LASER INTERFEROMETER GRAVITATIONAL WAVE OBSERVATORY

- LIGO –

CALIFORNIA INSTITUTE OF TECHNOLOGY
MASSACHUSETTS INSTITUTE OF TECHNOLOGY

Document Type	**DCC Number**	Date
Technical Note	**LIGO-D-010244-00-R**	30th October 2001

LIGO-II Seismic Attenuation System (SAS) test tower

Horizontal Accelerometer Mechanical drawings

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Riccardo DeSalvo (LIGO)

Distribution of this draft: TBD
This is an internal working note
of the LIGO Project.

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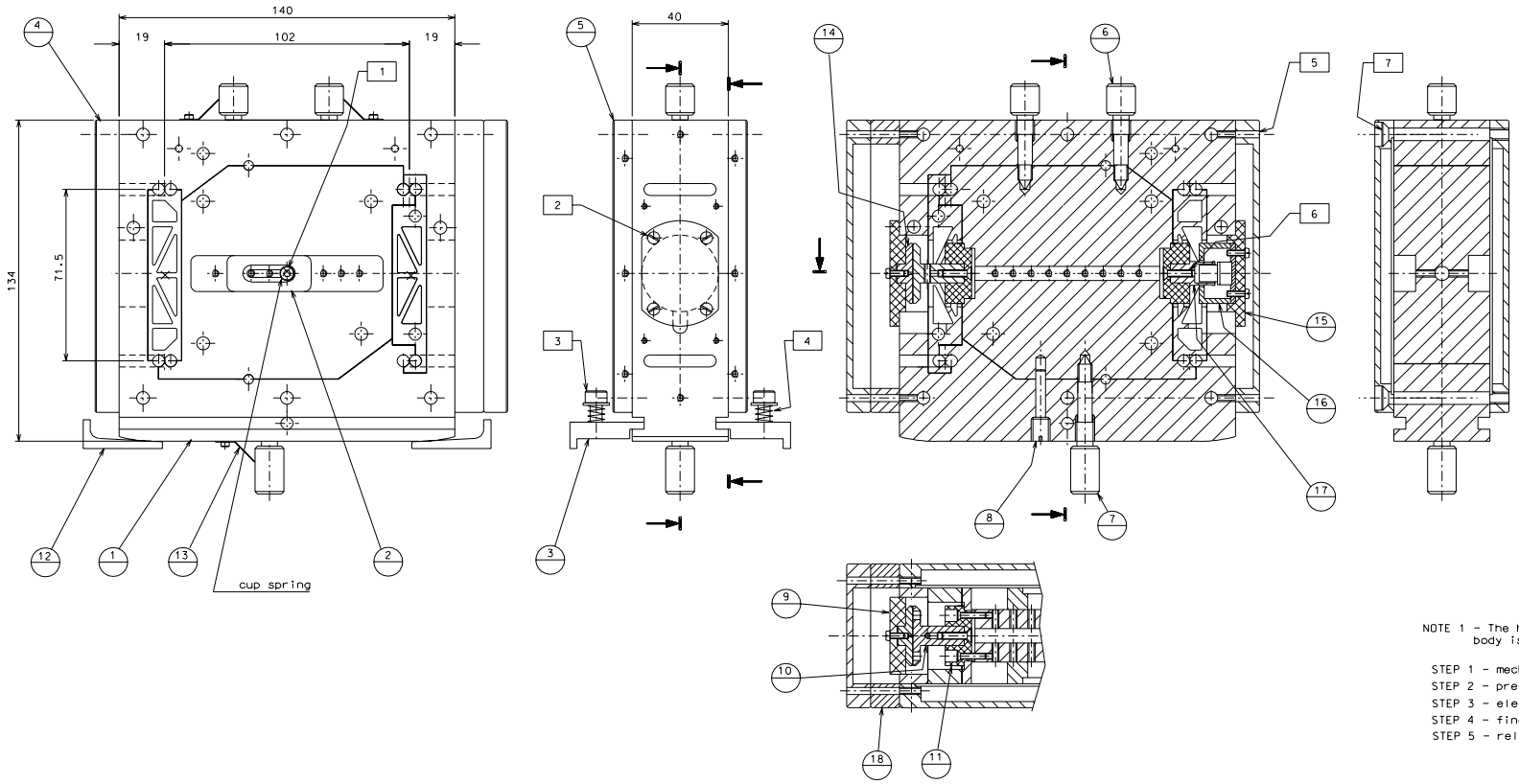

NOTE 1 - The horizontal accelerometer body is built in 5 steps

STEP 1 - mechanics	DWG 1
STEP 2 - pre-cut EDM	DWG 2
STEP 3 - electro-polish holes	DWG 3-4
STEP 4 - final cuts EDM	DWG 5
STEP 5 - release + delivery	DWG 6

NOTE 2 - Copper-beryllium
Material characteristic: C 17200 cube 2 alloy 25. HV 380-420. N/mm2 1200-1500. 98% copper. 1.8% beryllium. 0.2% cobalt

	last modification	14-11-00	
ref.	note	date	signature
modifications			

1	Socket head screw M3x12 n°2 pieces
2	Flat head screw M2.5x10 n°8 pieces
3	Socket head screw M5x25 n°4 pieces
4	Cylindrical spiral spring De=8. di=6. d wire 1. n°turns 7
5	Socket head screw M3x16 n°16 pieces
6	Flat head screw M3x12 n°2 pieces
7	Flat head screw M5x50 n°8 pieces

9	002	outer electrode insulat.	18	004	spacer
8	006	range limited pin	17	007	magnet
7	006	locking screw bottom	16	007	coil
6	006	locking screw top	15	006	outer electrode insulat.
5	004	side cover	14	006	inner electrode
4	006	end cover	13	004	retention spring
3	006	bracket	12	006	levelling wedge
2	006	frequency tuning weight	11	006	inner electrode insulat.
1	001	body	10	006	inner electrode
ref.	draw.	added legend	ref.	draw.	added legend

Size A1

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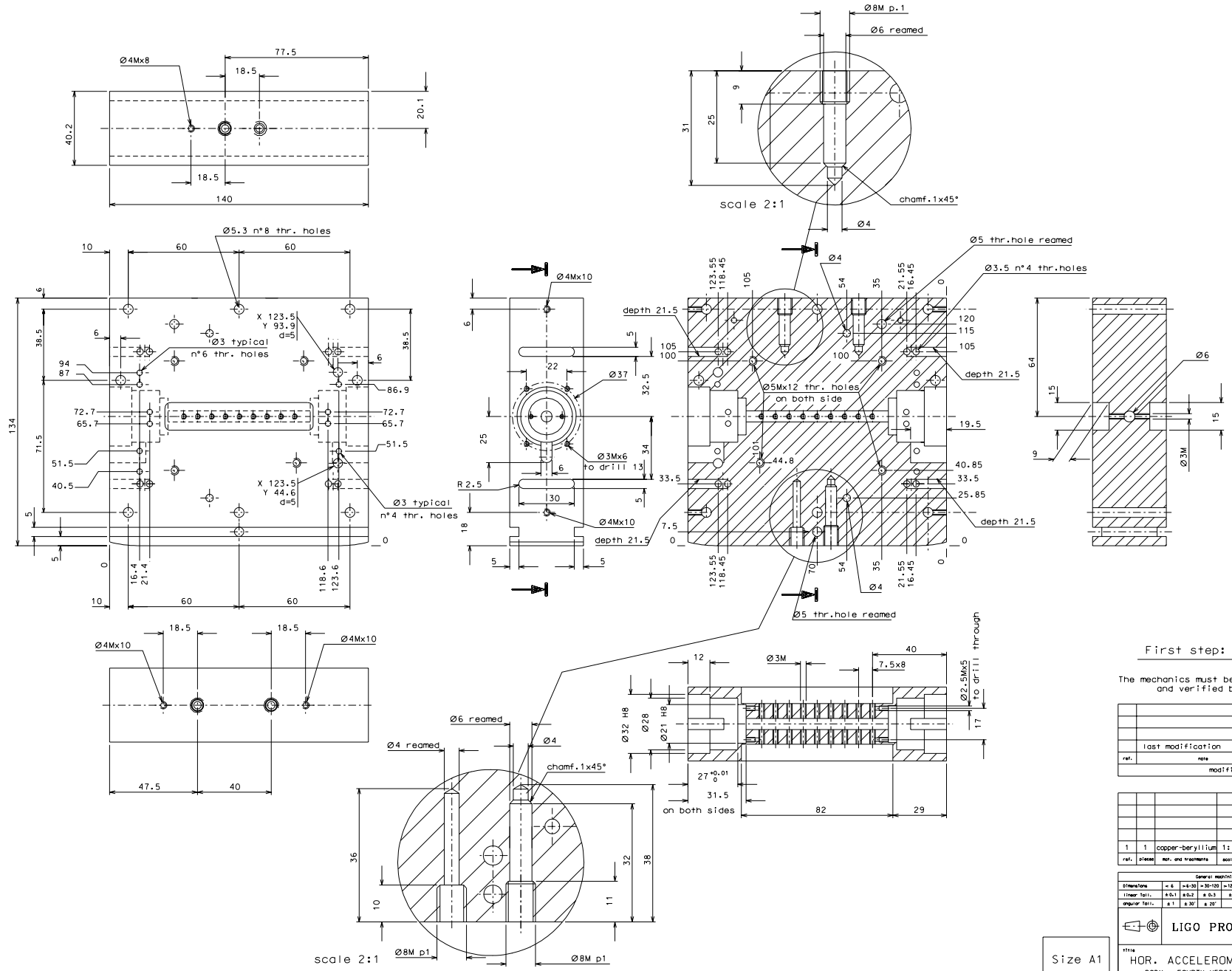
ass. numb. Acc_hor.+000

draw. PROMEC 28-6-00

scale 1:1

replaces dr. Numb.

title
HOR. ACCELEROMETER
ASSEMBLY - FOERTH VERSION



First step: machining

The mechanics must be completely assembled and verified before step two

ref.	note	date	signature
	last modification	14-11-00	
	modifications		

ref.	pieces	mat. and treatments	scale
1	1	copper-beryllium	1:1

ref.	pieces	mat. and treatments	scale

General machining tolerances UNI 5307-63

Dimensions	< 6	> 6÷30	> 30÷120	> 120÷315	> 315÷1000	> 1000÷2000	> 2000÷4000	> 4000
linear toll.	± 0.1	± 0.2	± 0.3	± 0.5	± 0.8	± 1.2	± 2	± 3
angular toll.	± 1	± 30'	± 20'		± 10'		referred to the shortest side	

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n. Acc_hor.001

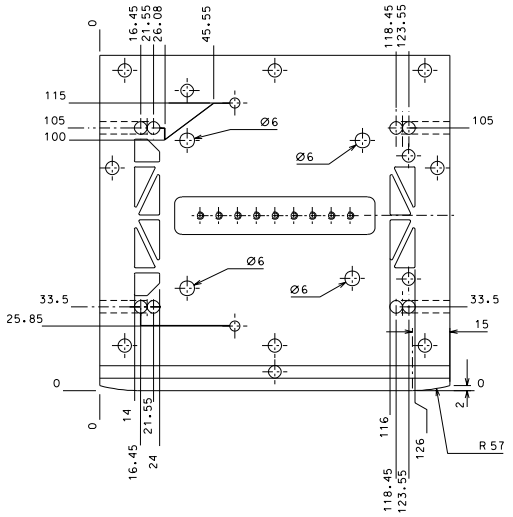
draw. PROMEC 28-6-00

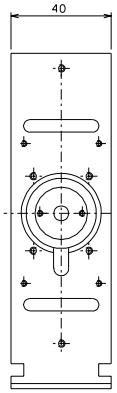
details from 000

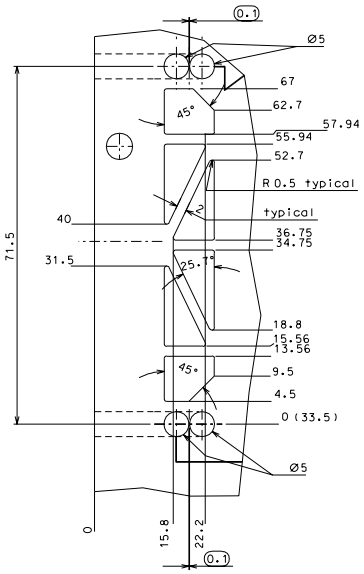
replaces dr. Numb.

title
HOR. ACCELEROMETER
BODY - FOURTH VERSION

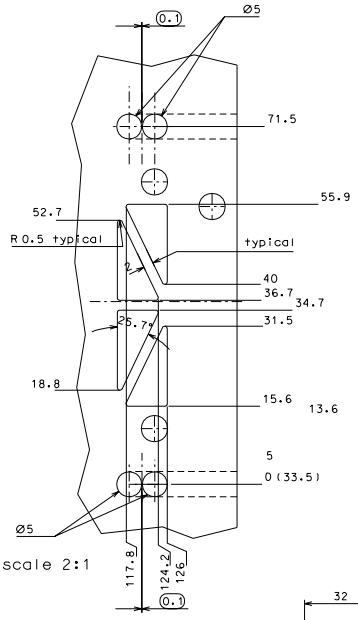
Size A1



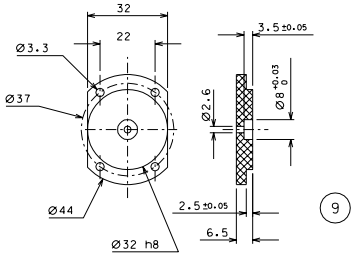




scale 2:1



scale 2:1



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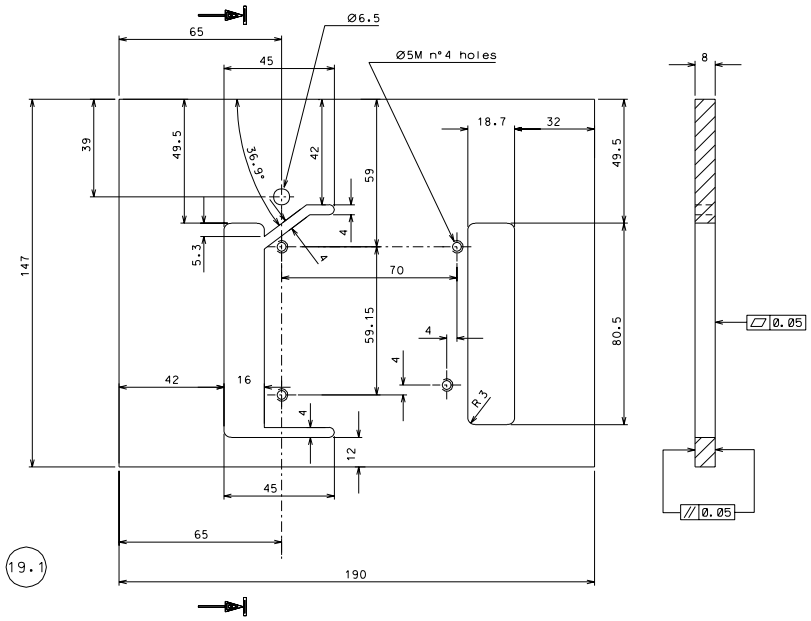

19.1

STEP 2 mask

Second step: First EDM machining with wire of 150 μm

ref.	note	done	signature
	last modification	14-11-00	
	modifications		

ref.	pieces	mat. and treatments	scale
9	1	peek	1:1
19.1	1	AISI 430	1:1

ref.	pieces	mat. and treatments	scale

General machining tolerances UNI 5307-63

Dimensions	< 6	>6-30	>30-120	>120-315	>315-1000	>1000-2000	>2000-4000	> 4000
linear tol.	±0.1	±0.2	± 0.3	± 0.5	± 0.8	± 1.2	± 2	± 3
angular tol.	± 1	± 30'	± 20'		± 10'	referred to the shortest side		

LIGO PROJECT

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n. Acc_hor.002

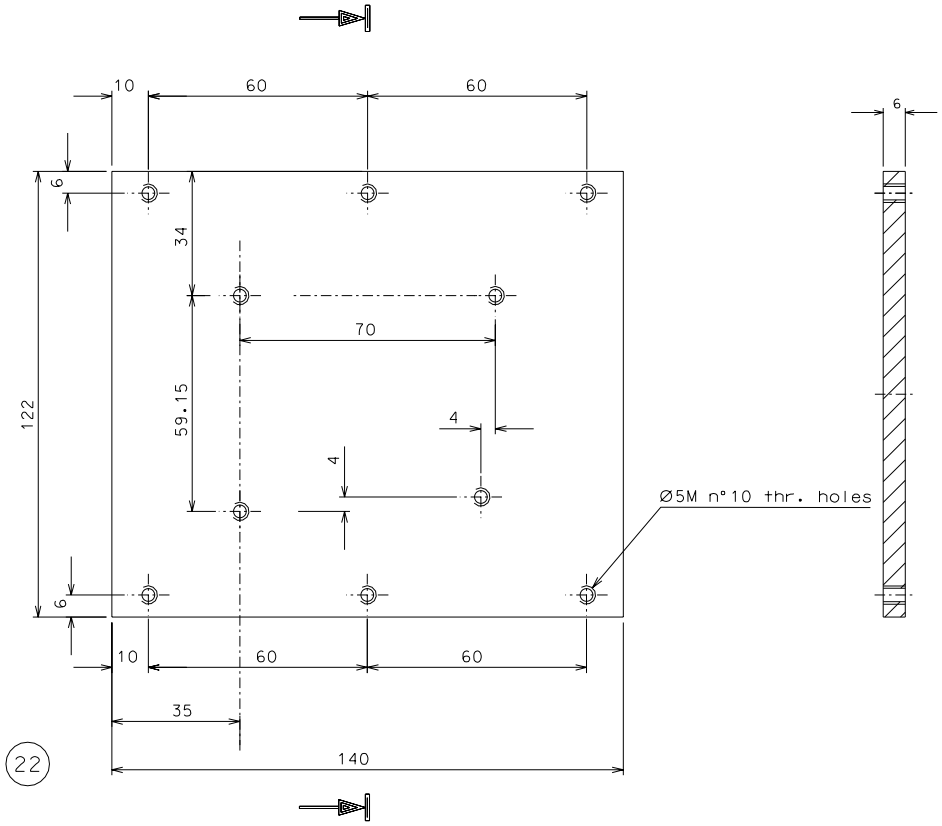
title: HOR. ACCELEROMETER
BODY - FOURTH VERSION

drw. PROMEC 28-6-00

details from 000-005

replaces dr. Numb.

Size A1



	last modification	14-11-00	
ref.	note	date	signature
	modifications		

22	1	UNI 9006/4	1:1
ref.	pieces	mat. and treatments	scale

ref.	pieces	mat. and treatments	scale

General machining tolerances UNI 5307-63

Dimensions	< 6	>6-30	>30-120	>120-315	>315-1000	>1000-2000	>2000-4000	> 4000
linear Toll.	± 0.1	± 0.2	± 0.3	± 0.5	± 0.8	± 1.2	± 2	± 3
angular Toll.	± 1	± 30'	± 20'	± 10' refered to the shortest side				

LIGO PROJECT

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N. Acc_hor.003

drow. PROMEC 28-6-00

details from 005

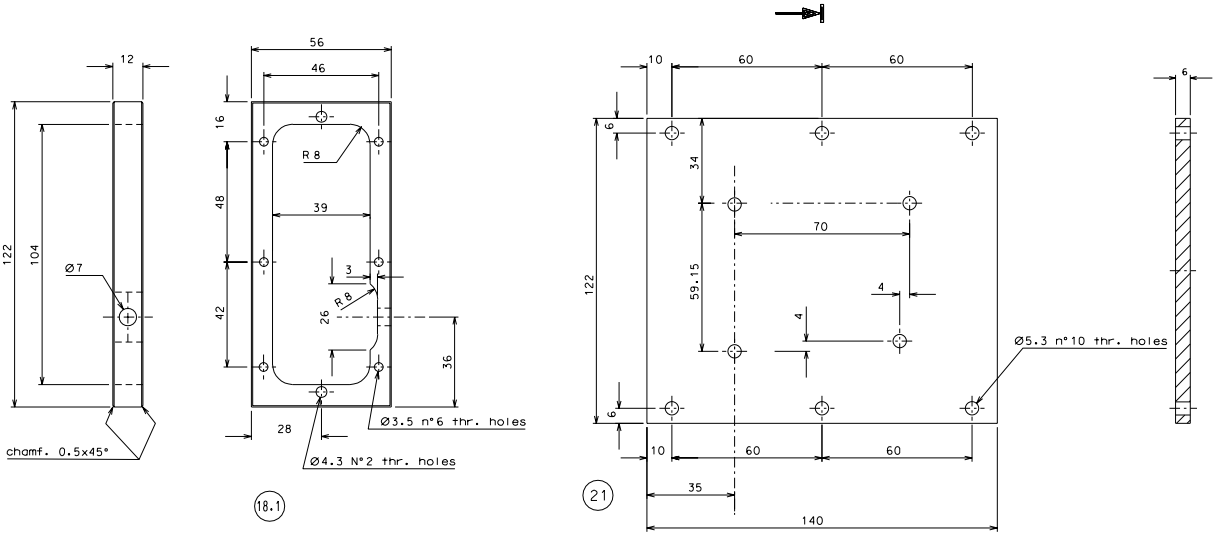
replaces dr. Numb.

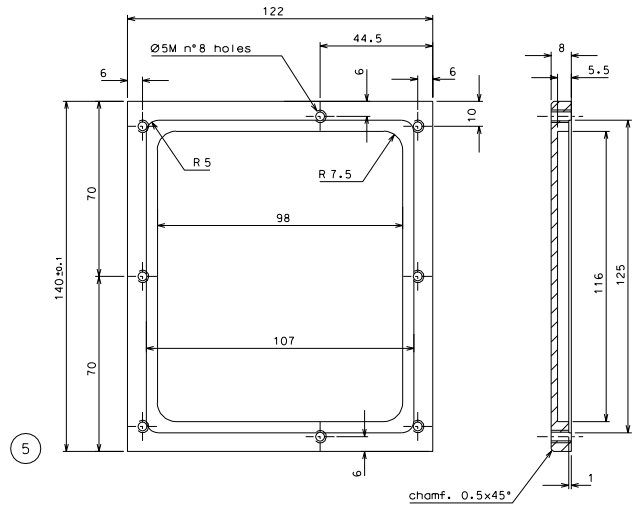
title

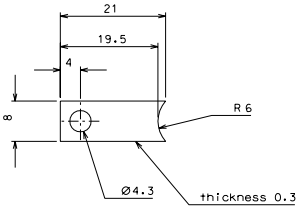
HOR. ACCELEROMETER

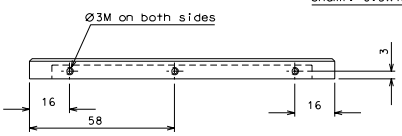
BODY - FOURTH VERSION

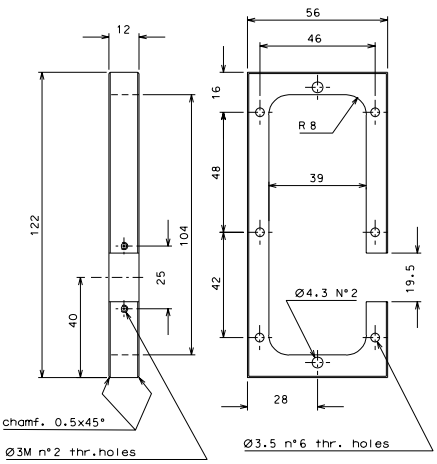
Size A2

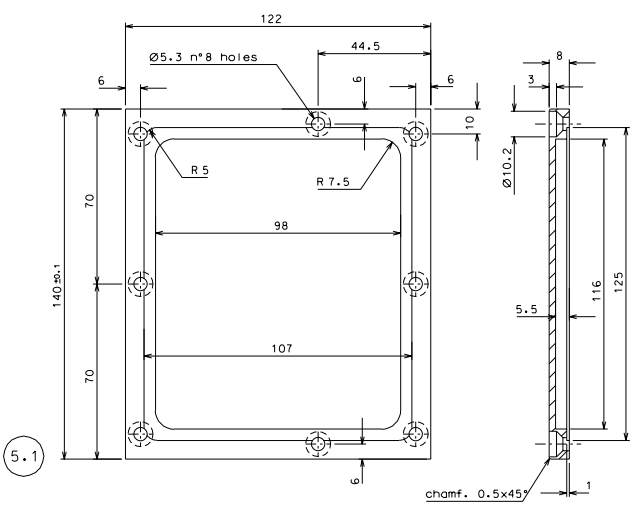


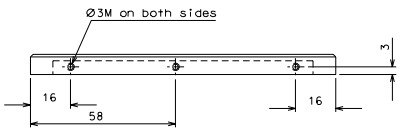












	last modification	14-11-00	
ref.	none	date	signature
	modifications		

18.1	1	copper-beryll.	1:1
18	1	copper-beryll.	1:1
13	6	copper-beryll.	2:1
5.1	1	"	1:1
5	1	"	1:1
ref.	pieces	mat. and treatments	scale

21	1	UNI 9006/4	1:1
ref.	pieces	mat. and treatments	scale

General machining tolerances UNI 5307-63

Dimensions	< 6	>6-30	>30-120	>120-315	>315-1000	>1000-2000	>2000-4000	> 4000
linear Tol.	±0.1	±0.2	± 0.3	± 0.5	± 0.8	± 1.2	± 2	± 3
angular Tol.	± 1	± 30'	± 20'		± 10'	referred to the shortest side		

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n. Acc_hor.004

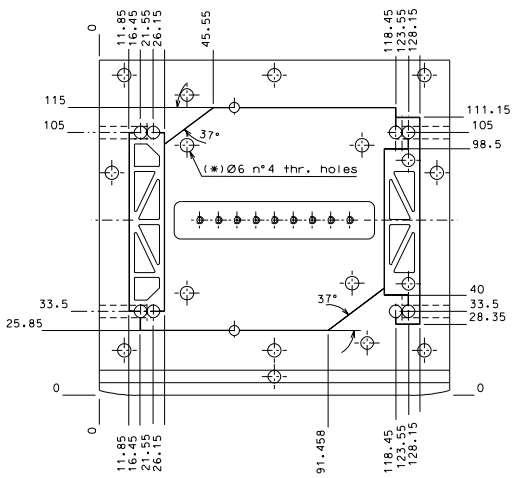
drw. PROMEC 28-6-00

details from 000

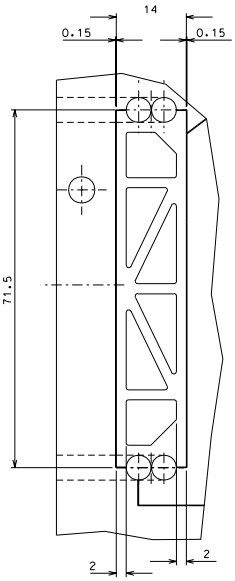
replaces dr. Numb.

Size A1

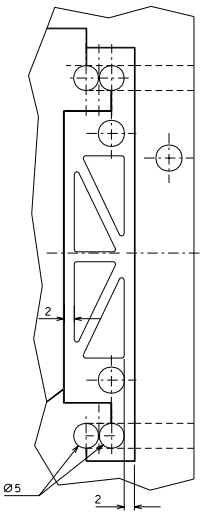
title: HOR. ACCELEROMETER
DETAILS - FOURTH VERSION



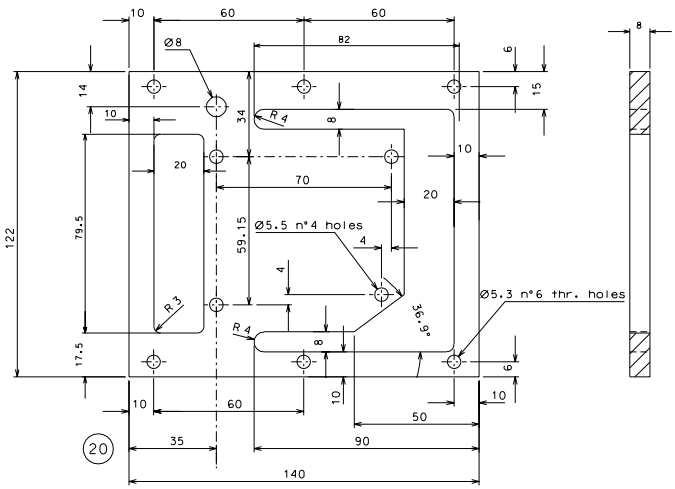
(*) To drill between second step and fourth step.
(Forare tra il secondo e quarto step.)



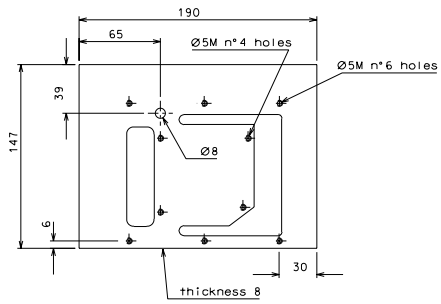
scale 2:1



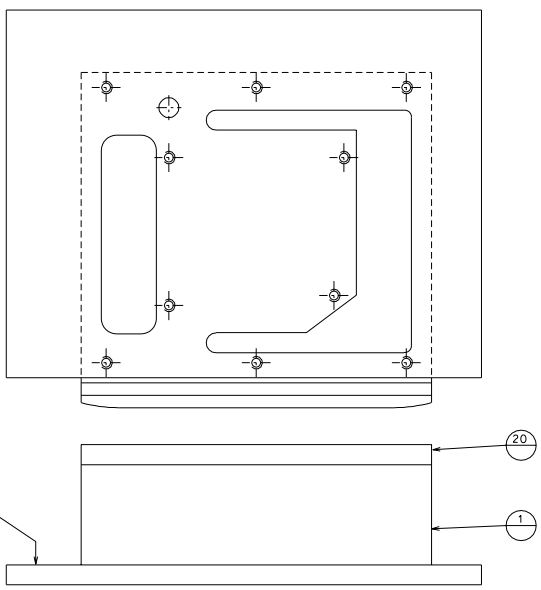
scale 2:1



(20)



(19) Internal dimensions like det. 17



STEP 4 mask

Third step: Final EDM machining.
Complete cuts using plates 19 and 20.
to sandwitch body 1 as temporary
blocking jig.

ref.	note	date	signature
	last modification	14-11-00	

modifications

ref.	pieces	mat. and treatments	scale
20	1	AISI 430	1:1
19	1	"	1:2

ref.	pieces	mat. and treatments	scale

General machining tolerances UNI 5307-63

Dimensions	< 6	>6-30	>30-120	>120-315	>315-1000	>1000-2000	>2000-4000	> 4000
linear Toll.	± 0.1	± 0.2	± 0.3	± 0.5	± 0.8	± 1.2	± 2	± 3
angular Toll.	± 1	± 30'	± 20'		± 10'	referred to the shortest side		

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Bertolini
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N. Acc_hor.005

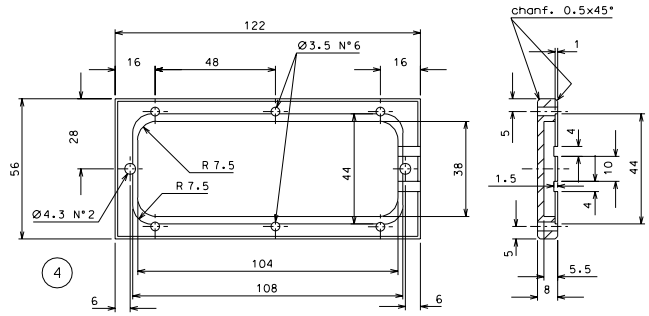
drw. PROMEC 28-6-00

details from 000

replaces dr. Numb.

title
HOR. ACCELEROMETER
BODY - FOURTH VERSION

Size A1



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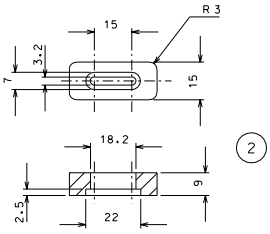

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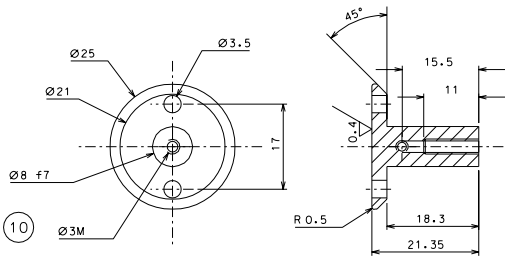

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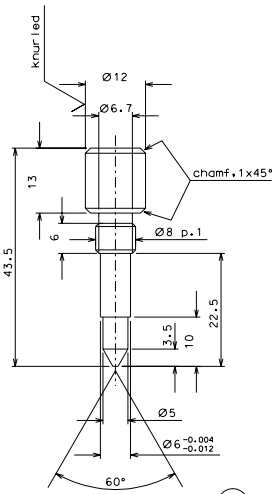

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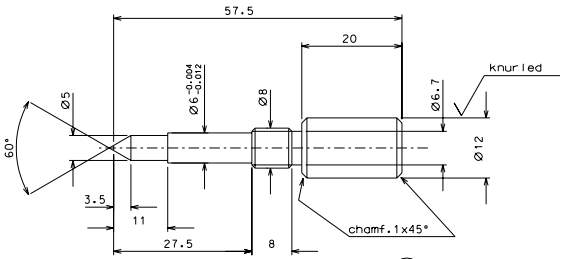

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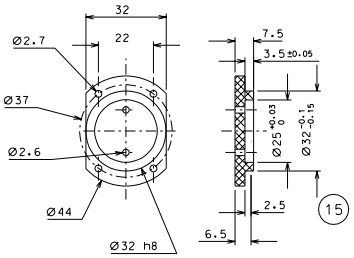

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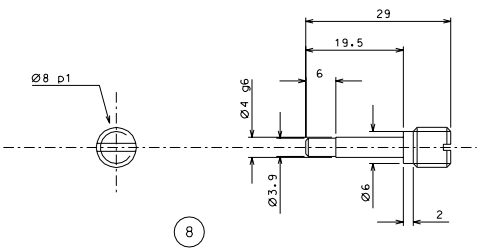

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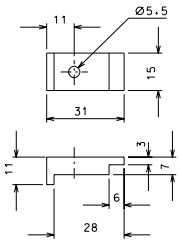

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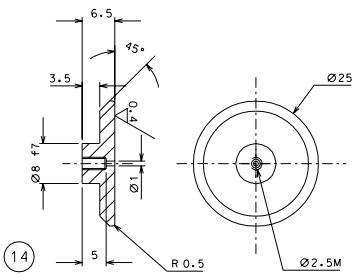

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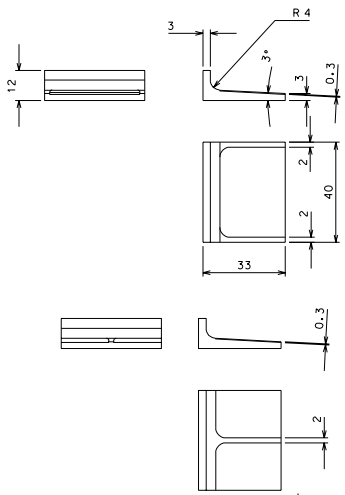
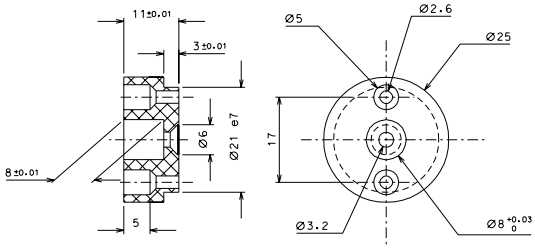


12

n°1 piece

12.1

n°1 piece



11

Drill central hole andcounter sink for a flat head screw in millingmachine to transfer positioning precision

Fourth step: Mount screws 6.7 before releasing plates 13 and 16 used in step four, tightening screws 6.7 0.05 Nm maximum.

ref.	note	date	signature
	last modification	14-11-00	

modifications

ref.	pieces	mat. and treatments	scale
8	1	AISI 304-316	2:1
7	1	"	2:1
6	2	"	2:1
4	2	copper-beryll.	1:1
3	4	AISI 304-316	1:1
2	2	copper-beryll.	1:1

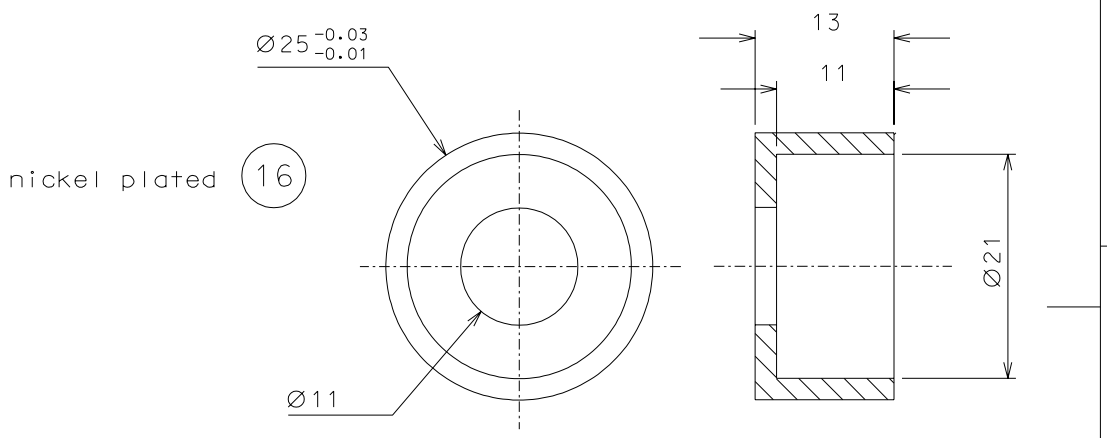
ref.	pieces	mat. and treatments	scale
15	1	peek	1:1
14	2	copper-beryll.	2:1
12.1	1	AISI 304-316	1:1
12	1	AISI 304-316	1:1
11	2	peek	2:1
10	2	copper-beryll.	2:1

General machining tolerances UNI 5307-63

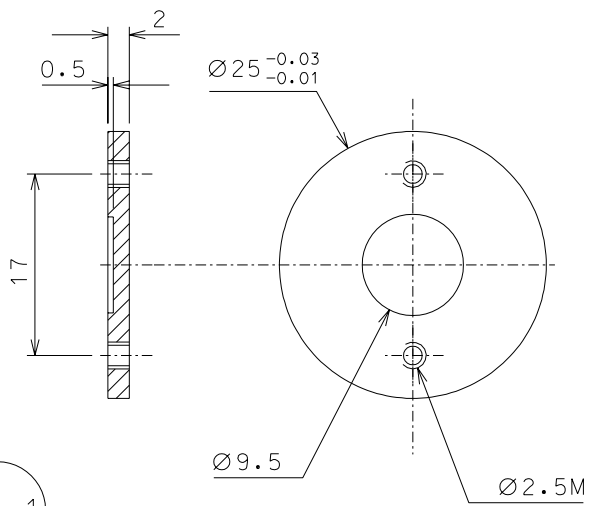
Dimensions	< 6	>6-30	>30-120	>120-315	>315-1000	>1000-2000	>2000-4000	> 4000
linear tol.	±0.1	±0.2	± 0.3	± 0.5	± 0.8	± 1.2	± 2	± 3
angular tol.	± 1	± 30'	± 20'		± 10'	refered to the shortest side		

	LIGO PROJECT	Bertolini designed for University-Pisa
		m. Acc_hor.006
title	HOR. ACCELEROMETER	drow. PROMEC 28-6-00
	DETAILS - FOURTH VERSION	details from 000
		replaces dr. Numb.

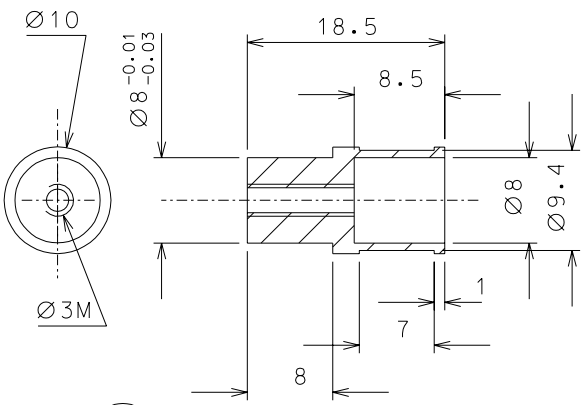
Size A1



nickel plated (16)

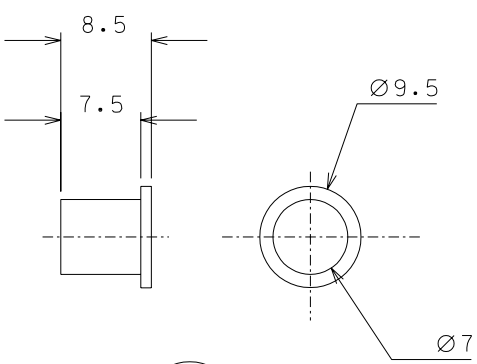


16.1 nickel plated



17

	last modification	14-11-00	
ref.	note	date	signature
modifications			



16.2 nickel plated

17	1	peek	2:1
16.2	1	ARMCO	2:1
16.1	1	"	2:1
16	1	"	2:1
ref.	pieces	mat. and treatments	scale

ref.	pieces	mat. and treatments	scale

General machining tolerances UNI 5307-63								
Dimensions	< 6	>6-30	>30-120	>120-315	>315-1000	>1000-2000	>2000-4000	> 4000
linear Toll.	±0.1	±0.2	± 0.3	± 0.5	± 0.8	± 1.2	± 2	± 3
angular Toll.	± 1	± 30'	± 20'	± 10' refered to the shortest side				

LIGO PROJECT

Bertolini
designed for University-Pisa

N. Acc_hor.007

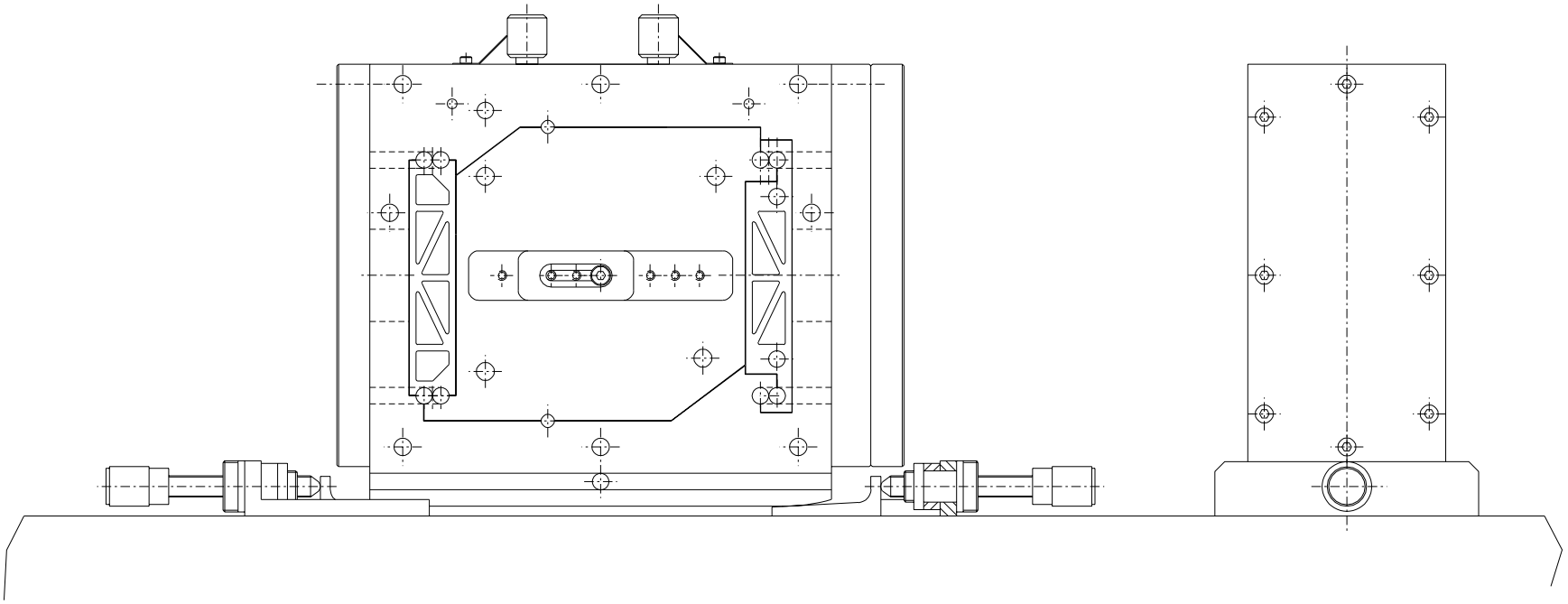
draw. PROMEC 28-6-00

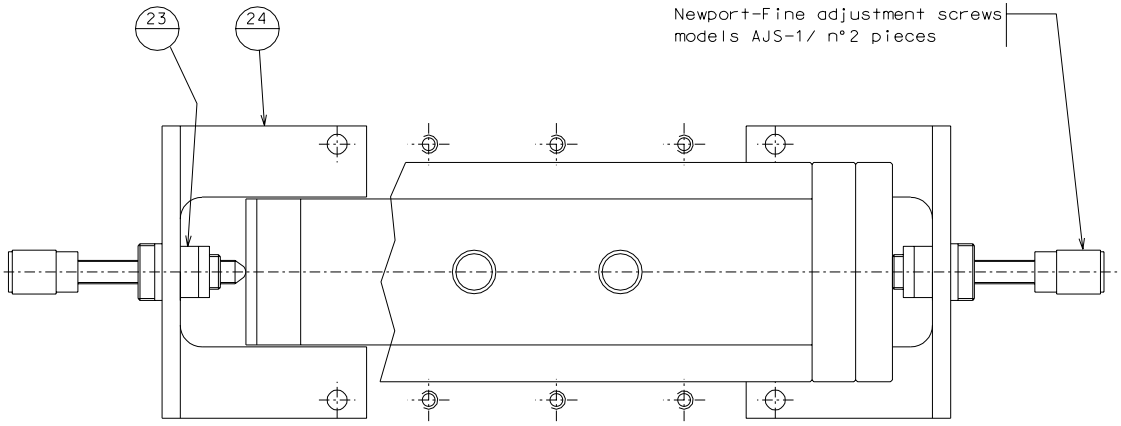
details from 000

replaces dr. Numb.

title
HOR. ACCELEROMETER
DETAILS - FOURTH VERSION

Size A3





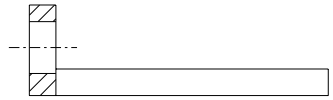
	last modification	14-11-00	
ref.	note	date	signature
modifications			

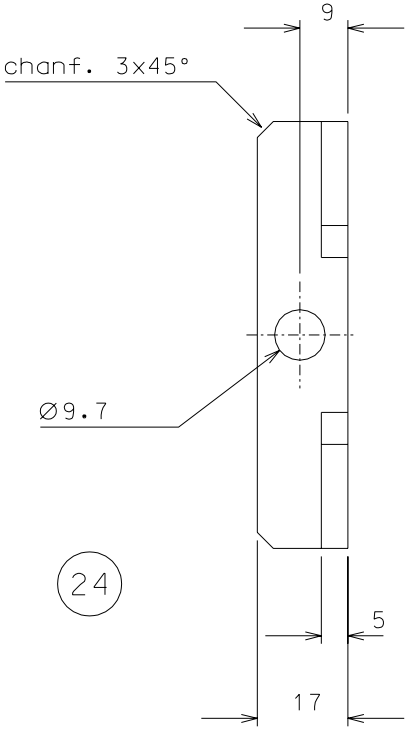
24	009	wedge's guide
23	009	spacer
ref.	draw.	added legend

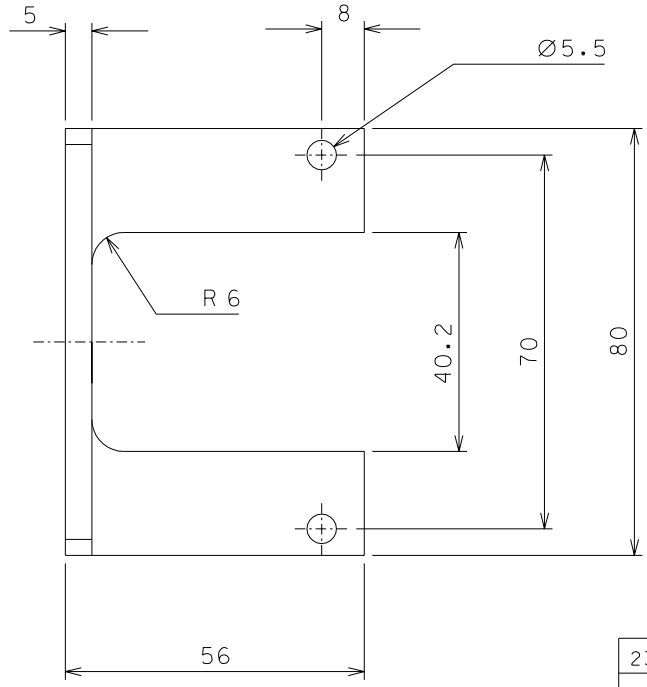
ref.	draw.	added legend

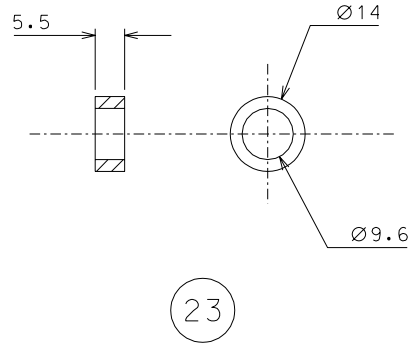
	LIGO PROJECT	designed for Bertolini University-Pisa
		ass. numb. Acc_hor.008
title		draw. PROMEC 1-11-00
HOR. ACCELEROMETER		scale 1:1
VERTIVAL ADJUSTMENT		replaces dr. Numb.

Size A2









23	2	UNI 9006/4	1:1
ref.	pieces	mat. and treatments	scale

24	2	AISI 304	1:1
ref.	pieces	mat. and treatments	scale

General machining tolerances UNI 5307-63								
Dimensions	< 6	> 6-30	> 30-120	> 120-315	> 315-1000	> 1000-2000	> 2000-4000	> 4000
linear Toll.	± 0.1	± 0.2	± 0.3	± 0.5	± 0.8	± 1.2	± 2	± 3
angular Toll.	± 1	± 30′	± 20′	± 10′ refered to the shortest side				

	last modification	14-11-00	
ref.	note	date	signature
modifications			

Size A3

LIGO PROJECT

Bertolini
designed for University-Pisa

N. Acc_hor.009

draw. PROMEC 1-11-00

details from 008

replaces dr. Numb.

title
HOR. ACCELEROMETER
DETAILS