/06

Material	2024 T351	Scale	1/4	creation date	08/06/06
object name	Crate - Face Superieure Gauche v10	Mass	56 Kg	max He leak rate	---
Specification	debur edges			General Tolerances JS/js	11
heat treatment	---			angular tol	± 0°10'
cleaning	---			Roughness	3.2
surface protection	---				

Roughness: N 2 3 4 5 6 7 8 9 10 — Ra 0.05 0.1 0.2 0.4 0.8 1.6 3.2 6.3 12.5

FACE SUPERIEURE GAUCHE

26K405 / Q_EMCAL_4.1_D_ST_003 | 3

Rep.	N° plan	Designation
---	---	---
3	26K405 / Q_EMCAL_4.1_D_ST_003	FACE SUPERIEURE GAUCHE

Modification N°	Rep	Designation	designer	Date
H	-	---	---	--/--/--
G	3	ajout 3 trous Ø20 et trou oblong	STUTZMANN.JS	16/04/08
	3	modification position trous	STUTZMANN.JS	27/03/08
	3	rajout de 2 trous lamés Ø11	STUTZMANN.JS	27/03/08
	3	modification longueur platine	STUTZMANN.JS	27/03/08
	3	retrait trous de fixarion boites electroniques	STUTZMANN.JS	27/03/08
F	-	renumerotation plan	STUTZMANN.JS	27/03/08
E	3	modification des tolerances generales	STUTZMANN.JS	14/11/06
D	3	ajout trous de fixarion boites electroniques	STUTZMANN.JS	06/11/06
C	3	modification des tolerances generales	STUTZMANN.JS	22/09/06
B	-	mise à jour	STUTZMANN.JS	07/09/06
A	-	creation	STUTZMANN.JS	08/06/06

EMCAL

MONTAGE CRATE

Format : A0

designer	06/06	STUTZMANN.JS
checkng	--/--	---

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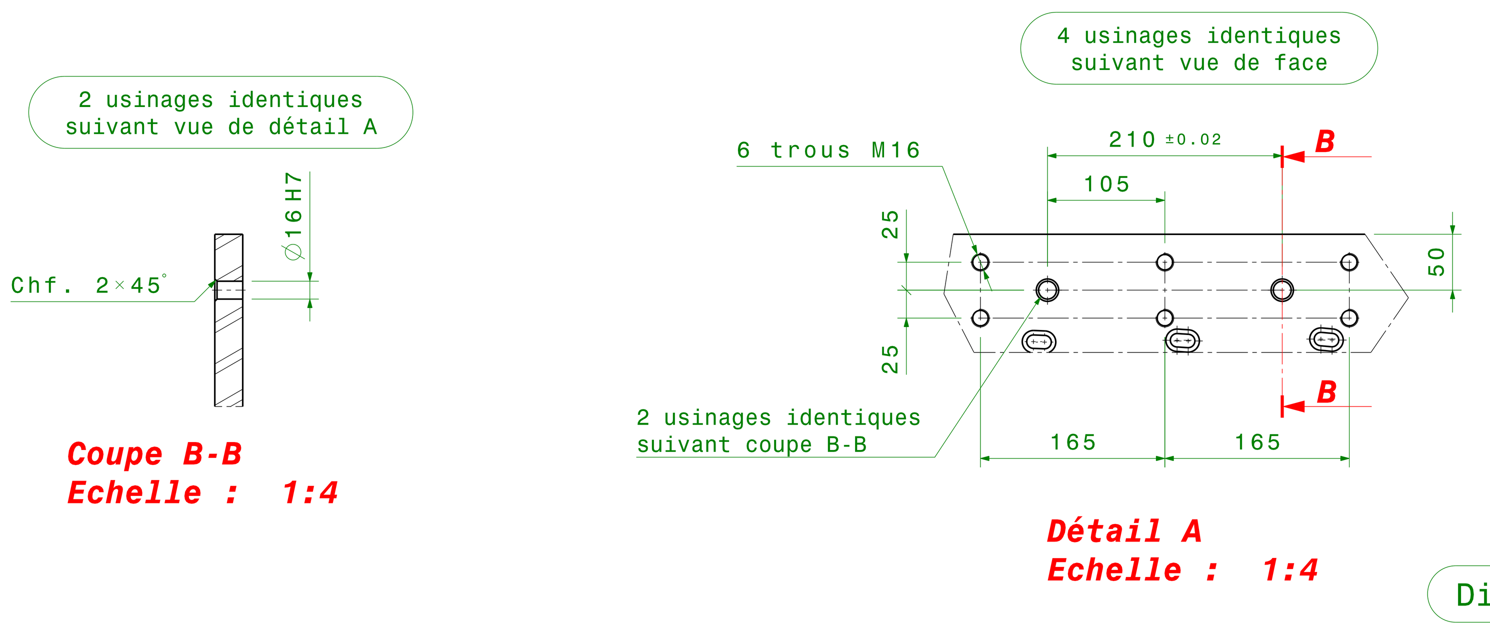
26K405 / Q_EMCAL_4.1_D_ST_003 — Revision G — 1/1



Dimensions valables pour une hauteur de de module de 302.61 mm

BON POUR FABRICATION

N°	Rep	Designation	Designer	Date
10	-	---	---	--/--/--
9	-	ajout 3 trous Ø20 et trou oblong	STUTZMANN.JS	16/04/08
8	-	modification position trous	STUTZMANN.JS	27/03/08
7	-	rajout de 2 trous lames ∅11	STUTZMANN.JS	27/03/08
6	-	modification longueur platine	STUTZMANN.JS	27/03/08
5	-	retrait trous de fixarion boites electroniques	STUTZMANN.JS	27/03/08
4	-	modification des tolerances generales	STUTZMANN.JS	14/11/06
3	-	ajout trous de fixarion boites electroniques	STUTZMANN.JS	06/11/06
2	-	modification des tolerances generales	STUTZMANN.JS	22/09/06
1	-	mise à jour	STUTZMANN.JS	07/09/06

Material	2024 T351	Scale	1/4	creation date	08/06/06
object name	Crate - Face Superieure Droite v10	Mass	56 Kg	max He leak rate	---
Specification	debur edges			General Tolerances JS/js	11
heat treatment	---			angular tol	± 0°10'
cleaning	---			Roughness	3.2
surface protection	---				

Roughness: N 2 3 4 5 6 7 8 9 10; Ra 0.05 0.1 0.2 0.4 0.8 1.6 3.2 6.3 12.5

FACE SUPERIEURE DROITE

26K406 / Q_EMCAL_4.1_D_ST_004 — 4

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Rep.	N° plan	Designation
---	---	---
4	26K406 / Q_EMCAL_4.1_D_ST_004	FACE SUPERIEURE DROITE

N°	Rep	Designation	designer	Date
H	-	---	---	--/--/--
G	4	ajout 3 trous ∅20 et trou oblong	STUTZMANN.JS	16/04/08
	4	modification position trous	STUTZMANN.JS	27/03/08
	4	rajout de 2 trous lames Ø11	STUTZMANN.JS	27/03/08
	4	modification longueur platine	STUTZMANN.JS	27/03/08
	4	retrait trous de fixarion boites electroniques	STUTZMANN.JS	27/03/08
F	-	renumerotation plan	STUTZMANN.JS	27/03/08
E	4	modification des tolerances generales	STUTZMANN.JS	14/11/06
D	4	ajout trous de fixarion boites electroniques	STUTZMANN.JS	06/11/06
C	4	modification des tolerances generales	STUTZMANN.JS	22/09/06
B	-	mise à jour	STUTZMANN.JS	07/09/06
A	-	creation	STUTZMANN.JS	08/06/06

EMCAL
MONTAGE CRATE

Format : A0
designer: 06/06 STUTZMANN.JS
checkng: --/-- ---

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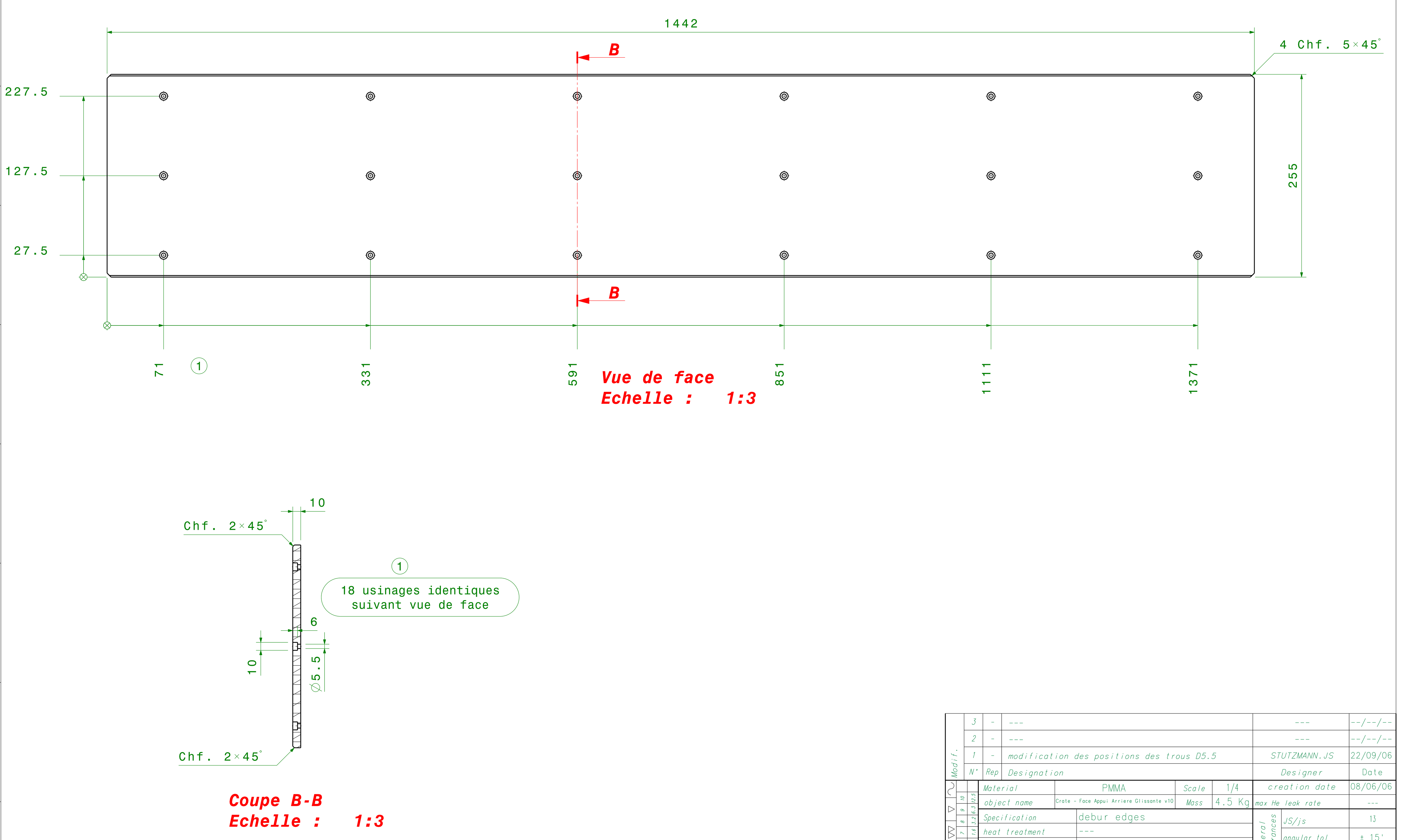
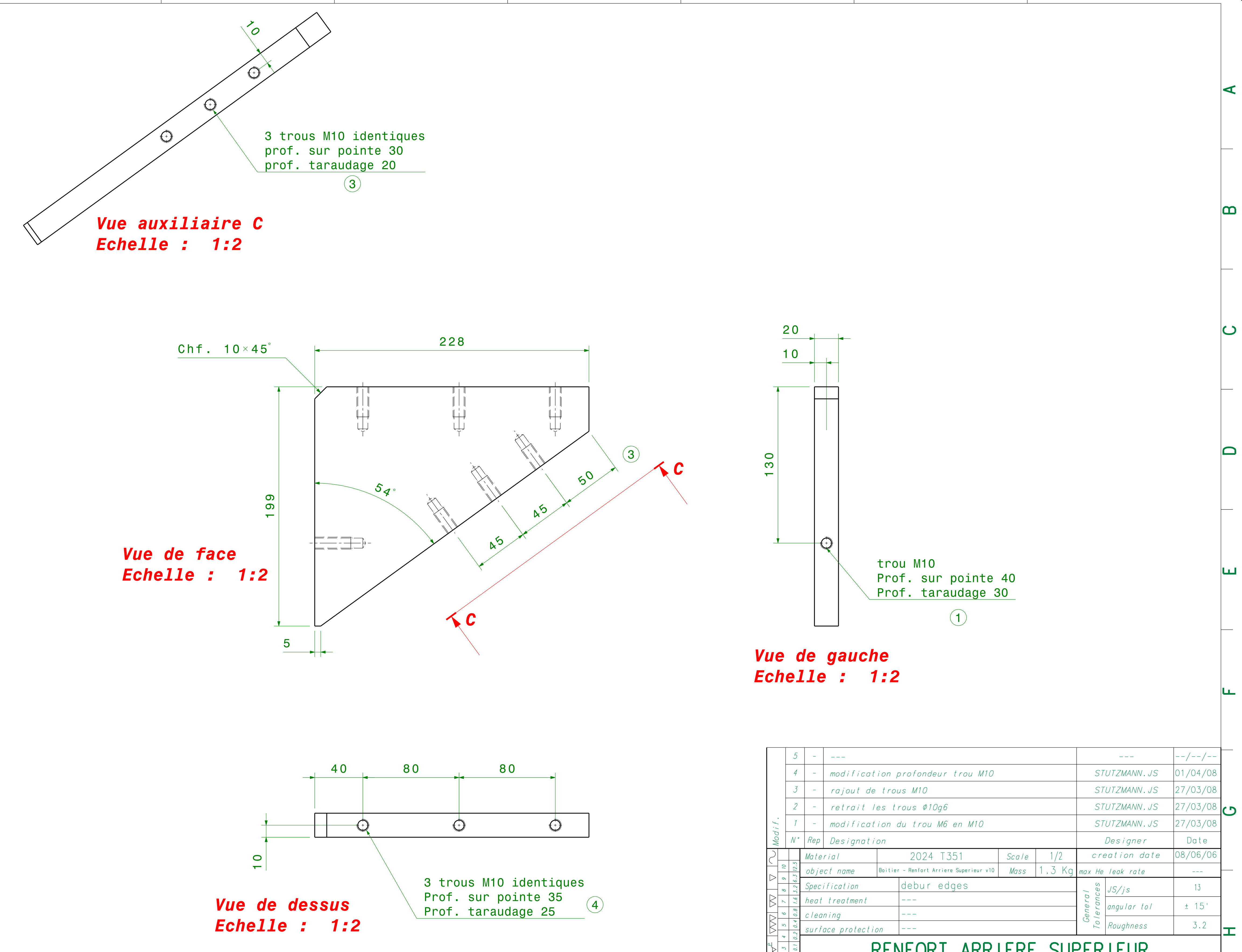
26K406 / Q_EMCAL_4.1_D_ST_004 — Revision G — 1/1



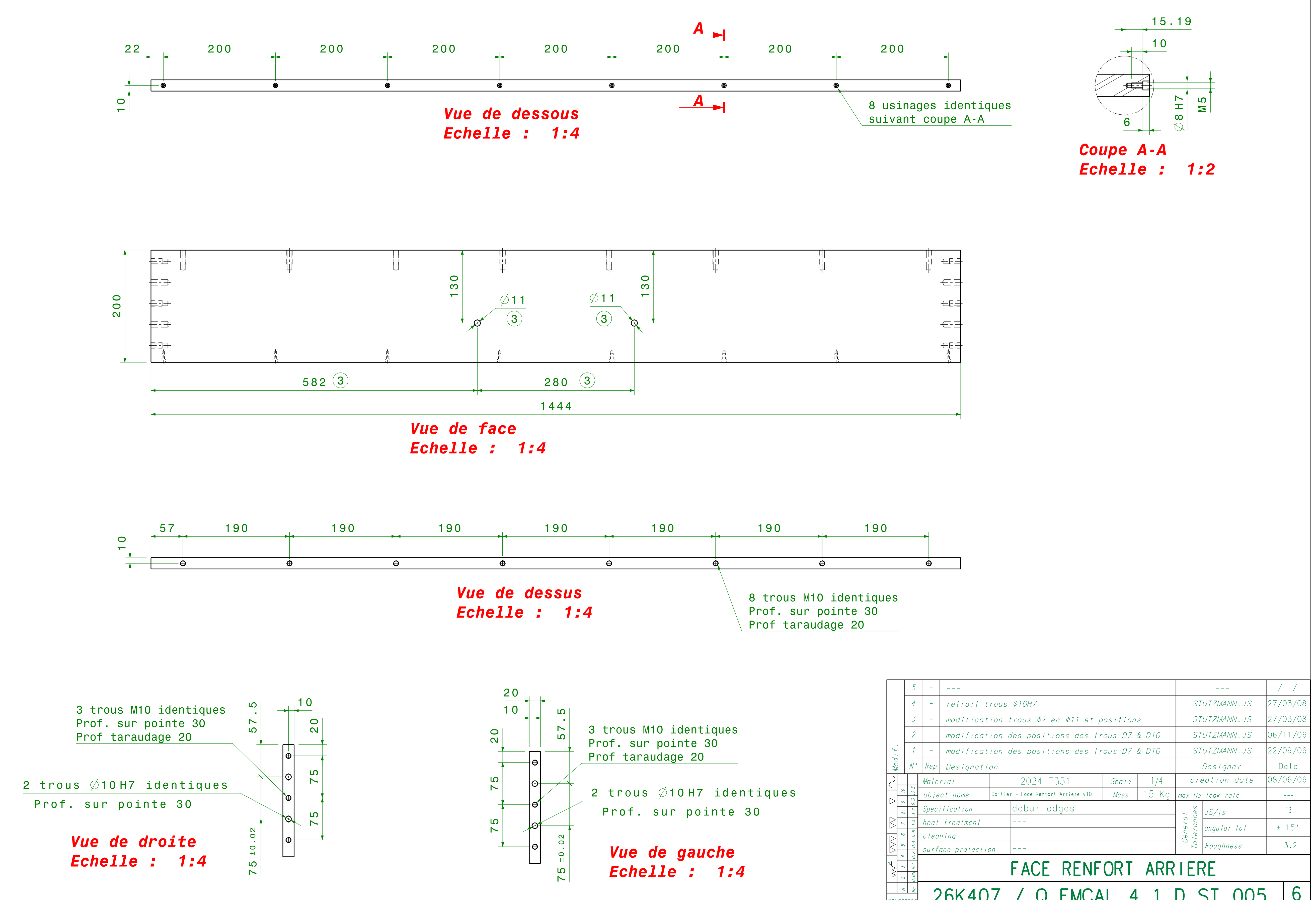
FACE APPUI ARRIERE GLISSANTE

26K407 / Q_EMCAL_4.1_D_ST_005 12



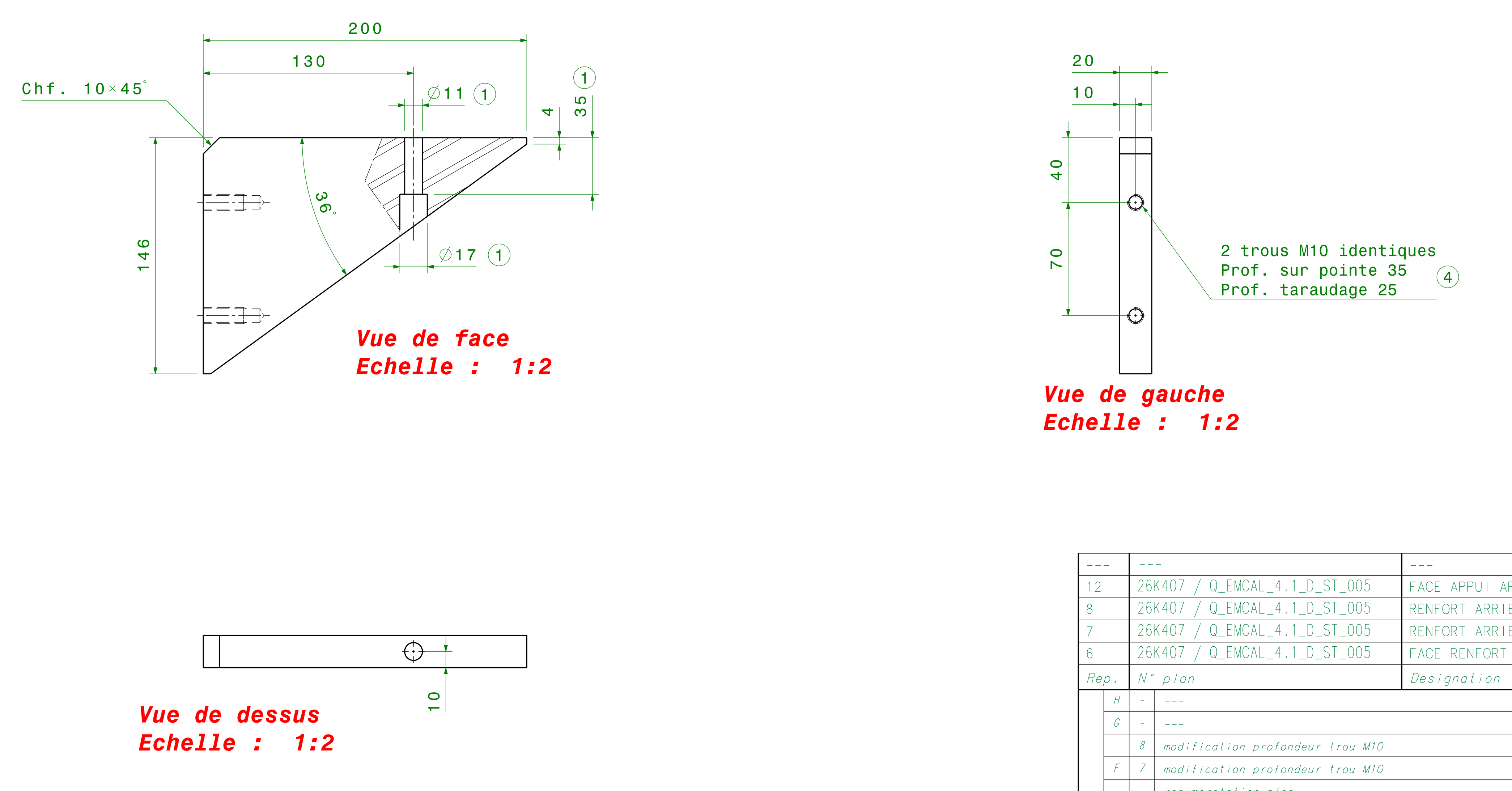
RENFORT ARRIERE SUPERIEUR

26K407 / Q_EMCAL_4.1_D_ST_005 7



FACE RENFORT ARRIERE

26K407 / Q_EMCAL_4.1_D_ST_005 6



Dimensions valables pour une hauteur de de module de 302.61 mm

BON POUR FABRICATION

RENFORT ARRIERE INFERIEUR

26K407 / Q_EMCAL_4.1_D_ST_005 8

Rep.	N° plan	Designation
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12	26K407 / Q_EMCAL_4.1_D_ST_005	FACE APPUI ARRIERE GLISSANTE
8	26K407 / Q_EMCAL_4.1_D_ST_005	RENFORT ARRIERE INFERIEUR
7	26K407 / Q_EMCAL_4.1_D_ST_005	RENFORT ARRIERE SUPERIEUR
6	26K407 / Q_EMCAL_4.1_D_ST_005	FACE RENFORT ARRIERE

N°	Rep	Designation	designer	Date
H	-	---	---	--/--/--
G	-	---	---	--/--/--
	8	modification profondeur trou M10	STUTZMANN.JS	01/04/08
F	7	modification profondeur trou M10	STUTZMANN.JS	01/04/08
	-	renumerotation plan	STUTZMANN.JS	27/03/08
	8	retrait des trous Ø10g6	STUTZMANN.JS	27/03/08
	8	modification du trou lame Ø8 en Ø11	STUTZMANN.JS	27/03/08
	7	rajout de trous M10	STUTZMANN.JS	27/03/08
	7	retrait les trous Ø10g6	STUTZMANN.JS	27/03/08
	7	modification du trou M6 en M10	STUTZMANN.JS	27/03/08
	6	retrait trous Ø10H7	STUTZMANN.JS	27/03/08
E	6	modification trous Ø7 en Ø11 et positions	STUTZMANN.JS	27/03/08
D	6	modification des positions des trous D7 & D10	STUTZMANN.JS	06/11/06
	12	modification des positions des trous D5.5	STUTZMANN.JS	22/09/06
C	6	modification des positions des trous D7 & D10	STUTZMANN.JS	22/09/06
B	-	mise à jour	STUTZMANN.JS	07/09/06
A	-	creation	STUTZMANN.JS	08/06/06

EMCAL

MONTAGE CRATE

Format : A0

designer 06/06 STUTZMANN.JS

checkng --/-- ---

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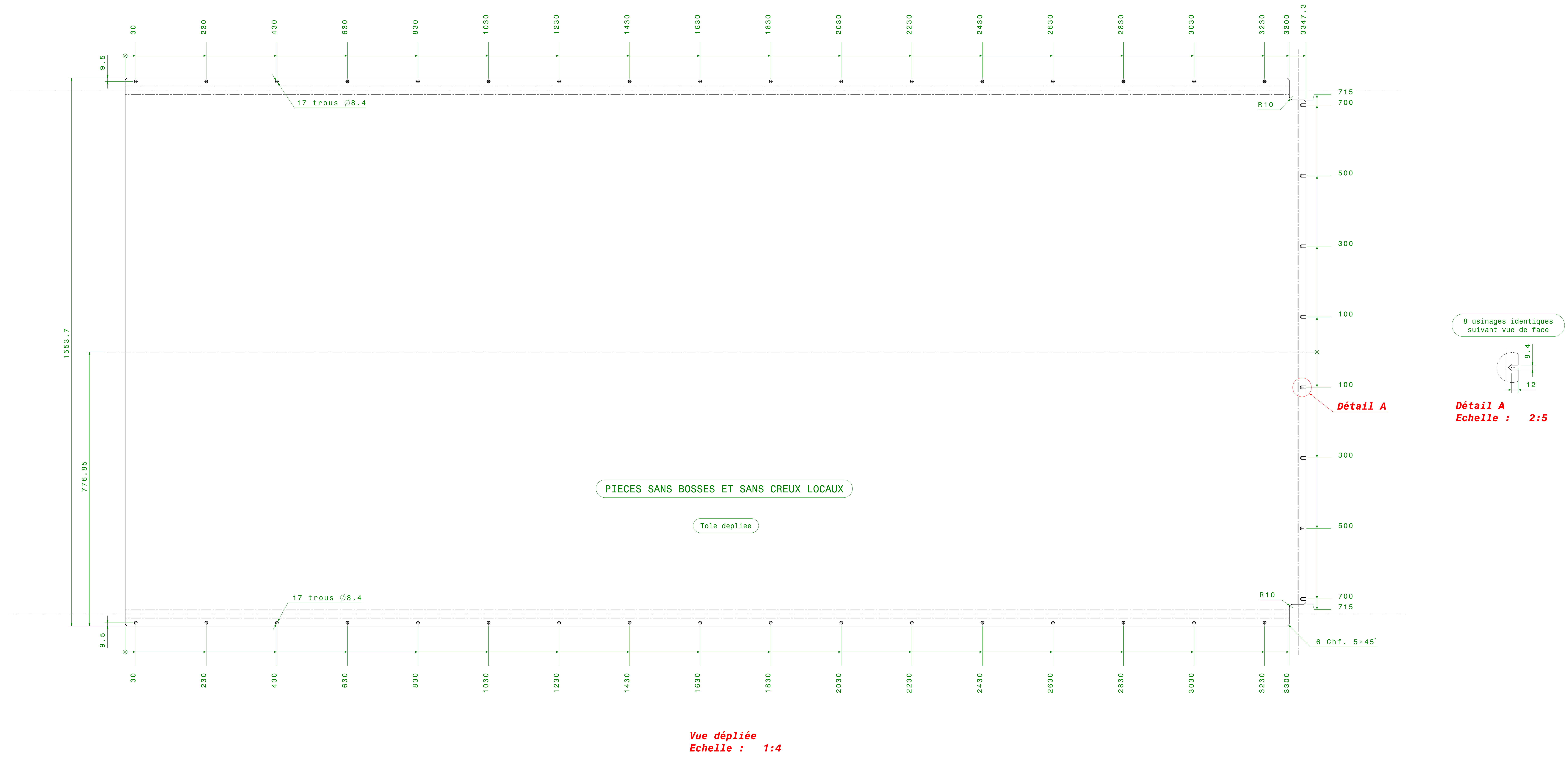
Revision F 1/1



BON POUR FABRICATION

Tole epaisseur 1 mm.

Dimensions valables pour une hauteur de de module de 302.61 mm

N°	Rep	Designation	Designer	Date
5	-	---	---	--/--/--
4	-	modification matiere	STUTZMANN.JS	22/09/06
3	-	modification des tolerances generales	STUTZMANN.JS	22/09/06
2	-	ajout d'une note	STUTZMANN.JS	22/09/06
1	-	mise à jour	STUTZMANN.JS	07/09/06

Material	INOX 304L	Scale	1/2	creation date	08/06/06
object name	Crate - Plaque Inferieure v10	Mass	41 Kg	max He leak rate	---
Specification	debur edges			JS/js	11
heat treatment	---			angular tol	± 0.5°
cleaning	---			Roughness	3.2
surface protection	---				

PLAQUE INFERIEURE

26K408 / Q_EMCAL_4.1_D_ST_006 | 9

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Rep.	N° plan	Designation
---	---	---
9	26K408 / Q_EMCAL_4.1_D_ST_006	PLAQUE INFERIEURE

N°	Rep	Designation	designer	Date
F	-	---	---	--/--/--
E	-	---	---	--/--/--
D	-	renumerotation plan	STUTZMANN.JS	27/03/08
	9	modification matiere	STUTZMANN.JS	22/09/06
	9	modification des tolerances generales	STUTZMANN.JS	22/09/06
C	9	ajout d'une note	STUTZMANN.JS	22/09/06
B	9	mise à jour	STUTZMANN.JS	07/09/06
A	-	creation	STUTZMANN.JS	08/06/06

EMCAL
MONTAGE CRATE

Format : A0

designer	06/06	STUTZMANN.JS
checkng	--/--	---

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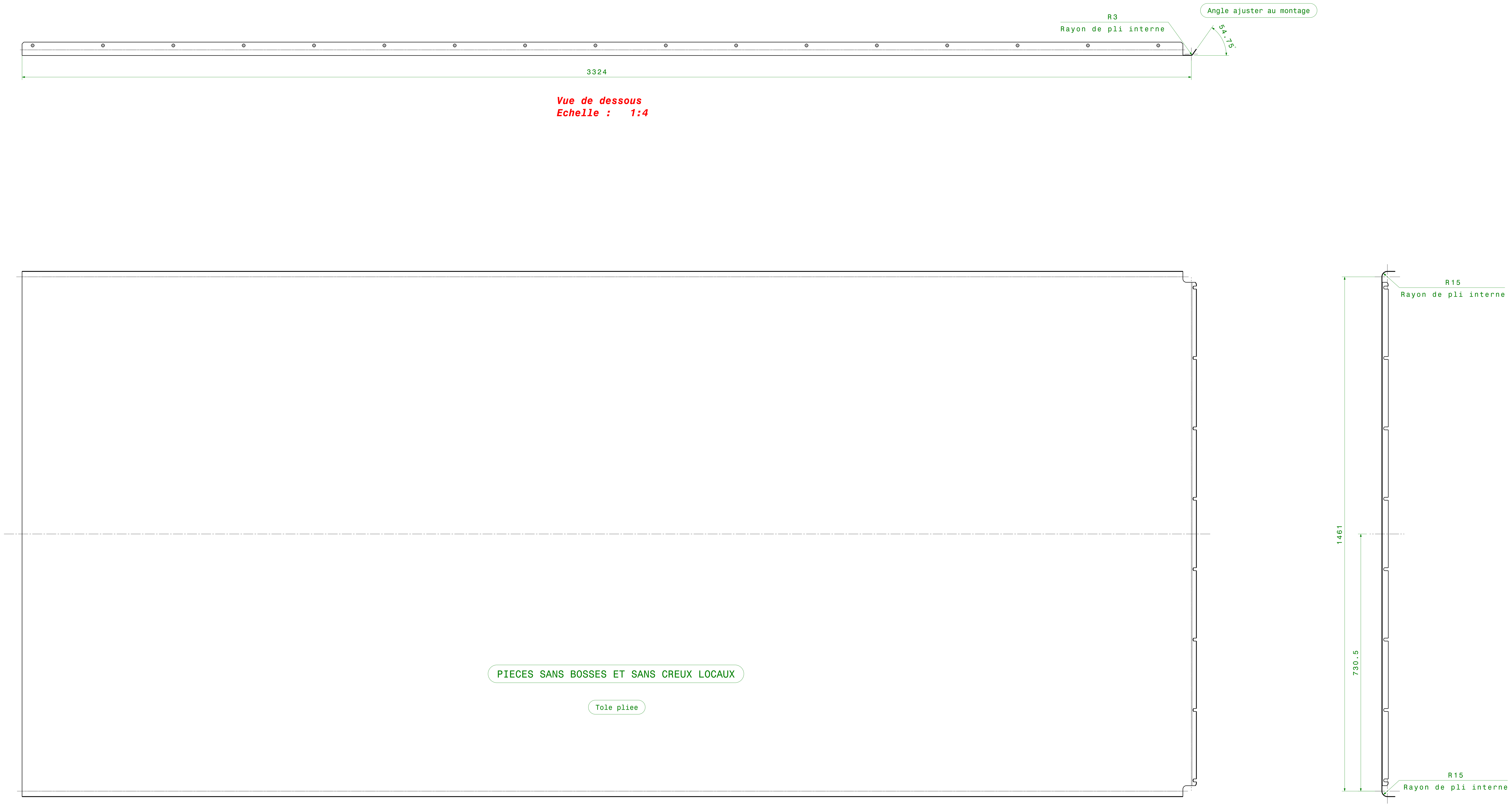
26K408 / Q_EMCAL_4.1_D_ST_006

Revision D — 1/2



Vue de dessous
Echelle : 1:4

Vue de face
Echelle : 1:4

Vue de gauche
Echelle : 1:4

BON POUR FABRICATION

Tole epaisseur 1 mm.

Dimensions valables pour une hauteur de de module de 302.61 mm

N°	Rep	Designation	Designer	Date
5	-	---	---	--/--/--
4	-	modification matiere	STUTZMANN.JS	22/09/06
3	-	modification des tolerances generales	STUTZMANN.JS	22/09/06
2	-	ajout d'une note	STUTZMANN.JS	22/09/06
1	-	mise à jour	STUTZMANN.JS	07/09/06

Material	INOX 304L	Scale	1/2	creation date	08/06/06
object name	Crate - Plaque Inferieure v10	Mass	41 Kg	max He leak rate	---
Specification	debur edges			JS/js	11
heat treatment	---			angular tol	± 0.5°
cleaning	---			Roughness	3.2
surface protection	---				

Roughness: N 2 3 4 5 6 7 8 9 10 / Ra 0.05 0.1 0.2 0.4 0.8 1.6 3.2 6.3 12.5

General Tolerances

PLAQUE INFERIEURE

26K409 / Q_EMCAL_4.1_D_ST_006 | 9

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Rep.	N° plan	Designation
---	---	---
9	26K409 / Q_EMCAL_4.1_D_ST_006	PLAQUE INFERIEURE

N°	Rep	Designation	designer	Date
F	-	---	---	--/--/--
E	-	---	---	--/--/--
D	-	renumerotation plan	STUTZMANN.JS	27/03/08
	9	modification matiere	STUTZMANN.JS	22/09/06
	9	modification des tolerances generales	STUTZMANN.JS	22/09/06
C	9	ajout d'une note	STUTZMANN.JS	22/09/06
B	9	mise à jour	STUTZMANN.JS	07/09/06
A	-	creation	STUTZMANN.JS	08/06/06

EMCAL
MONTAGE CRATE

Format : A0

designer	06/06	STUTZMANN.JS
checkng	--/--	---

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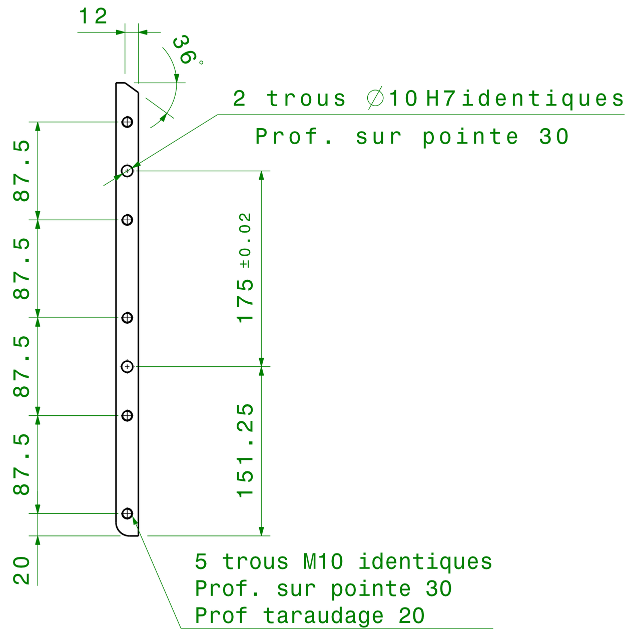
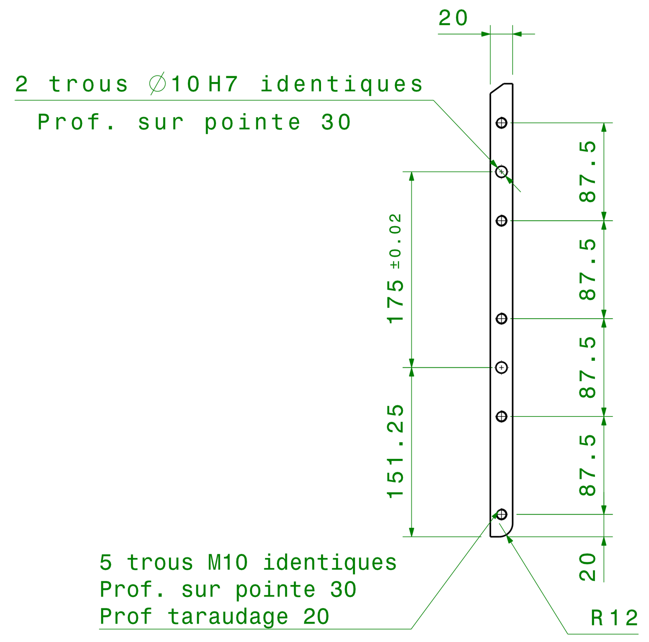
26K409 / Q_EMCAL_4.1_D_ST_006

Revision D

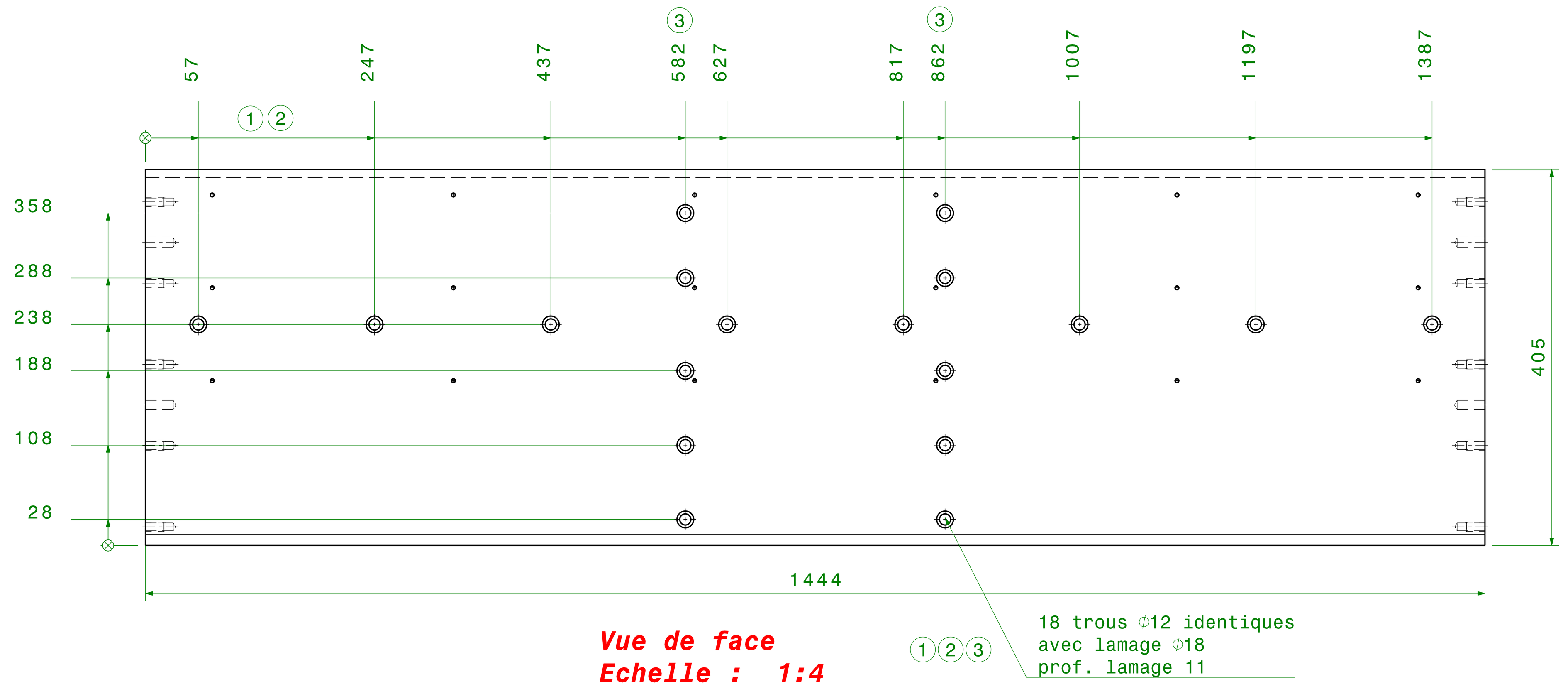
2/2



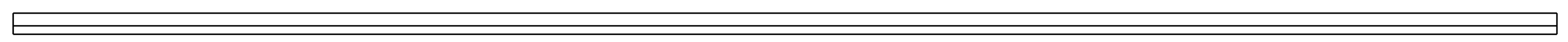
Vue de droite
Echelle : 1:4



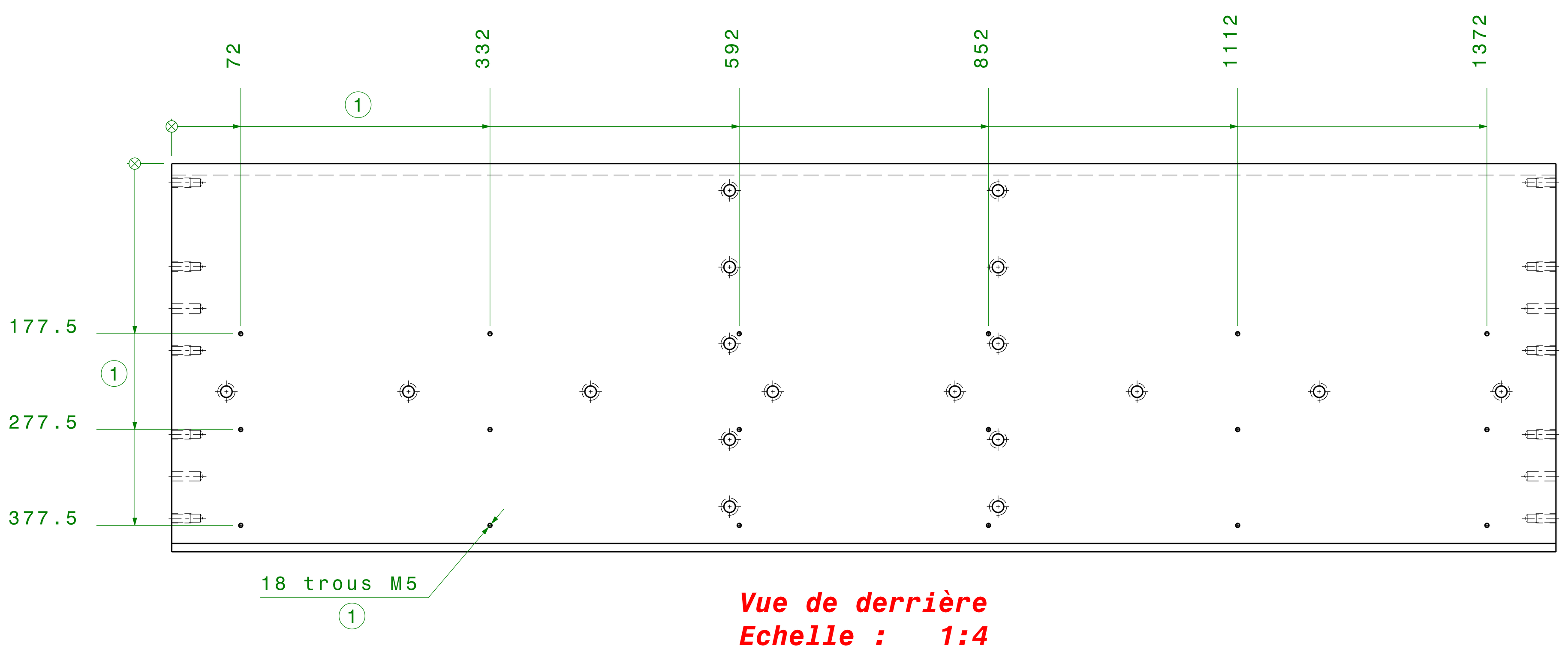
Vue de gauche
Echelle : 1:4



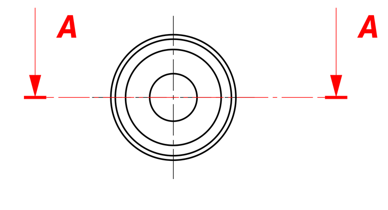
Vue de face
Echelle : 1:4



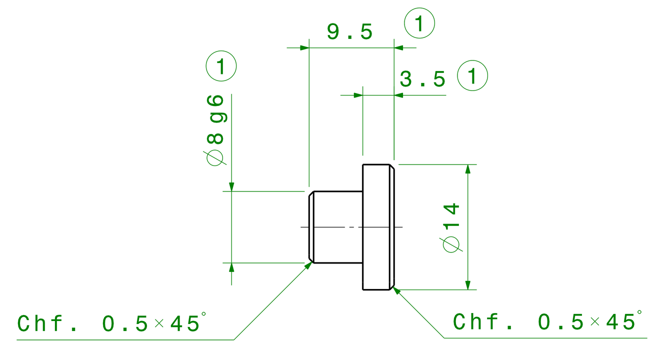
Vue de dessus
Echelle : 1:4



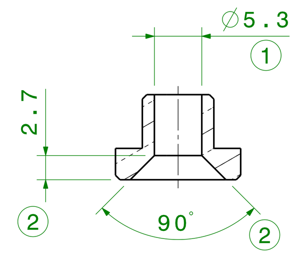
Vue de derrière
Echelle : 1:4



Vue de face
Echelle : 2:1



Vue de gauche
Echelle : 2:1



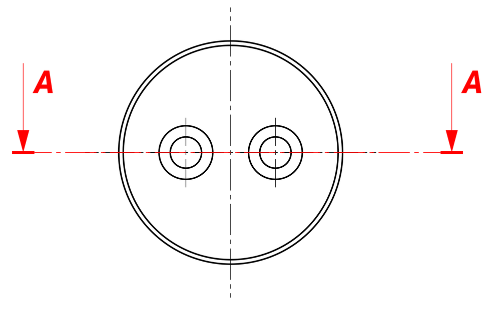
Coupe A-A
Echelle : 2:1

3	-	changement de matiere	STUTZMANN.JS	16/04/08
2	-	rajout du chanfrein sur trou	STUTZMANN.JS	27/03/08
1	-	modification cotes	STUTZMANN.JS	27/03/08
N°	Rep	Designation	Designer	Date

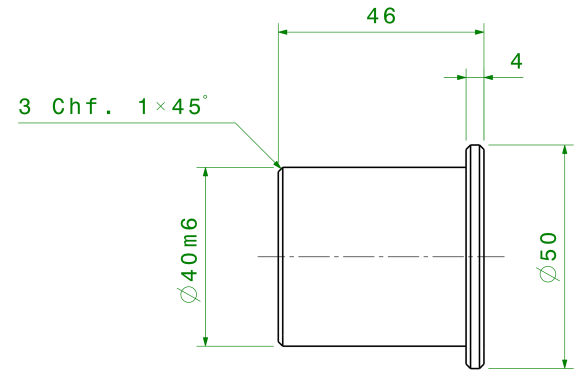
Material	INOX 304L	Scale	2/1	creation date	08/06/06
object name	Crate - Pince Plaque Inferieure v10	Mass	3 gr	max He leak rate	---
Specification	debur edges			JS/js	13
heat treatment	---			angular tol	± 15'
cleaning	---			Roughness	3.2
surface protection	---				

PINCE PLAQUE INFERIEURE

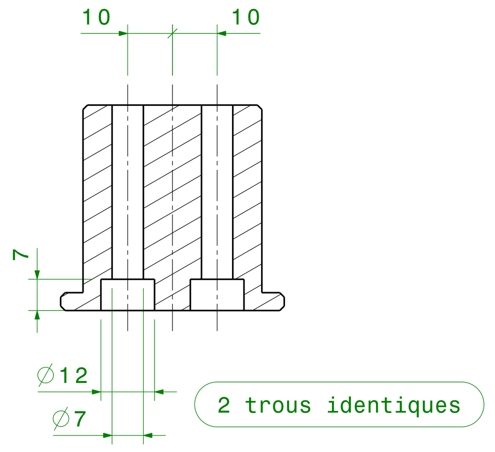
26K410 / Q_EMCAL_4.1_D_ST_007 | 10



Vue de face
Echelle : 1:1



Vue de gauche
Echelle : 1:1



Coupe A-A
Echelle : 1:1

1	-	---	---	--/--/--
N°	Rep	Designation	Designer	Date

Material	INOX 316LN	Scale	1/1	creation date	08/06/06
object name	Crate - Point Ancrage v1	Mass	500 gr	max He leak rate	---
Specification	debur edges			JS/js	13
heat treatment	---			angular tol	± 15'
cleaning	---			Roughness	3.2
surface protection	---				

POINT ANCRAGE

26K410 / Q_EMCAL_4.1_D_ST_007 | 11

4	-	---	---	--/--/--
3	-	redefinition des positions des trous D12	STUTZMANN.JS	27/03/08
2	-	redefinition des positions des trous D12	STUTZMANN.JS	0/11/06
1	-	redefinition des positions des trous D12 et M5	STUTZMANN.JS	22/09/06
N°	Rep	Designation	Designer	Date

Material	2024 T351	Scale	1/4	creation date	07/09/06
object name	Crate - Face Appui Arriere v10	Mass	30 Kg	max He leak rate	---
Specification	debur edges			JS/js	13
heat treatment	---			angular tol	± 15'
cleaning	---			Roughness	3.2
surface protection	---				

FACE APPUI ARRIERE

26K410 / Q_EMCAL_4.1_D_ST_007 | 5

Dimensions valables pour une hauteur de de module de 302.61 mm

BON POUR FABRICATION

Rep.	N° plan	Designation
---	---	---
11	26K410 / Q_EMCAL_4.1_D_ST_007	POINT ANCRAGE
10	26K410 / Q_EMCAL_4.1_D_ST_007	PINCE PLAQUE INFERIEURE
5	26K410 / Q_EMCAL_4.1_D_ST_007	FACE APPUI ARRIERE

N°	Rep	Designation	designer	Date
G	-	---	---	--/--/--
F	10	changement de matiere	STUTZMANN.JS	16/04/08
	10	rajout du chanfrein sur trou	STUTZMANN.JS	27/03/08
	10	modification cotes	STUTZMANN.JS	27/03/08
	5	redefinition des positions des trous D12	STUTZMANN.JS	27/03/08
E	-	renumerotation plan	STUTZMANN.JS	27/03/08
D	5	redefinition des positions des trous D12	STUTZMANN.JS	06/11/06
	-	retrait pieces 13,14 & 15	STUTZMANN.JS	22/09/06
	5	redefinition des positions des trous D12 et M5	STUTZMANN.JS	22/09/06
C	-	mise à jour, ajout piece 5	STUTZMANN.JS	22/09/06
B	-	mise à jour, ajout pieces 13,14 & 15	STUTZMANN.JS	07/09/06
A	-	creation	STUTZMANN.JS	07/09/06

EMCAL

MONTAGE CRATE

designer	06/06	STUTZMANN.JS
checkng	--/--	---

Format : A0

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26K410 / Q_EMCAL_4.1_D_ST_007 — Revision F — 1/1

BON POUR FABRICATION

Dimensions valables pour une hauteur de de module de 302.61 mm

Modif. N°	Rep	Designation	Designer	Date
9	-	---	---	--/--/--
8	-	modification position trous	STUTZMANN.JS	27/03/08
7	-	rajout de 2 trous lamés Ø11	STUTZMANN.JS	27/03/08
6	-	modification longueur platine	STUTZMANN.JS	27/03/08
5	-	retrait trous de fixarion boites electroniques	STUTZMANN.JS	27/03/08
4	-	modification des tolerances generales	STUTZMANN.JS	14/11/06
3	-	ajout trous de fixarion boites electroniques	STUTZMANN.JS	06/11/06
2	-	modification des tolerances generales	STUTZMANN.JS	22/09/06
1	-	mise à jour	STUTZMANN.JS	07/09/06

Material	2024 T351	Scale	1/4	creation date	08/06/06
object name	Crate - Face Superieure Gauche v10	Mass	56 Kg	max He leak rate	---
Specification	debur edges			General Tolerances JS/js	11
heat treatment	---			angular tol	± 0°10'
cleaning	---			Roughness	3.2
surface protection	---				

Roughness: Ra 0.05 0.1 0.2 0.4 0.8 1.6 3.2 6.3 12.5 — N 2 3 4 5 6 7 8 9 10

FACE SUPERIEURE GAUCHE

26K405 / Q_EMCAL_4.1_D_ST_003 — 3

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Rep.	N° plan	Designation
---	---	---
3	26K405 / Q_EMCAL_4.1_D_ST_003	FACE SUPERIEURE GAUCHE

Modification N°	Rep	Designation	designer	Date
H	-	---	---	--/--/--
G	-	---	---	--/--/--
	3	modification position trous	STUTZMANN.JS	27/03/08
	3	rajout de 2 trous lamés Ø11	STUTZMANN.JS	27/03/08
	3	modification longueur platine	STUTZMANN.JS	27/03/08
	3	retrait trous de fixarion boites electroniques	STUTZMANN.JS	27/03/08
F	-	renumerotation plan	STUTZMANN.JS	27/03/08
E	3	modification des tolerances generales	STUTZMANN.JS	14/11/06
D	3	ajout trous de fixarion boites electroniques	STUTZMANN.JS	06/11/06
C	3	modification des tolerances generales	STUTZMANN.JS	22/09/06
B	-	mise à jour	STUTZMANN.JS	07/09/06
A	-	creation	STUTZMANN.JS	08/06/06

EMCAL

MONTAGE CRATE

Format : A0

designer	06/06	STUTZMANN.JS
checkng	--/--	---

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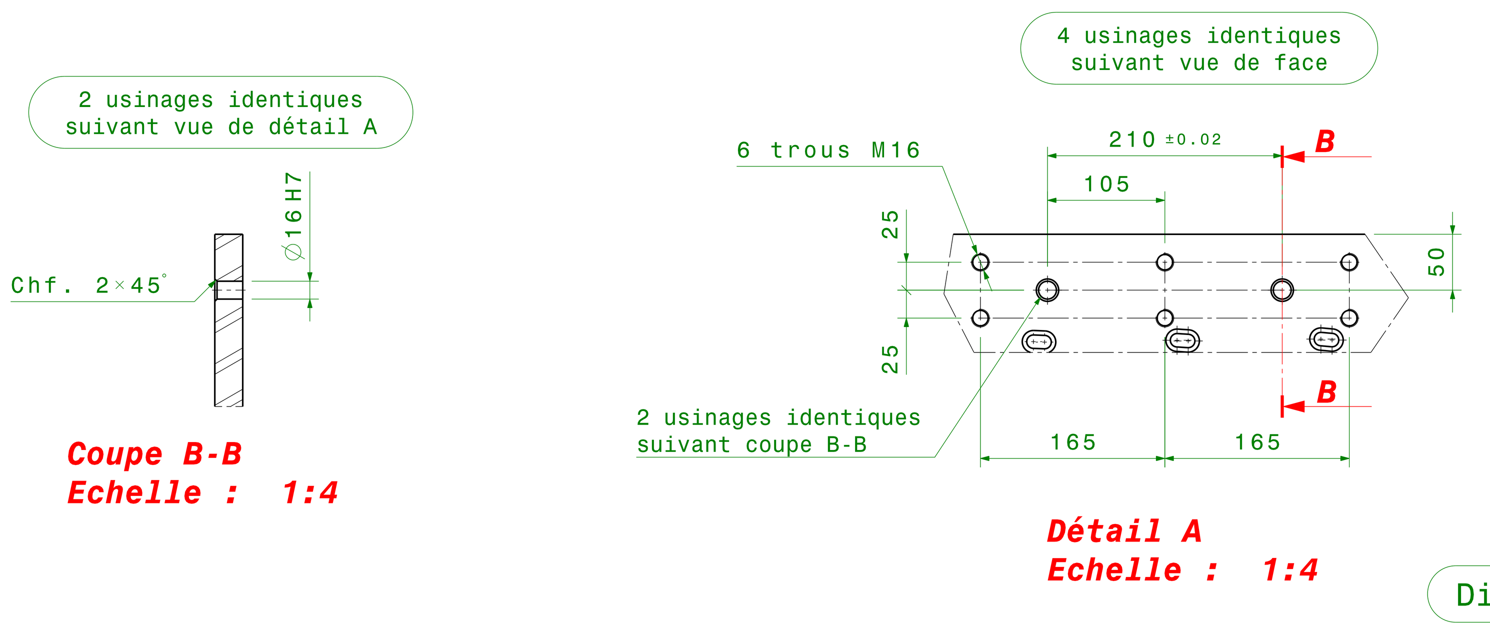
26K405 / Q_EMCAL_4.1_D_ST_003 — Revision F — 1/1



Dimensions valables pour une hauteur de de module de 302.61 mm

BON POUR FABRICATION

N°	Rep	Designation	Designer	Date
9	-	---	---	--/--/--
8	-	modification position trous	STUTZMANN.JS	27/03/08
7	-	rajout de 2 trous lames Ø11	STUTZMANN.JS	27/03/08
6	-	modification longueur platine	STUTZMANN.JS	27/03/08
5	-	retrait trous de fixarion boites electroniques	STUTZMANN.JS	27/03/08
4	-	modification des tolerances generales	STUTZMANN.JS	14/11/06
3	-	ajout trous de fixarion boites electroniques	STUTZMANN.JS	06/11/06
2	-	modification des tolerances generales	STUTZMANN.JS	22/09/06
1	-	mise à jour	STUTZMANN.JS	07/09/06

Material	2024 T351	Scale	1/4	creation date	08/06/06
object name	Crate - Face Superieure Droite v10	Mass	56 Kg	max He leak rate	---
Specification	debur edges			JS/js	11
heat treatment	---			angular tol	± 0°10'
cleaning	---			Roughness	3.2
surface protection	---				

FACE SUPERIEURE DROITE

26K406 / Q_EMCAL_4.1_D_ST_004 | 4

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Rep.	N° plan	Designation
---	---	---
4	26K406 / Q_EMCAL_4.1_D_ST_004	FACE SUPERIEURE DROITE

N°	Rep	Designation	designer	Date
H	-	---	---	--/--/--
G	-	---	---	--/--/--
	4	modification position trous	STUTZMANN.JS	27/03/08
	4	rajout de 2 trous lames Ø11	STUTZMANN.JS	27/03/08
	4	modification longueur platine	STUTZMANN.JS	27/03/08
	4	retrait trous de fixarion boites electroniques	STUTZMANN.JS	27/03/08
F	-	renumerotation plan	STUTZMANN.JS	27/03/08
E	4	modification des tolerances generales	STUTZMANN.JS	14/11/06
D	4	ajout trous de fixarion boites electroniques	STUTZMANN.JS	06/11/06
C	4	modification des tolerances generales	STUTZMANN.JS	22/09/06
B	-	mise à jour	STUTZMANN.JS	07/09/06
A	-	creation	STUTZMANN.JS	08/06/06

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MONTAGE CRATE

Format : A0

designer	06/06	STUTZMANN.JS
checkng	--/--	---

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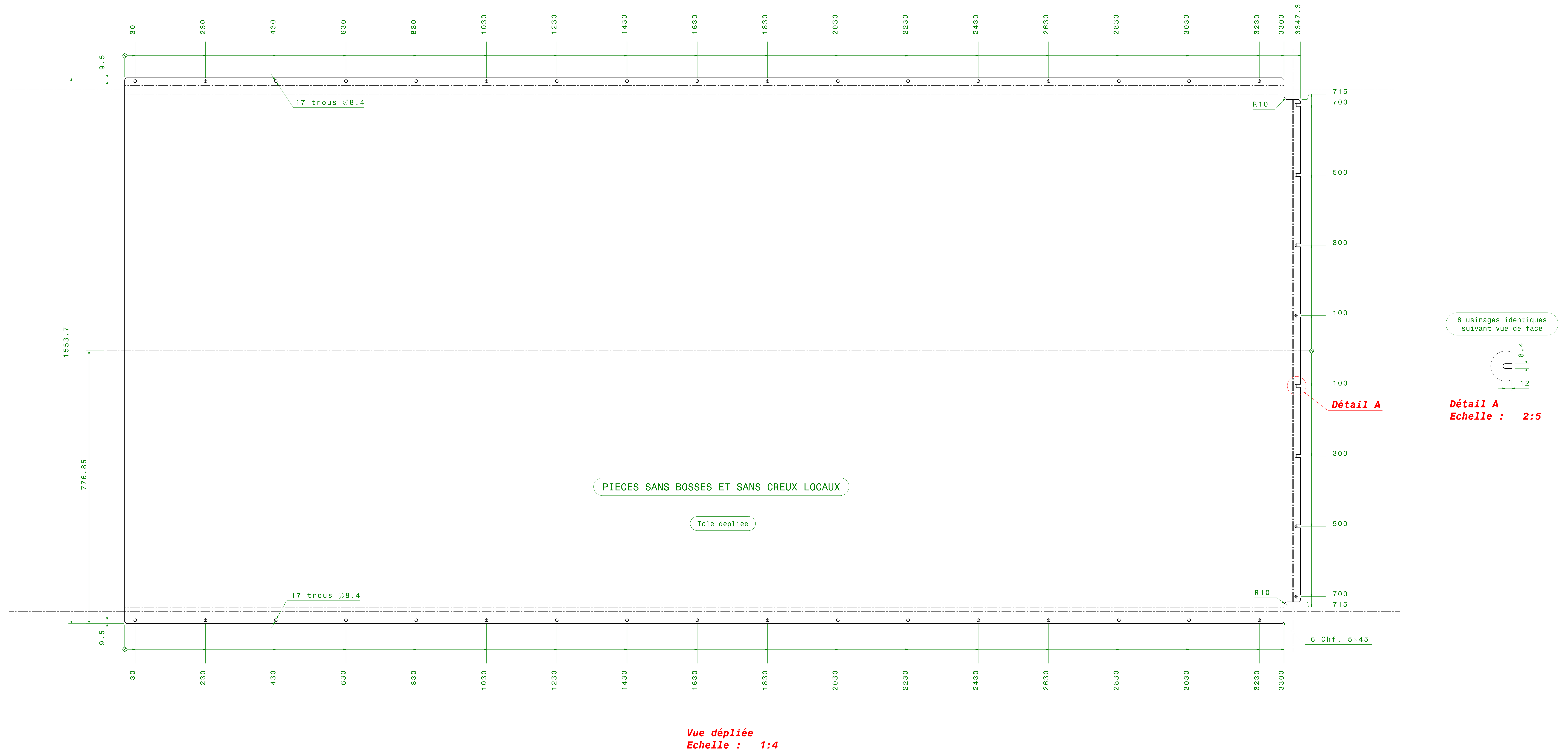
26K406 / Q_EMCAL_4.1_D_ST_004 — Revision F — 1/1

Vue de face
Echelle : 1:3
4 Chf. 5×45°
1442
255
227.5
127.5
27.5
71
331
591
851
1111
1371
Coupe B-B
Echelle : 1:3
Chf. 2×45°
18 usinages identiques suivant vue de face
Vue auxiliaire C
Echelle : 1:2
3 trous M10 identiques
prof. sur pointe 30
prof. taraudage 20
Vue de face
Echelle : 1:2
Chf. 10×45°
228
199
54°
45
45
50
Vue de gauche
Echelle : 1:2
trou M10
Prof. sur pointe 40
Prof. taraudage 30
Vue de dessus
Echelle : 1:2
3 trous M10 identiques
Prof. sur pointe 35
Prof. taraudage 25
FACE APPUI ARRIERE GLISSANTE
26K407 / Q_EMCAL_4.1_D_ST_005 12
RENFORT ARRIERE SUPERIEUR
26K407 / Q_EMCAL_4.1_D_ST_005 7
Vue de dessous
Echelle : 1:4
8 usinages identiques suivant coupe A-A
Coupe A-A
Echelle : 1:2
Vue de face
Echelle : 1:4
Ø11
582
280
1444
Vue de dessous
Echelle : 1:4
8 trous M10 identiques
Prof. sur pointe 30
Prof taraudage 20
3 trous M10 identiques
Prof. sur pointe 30
Prof taraudage 20
2 trous Ø10 H7 identiques
Prof. sur pointe 30
Vue de droite
Echelle : 1:4
Vue de gauche
Echelle : 1:4
FACE RENFORT ARRIERE
26K407 / Q_EMCAL_4.1_D_ST_005 6
Vue de face
Echelle : 1:2
Chf. 10×45°
Ø11
Ø17
Vue de gauche
Echelle : 1:2
2 trous M10 identiques
Prof. sur pointe 35
Prof. taraudage 25
Vue de dessus
Echelle : 1:2
Dimensions valables pour une hauteur de de module de 302.61 mm
BON POUR FABRICATION
RENFORT ARRIERE INFERIEUR
26K407 / Q_EMCAL_4.1_D_ST_005 8
EMCAL
MONTAGE CRATE
SUBATECH
26K407 / Q_EMCAL_4.1_D_ST_005



BON POUR FABRICATION

Tole epaisseur 1 mm.

Dimensions valables pour une hauteur de de module de 302.61 mm

N°	Rep	Designation	Designer	Date
5	-	---	---	--/--/--
4	-	modification matiere	STUTZMANN.JS	22/09/06
3	-	modification des tolerances generales	STUTZMANN.JS	22/09/06
2	-	ajout d'une note	STUTZMANN.JS	22/09/06
1	-	mise à jour	STUTZMANN.JS	07/09/06

Material	INOX 304L	Scale	1/2	creation date	08/06/06
object name	Crate - Plaque Inferieure v10	Mass	41 Kg	max He leak rate	---
Specification	debur edges			JS/js	11
heat treatment	---			angular tol	± 0.5°
cleaning	---			Roughness	3.2
surface protection	---				

PLAQUE INFERIEURE

26K408 / Q_EMCAL_4.1_D_ST_006 | 9

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Rep.	N° plan	Designation
---	---	---
9	26K408 / Q_EMCAL_4.1_D_ST_006	PLAQUE INFERIEURE

N°	Rep	Designation	designer	Date
F	-	---	---	--/--/--
E	-	---	---	--/--/--
D	-	renumerotation plan	STUTZMANN.JS	27/03/08
	9	modification matiere	STUTZMANN.JS	22/09/06
	9	modification des tolerances generales	STUTZMANN.JS	22/09/06
C	9	ajout d'une note	STUTZMANN.JS	22/09/06
B	9	mise à jour	STUTZMANN.JS	07/09/06
A	-	creation	STUTZMANN.JS	08/06/06

EMCAL

MONTAGE CRATE

Format : A0

designer	06/06	STUTZMANN.JS
checkng	--/--	---

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26K408 / Q_EMCAL_4.1_D_ST_006 — Revision D — 1/2

BON POUR FABRICATION

Tole epaisseur 1 mm.

Dimensions valables pour une hauteur de de module de 302.61 mm

Modif. N°	Rep	Designation	Designer	Date
5	-	---	---	--/--/--
4	-	modification matiere	STUTZMANN.JS	22/09/06
3	-	modification des tolerances generales	STUTZMANN.JS	22/09/06
2	-	ajout d'une note	STUTZMANN.JS	22/09/06
1	-	mise à jour	STUTZMANN.JS	07/09/06

Material	INOX 304L	Scale	1/2	creation date	08/06/06
object name	Crate - Plaque Inferieure v10	Mass	41 Kg	max He leak rate	---

		General Tolerances	
Specification	debur edges	JS/js	11
heat treatment	---	angular tol	± 0.5°
cleaning	---	Roughness	3.2
surface protection	---		

Roughness: N 2 3 4 5 6 7 8 9 10 — Ra 0.05 0.1 0.2 0.4 0.8 1.6 3.2 6.3 12.5

PLAQUE INFERIEURE

26K409 / Q_EMCAL_4.1_D_ST_006 | 9

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Rep.	N° plan	Designation
---	---	---
9	26K409 / Q_EMCAL_4.1_D_ST_006	PLAQUE INFERIEURE

Modification N°	Rep	Designation	designer	Date
F	-	---	---	--/--/--
E	-	---	---	--/--/--
D	-	renumerotation plan	STUTZMANN.JS	27/03/08
	9	modification matiere	STUTZMANN.JS	22/09/06
	9	modification des tolerances generales	STUTZMANN.JS	22/09/06
C	9	ajout d'une note	STUTZMANN.JS	22/09/06
B	9	mise à jour	STUTZMANN.JS	07/09/06
A	-	creation	STUTZMANN.JS	08/06/06

EMCAL
MONTAGE CRATE

Format : A0

designer	06/06	STUTZMANN.JS
checkng	--/--	---

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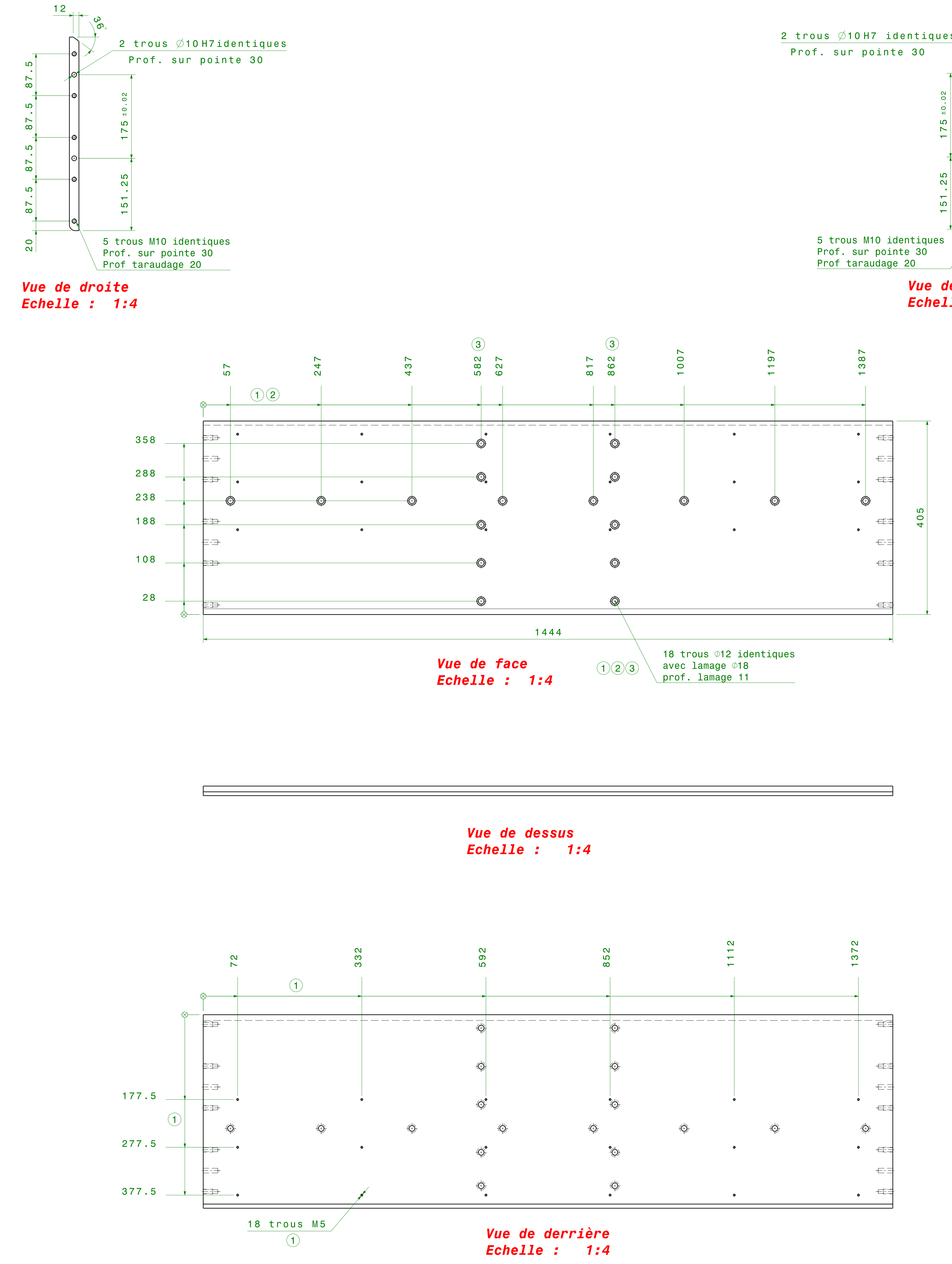
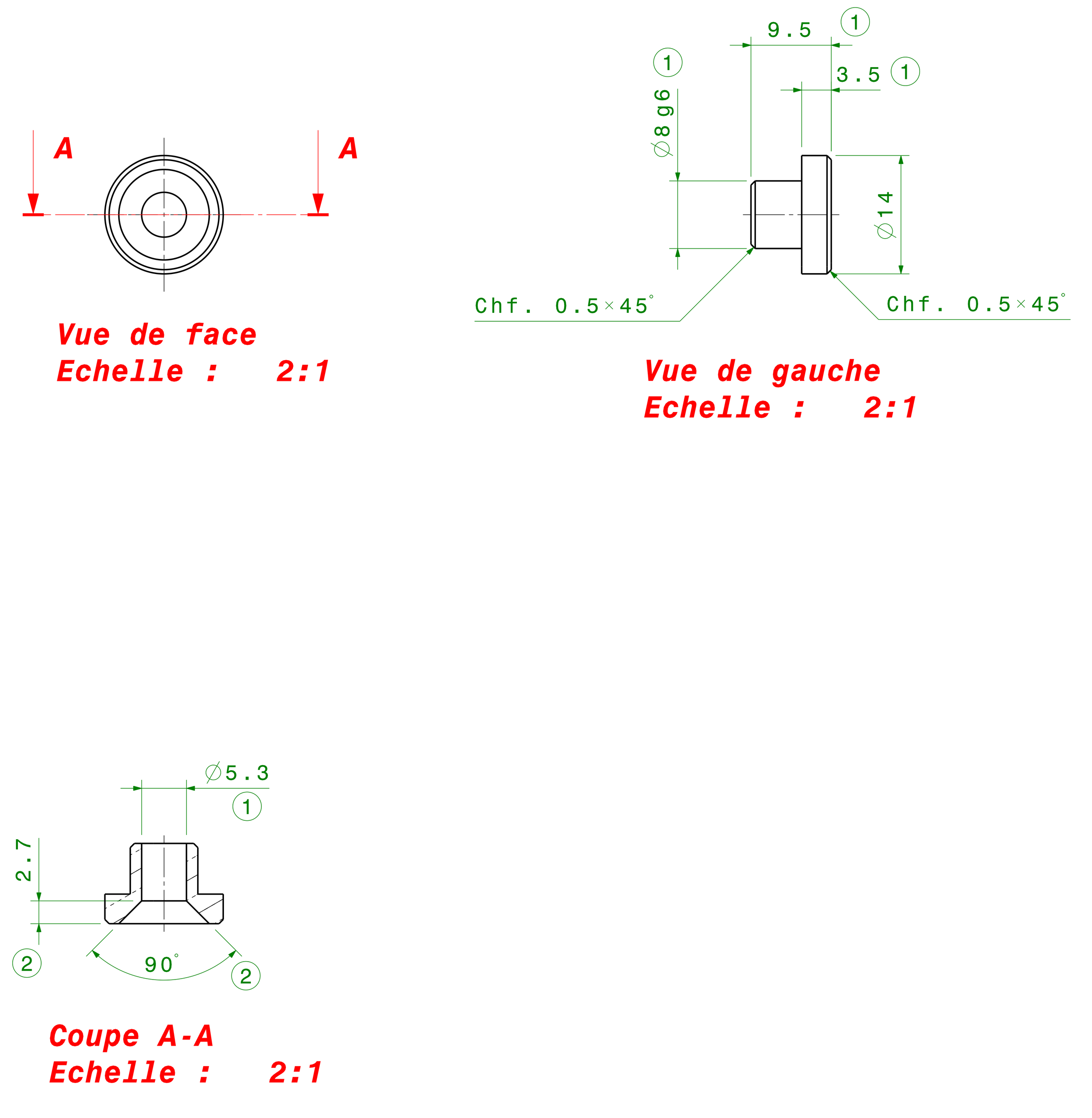
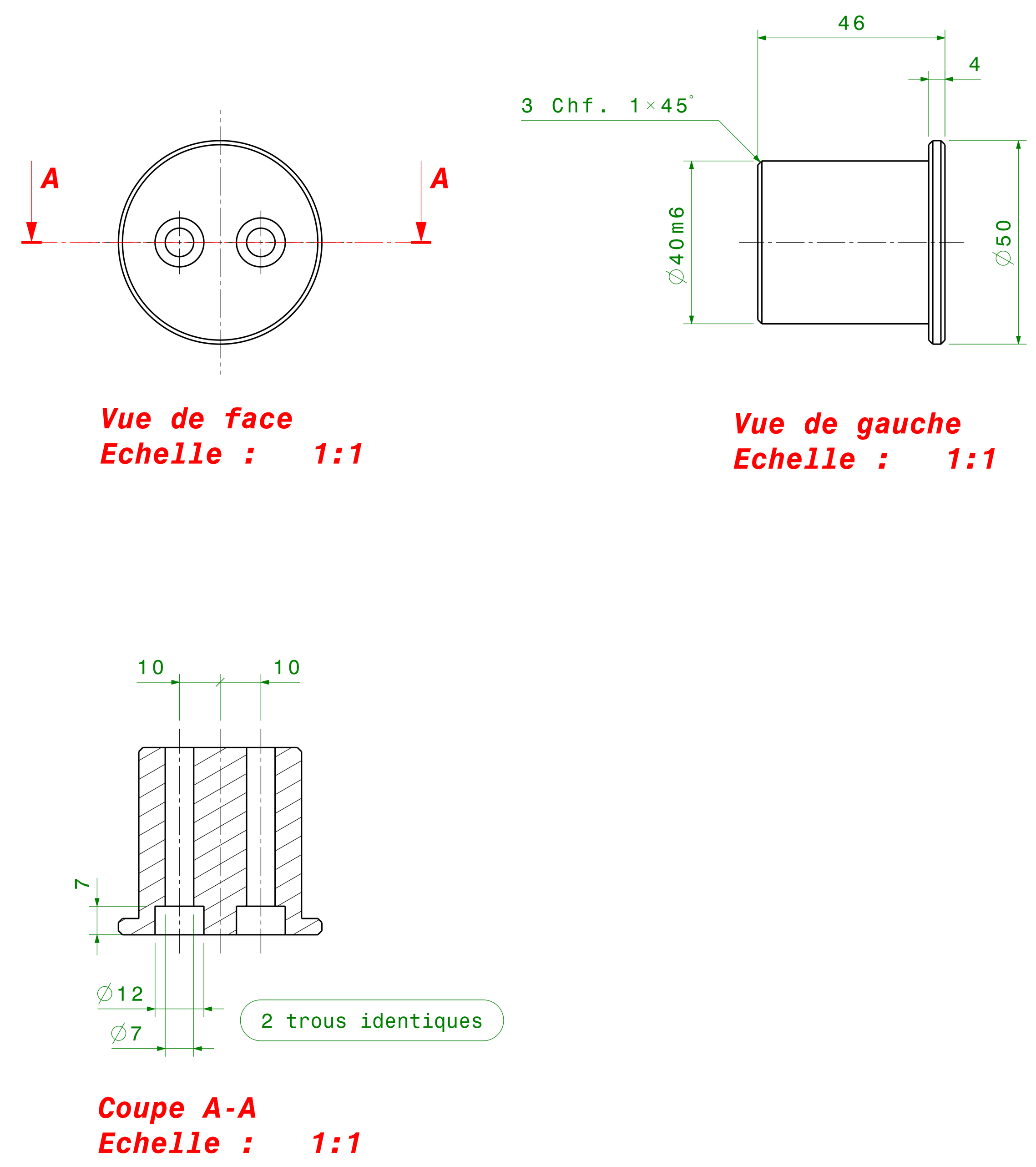
26K409 / Q_EMCAL_4.1_D_ST_006 — Revision D — 2/2





Modif. 3	-	---		---	--/--/--
2	-	rajout du chanfrein sur trou		STUTZMANN.JS	27/03/08
1	-	modification cotes		STUTZMANN.JS	27/03/08
N°	Rep	Designation		Designer	Date
Material	Cu-Be	Scale	2/1	creation date	08/06/06
object name	Crate - Pince Plaque Inferieure v10	Mass	3 gr	max He leak rate	---
Specification	debur edges			General Tolerances JS/js	13
heat treatment	---			angular tol	± 15'
cleaning	---				
surface protection	---			Roughness	3.2
PINCE PLAQUE INFERIEURE					
26K410 / Q_EMCAL_4.1_D_ST_007					10



Modif. 1	-	---		---	--/--/--
N°	Rep	Designation		Designer	Date
Material	INOX 316LN	Scale	1/1	creation date	08/06/06
object name	Crate - Point Ancrage v1	Mass	500 gr	max He leak rate	---
Specification	debur edges			General Tolerances JS/js	13
heat treatment	---			angular tol	± 15'
cleaning	---				
surface protection	---			Roughness	3.2
POINT ANCRAGE					
26K410 / Q_EMCAL_4.1_D_ST_007					11

Dimensions valables pour une hauteur de de module de 302.61 mm

BON POUR FABRICATION

Modif. 4	-	---		---	--/--/--
3	-	redefinition des positions des trous D12		STUTZMANN.JS	27/03/08
2	-	redefinition des positions des trous D12		STUTZMANN.JS	0/11/06
1	-	redefinition des positions des trous D12 et M5		STUTZMANN.JS	22/09/06
N°	Rep	Designation		Designer	Date
Material	2024 T351	Scale	1/4	creation date	07/09/06
object name	Crate - Face Appui Arriere v10	Mass	30 Kg	max He leak rate	---
Specification	debur edges			General Tolerances JS/js	13
heat treatment	---			angular tol	± 15'
cleaning	---				
surface protection	---			Roughness	3.2
FACE APPUI ARRIERE					
26K410 / Q_EMCAL_4.1_D_ST_007					5

Rep.	N° plan	Designation
---	---	---
11	26K410 / Q_EMCAL_4.1_D_ST_007	POINT ANCRAGE
10	26K410 / Q_EMCAL_4.1_D_ST_007	PINCE PLAQUE INFERIEURE
5	26K410 / Q_EMCAL_4.1_D_ST_007	FACE APPUI ARRIERE

N°	Rep	Designation	designer	Date
G	-	---	---	--/--/--
F	-	---	---	--/--/--
	10	rajout du chanfrein sur trou	STUTZMANN.JS	27/03/08
	10	modification cotes	STUTZMANN.JS	27/03/08
	5	redefinition des positions des trous D12	STUTZMANN.JS	27/03/08
E	-	renumerotation plan	STUTZMANN.JS	27/03/08
D	5	redefinition des positions des trous D12	STUTZMANN.JS	06/11/06
	-	retrait pieces 13,14 & 15	STUTZMANN.JS	22/09/06
	5	redefinition des positions des trous D12 et M5	STUTZMANN.JS	22/09/06
C	-	mise à jour, ajout piece 5	STUTZMANN.JS	22/09/06
B	-	mise à jour, ajout pieces 13,14 & 15	STUTZMANN.JS	07/09/06
A	-	creation	STUTZMANN.JS	07/09/06

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MONTAGE CRATE

Format :	AO	
designer	06/06	STUTZMANN.JS
checkng	--/--	---

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26K410 / Q_EMCAL_4.1_D_ST_007 Revision E 1/1

Dimensions valables pour une hauteur de de module de 302.61 mm

BON POUR FABRICATION

Rep.	N° plan	Designation
---	---	---
12	26K407 / Q_EMCAL_4.1_D_ST_005	FACE APPUI ARRIERE GLISSANTE
11	26K410 / Q_EMCAL_4.1_D_ST_007	POINT ANCRAGE
10	26K410 / Q_EMCAL_4.1_D_ST_007	PINCE PLAQUE INFERIEURE
9	26K408-26K409 / Q_EMCAL_4.1_D_ST_006	PLAQUE INFERIEURE
8	26K407 / Q_EMCAL_4.1_D_ST_005	RENFORT ARRIERE INFERIEUR
7	26K407 / Q_EMCAL_4.1_D_ST_005	RENFORT ARRIERE SUPERIEUR
6	26K407 / Q_EMCAL_4.1_D_ST_005	FACE RENFORT ARRIERE
5	26K410 / Q_EMCAL_4.1_D_ST_007	FACE APPUI ARRIERE
4	26K406 / Q_EMCAL_4.1_D_ST_004	FACE SUPERIEURE DROITE
3	26K405 / Q_EMCAL_4.1_D_ST_003	FACE SUPERIEURE GAUCHE
2	26K404 / Q_EMCAL_4.1_D_ST_002	FACE INFERIEURE DROITE
1	26K403 / Q_EMCAL_4.1_D_ST_001	FACE INFERIEURE GAUCHE

Modification

N°	Rep	Designation	designer	Date
F	-	---	---	--/--/--
E	-	renumerotation plan	STUTZMANN.JS	27/03/08
D	-	mise à jour	STUTZMANN.JS	06/11/06
C	-	mise à jour	STUTZMANN.JS	22/09/06
B	-	mise à jour	STUTZMANN.JS	11/09/06
A	-	creation	STUTZMANN.JS	08/06/06

EMCAL

MONTAGE CRATE

Format : A0

designer	06/06	STUTZMANN.JS
checkng	--/--	---

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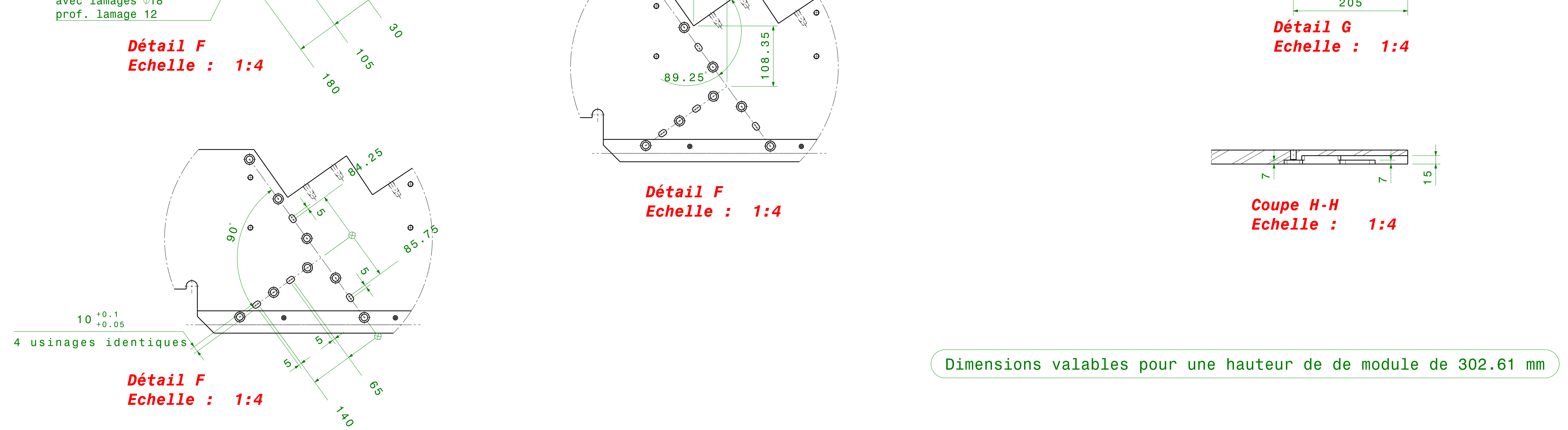
26K400 / Q_EMCAL_4.1_E_ST_001

Revision E

1/1



N°	Rep	Designation	Designer	Date
12	-	---	---	--/--/--
11	-	changement trou Ø10g6 en Ø10H7	STUTZMANN.JS	01/04/08
10	-	rajout de 2 trous M10	STUTZMANN.JS	27/03/08
9	-	usinage suplementaire	STUTZMANN.JS	27/03/08
8	-	retrait trous de fixation boites electroniques	STUTZMANN.JS	27/03/08
7	-	retrait plan 2/2 : trous retires	STUTZMANN.JS	27/03/08
6	-	modification longueur platine	STUTZMANN.JS	27/03/08
5	-	modification des tolerances generales	STUTZMANN.JS	14/11/06
4	1	ajout trous de fixation boites electroniques	STUTZMANN.JS	06/11/06
3	-	modification des tolerances generales	STUTZMANN.JS	22/09/06
2	-	ajout de notes	STUTZMANN.JS	22/09/06
1	-	mise à jour	STUTZMANN.JS	07/09/06

Material	2024 T351	Scale	1/4	creation date	08/06/06
object name	Crate - Face Inferieure Gauche v10	Mass	67 Kg	max He leak rate	---
Specification	debur edges			General Tolerances JS/js	11
heat treatment	---			angular tol	± 0°10'
cleaning	---			Roughness	3.2
surface protection	---				

FACE INFERIEURE GAUCHE

26K403 / Q_EMCAL_4.1_D_ST_001 | 1

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Rep.	N° plan	Designation
---	---	---
1	26K403 / Q_EMCAL_4.1_D_ST_001	FACE INFERIEURE GAUCHE

N°	Rep	Designation	designer	Date
H	1	---	---	--/--/--
G	1	changement trou Ø10g6 en Ø10H7	STUTZMANN.JS	01/04/08
	1	rajout de 2 trous M10	STUTZMANN.JS	27/03/08
	1	usinage suplementaire	STUTZMANN.JS	27/03/08
	1	retrait trous de fixation boites electroniques	STUTZMANN.JS	27/03/08
	1	retrait plan 2/2 : trous retires	STUTZMANN.JS	27/03/08
	1	modification longueur platine	STUTZMANN.JS	27/03/08
F	-	renumerotation plan	STUTZMANN.JS	27/03/08
E	1	modification des tolerances generales	STUTZMANN.JS	14/11/06
D	1	ajout trous de fixation boites electroniques	STUTZMANN.JS	06/11/06
	1	modification des tolerances generales	STUTZMANN.JS	22/09/06
C	1	ajout de notes	STUTZMANN.JS	22/09/06
B	1	mise à jour	STUTZMANN.JS	07/09/06
A	-	creation	STUTZMANN.JS	08/06/06

EMCAL

MONTAGE CRATE

Format : A0

designer	06/06	STUTZMANN.JS
checkng	--/--	---

SUBATECH — IN2P3/CNRS, Ecole des Mines de Nantes, Universite de Nantes

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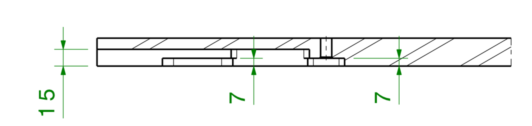

BON POUR FABRICATION

Dimensions valables pour une hauteur de de module de 302.61 mm

Modif. N°	Rep	Designation	Designer	Date
12	-	---	---	--/--/--
11	-	changement trou Ø10g6 en Ø10H7	STUTZMANN.JS	01/04/08
10	-	rajout de 2 trous M10	STUTZMANN.JS	27/03/08
9	-	usinage suplementaire	STUTZMANN.JS	27/03/08
8	-	retrait trous de fixation boites electroniques	STUTZMANN.JS	27/03/08
7	-	retrait plan 2/2 : trous retires	STUTZMANN.JS	27/03/08
6	-	modification longueur platine	STUTZMANN.JS	27/03/08
5	-	modification des tolerances generales	STUTZMANN.JS	14/11/06
4	-	ajout trous de fixation boites electroniques	STUTZMANN.JS	06/11/06
3	-	modification des tolerances generales	STUTZMANN.JS	22/09/06
2	-	ajout de notes	STUTZMANN.JS	22/09/06
1	-	mise à jour	STUTZMANN.JS	07/09/06

Material	2024 T351	Scale	1/4	creation date	08/06/06
object name	Crate - Face Inferieure Gauche v10	Mass	67 Kg	max He leak rate	---
Specification	debur edges			General Tolerances JS/js	11
heat treatment	---			angular tol	± 0°10'
cleaning	---			Roughness	3.2
surface protection	---				

Roughness: N 2 3 4 5 6 7 8 9 10 — Ra 0.05 0.1 0.2 0.4 0.8 1.6 3.2 6.3 12.5

FACE INFERIEURE DROITE

26K404 / Q_EMCAL_4.1_D_ST_002 — 2

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Rep.	N° plan	Designation
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2	26K404 / Q_EMCAL_4.1_D_ST_002	FACE INFERIEURE DROITE

Modification N°	Rep	Designation	designer	Date
H	-	---	---	--/--/--
G	-	changement trou Ø10g6 en Ø10H7	STUTZMANN.JS	01/04/08
	2	rajout de 2 trous M10	STUTZMANN.JS	27/03/08
	2	usinage suplementaire	STUTZMANN.JS	27/03/08
	2	retrait trous de fixation boites electroniques	STUTZMANN.JS	27/03/08
	2	retrait plan 2/2 : trous retires	STUTZMANN.JS	27/03/08
	2	modification longueur platine	STUTZMANN.JS	27/03/08
F	-	renumerotation plan	STUTZMANN.JS	27/03/08
E	2	modification des tolerances generales	STUTZMANN.JS	14/11/06
D	2	ajout trous de fixation boites electroniques	STUTZMANN.JS	06/11/06
	2	modification des tolerances generales	STUTZMANN.JS	22/09/06
C	2	ajout de notes	STUTZMANN.JS	22/09/06
B	2	mise à jour	STUTZMANN.JS	07/09/06
A	-	creation	STUTZMANN.JS	08/06/06

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MONTAGE CRATE

Format : A0

designer	06/06	STUTZMANN.JS
checkng	--/--	---

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