



Universidad Politécnica de Durango  
Universidad Pública de Calidad



## UNIVERSIDAD POLITECNICA DE DURANGO

### 5TH NATIONAL METROLOGY SCHOOL COMPETITION

#### DESIGN AND DEVELOPMENT OF CHECKING FIXTURE FOR AUTOMOTIVE INDUSTRY COMPONENTS

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#### **TEAM SINERGIA**

Victoria de Durango a 05 de Octubre del 2017

# Index

INTRODUCTION .....	3
SCOPE.....	3
PURPOSE.....	3
PROJECT DEVELOPMENT.....	4
DESIGN AND CONSTRUCTION OF CHECKING FIXTURE .....	6
ESTIMATED COST ANALYSIS VERSUS REAL COST .....	15
ESTIMATED COST: .....	15
REAL COST: .....	16
REAL COST: .....	17
CONCLUSIONS.....	18
BIBLIOGRAPHY.....	19

## **INTRODUCTION**

A Checking Fixture is an object designed and manufactured to control only one part. The manufacturing tolerance should be 10% more than the tolerance of the part to check. Is a testing station of the part that simulates the assembly conditions, verifies the repetitions that ensure the same alignment and the same position of the part.

## **SCOPE**

This project satisfies the need of the automotive industry in the question of checking and verifying that its parts meet the specified requirements in order to deliver a device capable of determining if the part being checked is correct or not.

## **PURPOSE**

Our main purpose with the development of the Checking fixture is to be able to integrate and get involved in the flow of metrological knowledge required by the Automotive Industry, promoting creativity for the design and development of measurement devices. Knowledge of Metrology, Engineering, Design, Costs, Times, Resource Management, Project Management, Negotiation and Languages are included. In addition to the development of this project has the purpose of making the best Checking that meets the specified requirements to ensure that the automotive industry is meeting all specifications of its customers and ensure the functionality of the part for which it was developed the device.

## PROJECT DEVELOPMENT

Below we describe each one of the steps that were followed in order to obtain our device, as well is attached evidence of some of the steps carried out:

- 1.- Entry to competition (Choose team leader, designates team advisor, Send the registration paperwork, Expect mail acceptance and registration)
- 2.- Tolerances and Metrology course (Review of geometric tolerances, Review of dimensional tolerances and Review on the use of Vernier and measurement tools)
- 3.- Definition of technical language to use (Definition and history of the checking fixture, Determine the checking process and Determine parts of the checking)
- 4.- Delivery of parts and requirements of the project by the organizers (Presented on June 9 in CENAM, Register in the attendance lists, deliver letters of confidentiality signed and stamped by the institution and Resolution of doubts about project)
- 5.- Analyze part and possible checking fixture (Meeting with all the members of the team and advisors and Make sketches of the possible fixture)
- 6.- Work on the design (Take points for the design of the piece that is going to work, make design of automotive part, do the checking fixture design and Plate and label of the fixture design)
- 7.- Define resources (Define necessary material, define checking parts and define critical points)
- 8.- Start manufacturing the checking fixture (Having the necessary material, having defined the final checking fixture design and make sure that all certain critical points are checked)

9.- Production of labels and use sheets (Label for plate manufacturing data and part to check and sheet processing with step for the use of the checking and specifications)

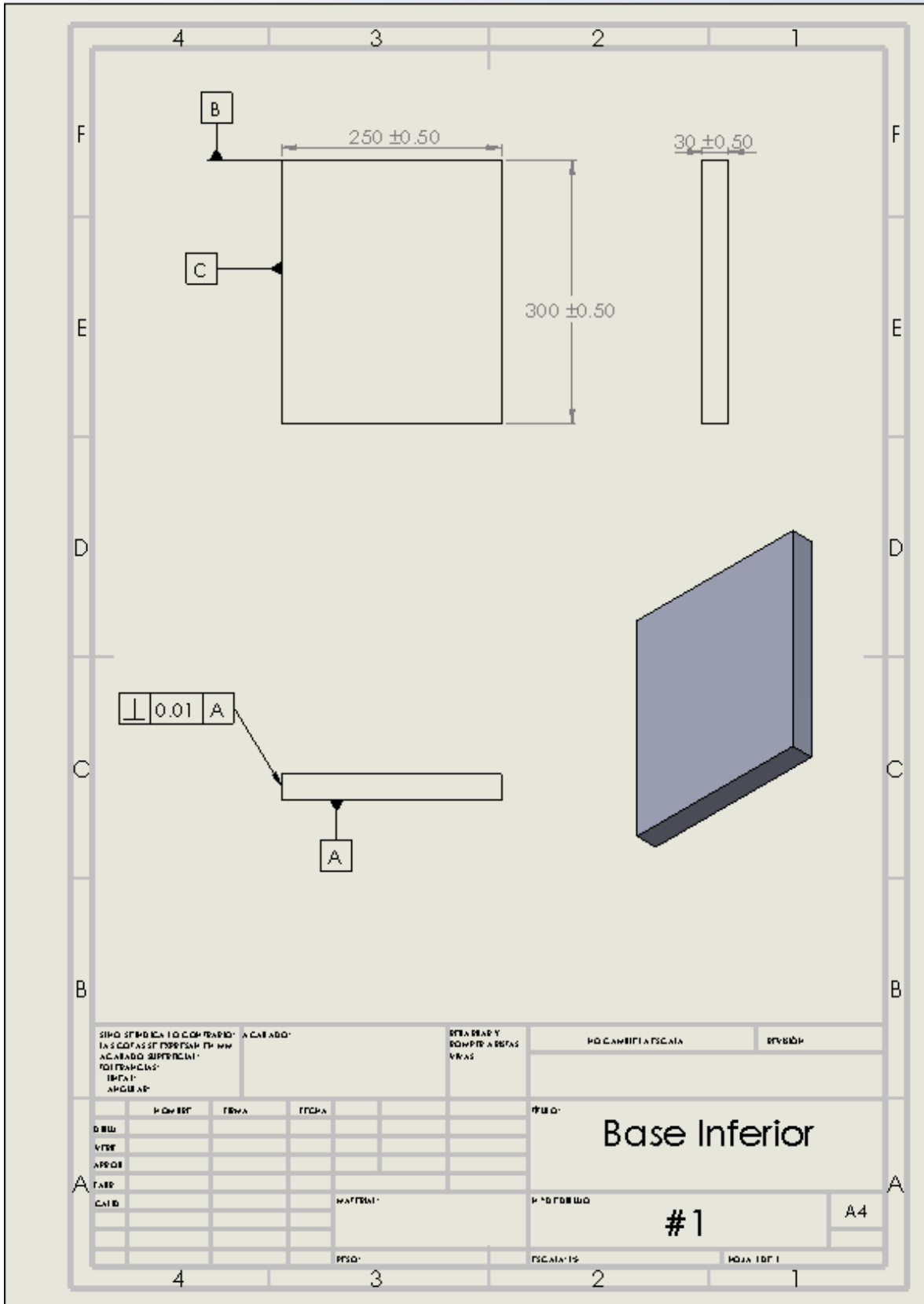
10.- Preparation of material to present (Preparation of presentation for final presentation and completing the folder to deliver with all parts of the Project)

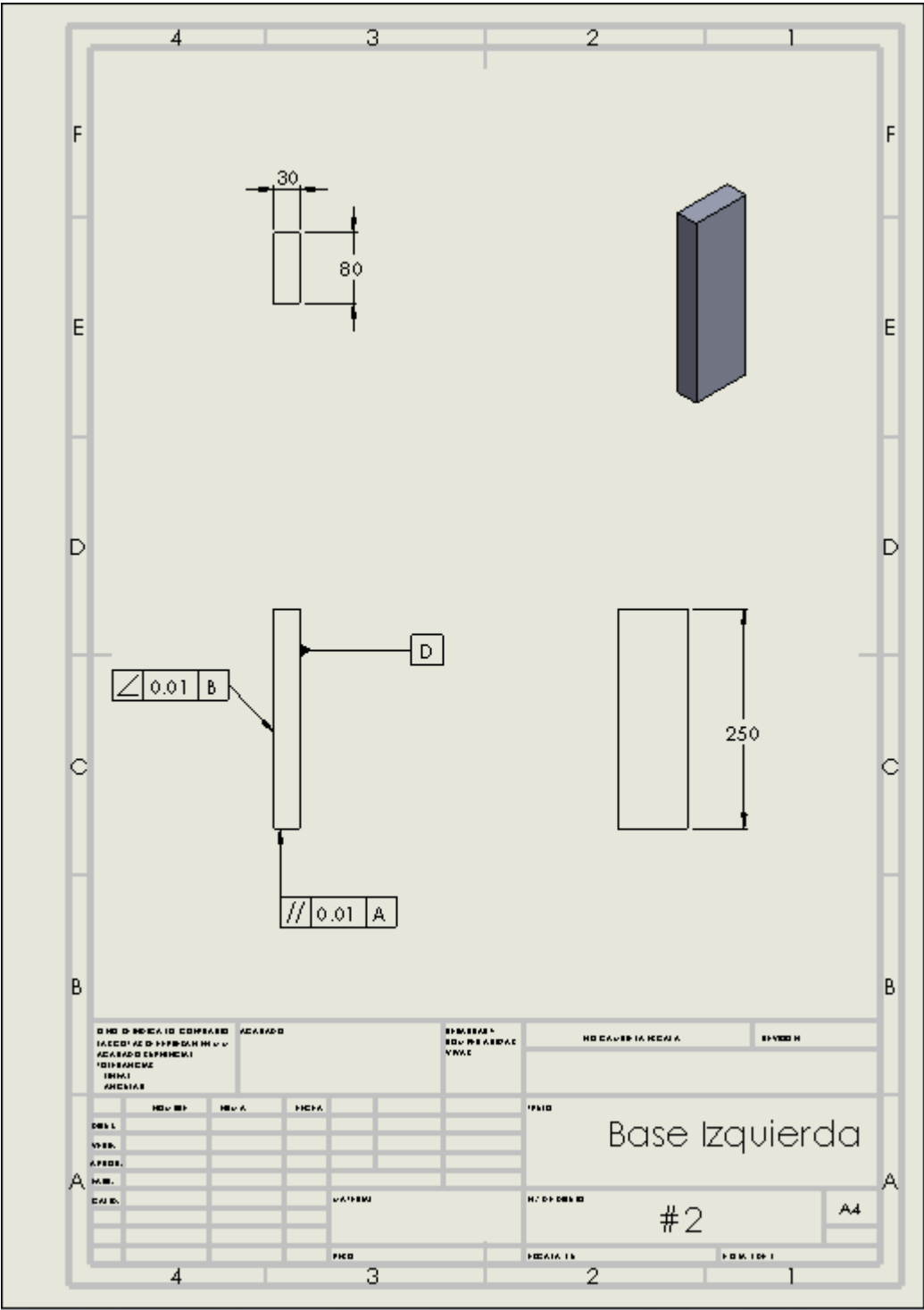
11.- Finish sheet (Include all designs and plans, ensure that it includes all the required material and final review of sheet by internal and external consultants)

12.- Check proper functioning (Check that they comply with the specifications of GM and Verify tolerances and assemblies)

13.- Final presentations (Present the full team in CENAM, Check the operation of the checking fixture in visual and theoretical manner and Expect results and awards)

# DESIGN AND CONSTRUCTION OF CHECKING FIXTURE





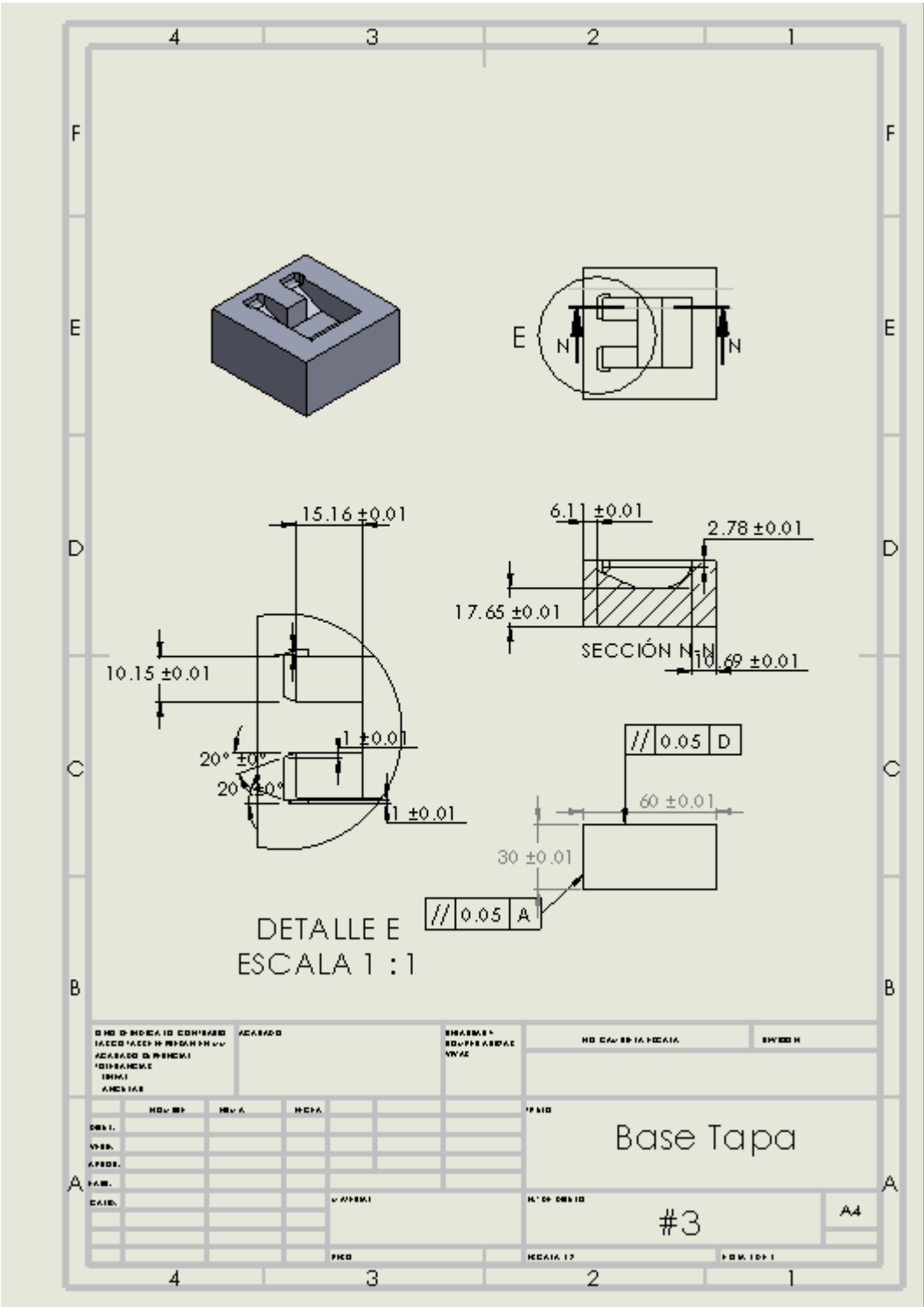
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DISEÑO DE BOCAL DE COMPRESOR			ACABADO		DIMENSIONES		MATERIAL		FECHA	
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DES. II.										
DES. III.										
DES. IV.										
DES. V.										
DES. VI.										
DES. VII.										
DES. VIII.										
DES. IX.										
DES. X.										
DES. XI.										
DES. XII.										
DES. XIII.										
DES. XIV.										
DES. XV.										
DES. XVI.										
DES. XVII.										
DES. XVIII.										
DES. XIX.										
DES. XX.										

Base Izquierda

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DETALLE E  
ESCALA 1 : 1

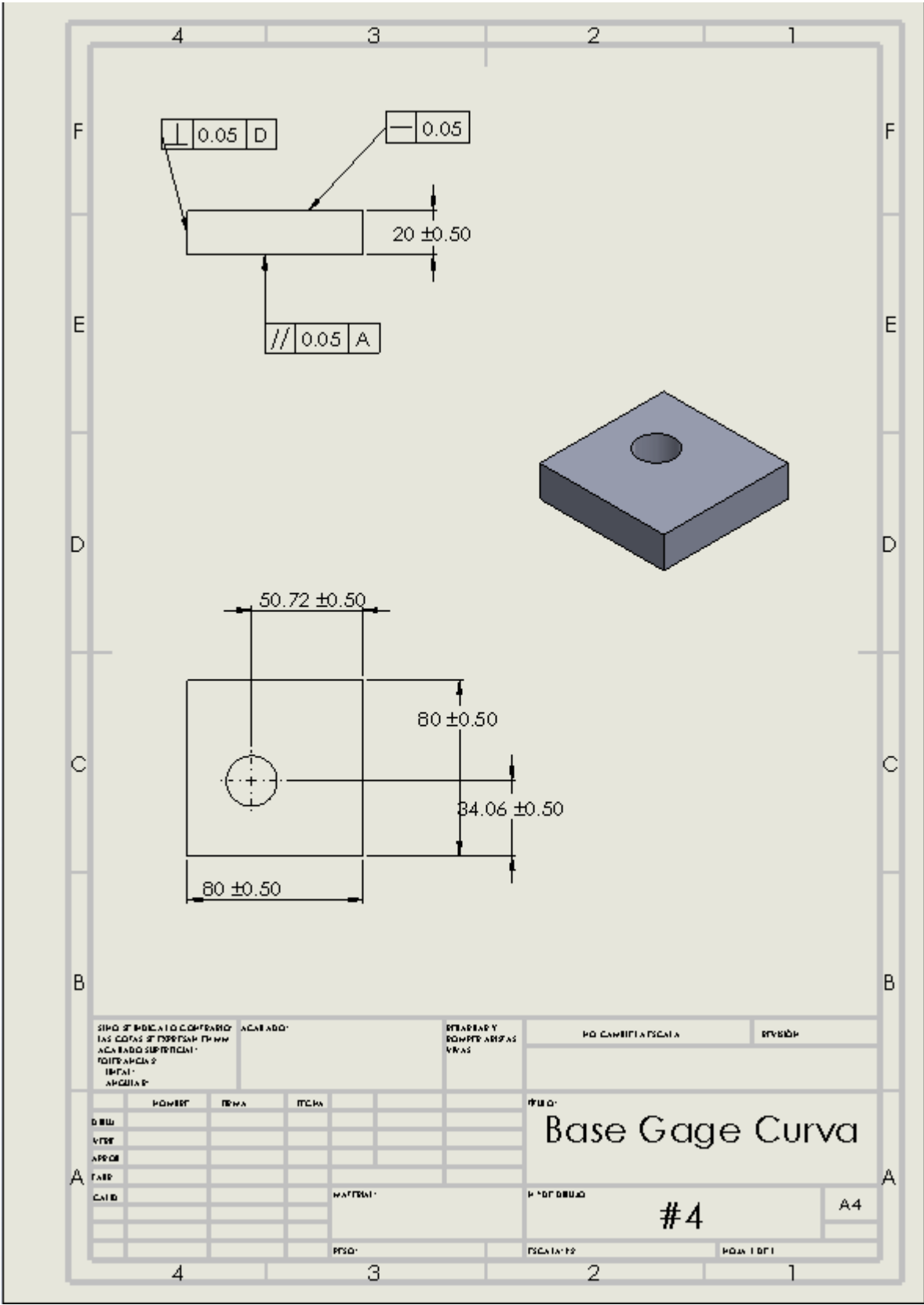
DISEÑO DE DIBUJOS CONVENCIONALES		ACABADO		EQUIPAMIENTO		NÚMERO DE LA PIEZA		DISEÑO	
TALLERES DE DISEÑO Y DIBUJO		MATERIALES		MATERIALES		MATERIALES		MATERIALES	
ACABADO DE SUPERFICIE		MATERIALES		MATERIALES		MATERIALES		MATERIALES	
MATERIALES		MATERIALES		MATERIALES		MATERIALES		MATERIALES	
DESIGN.									
VERB.									
APROB.									
FECH.									
OTRO.									
						N.º DE DISEÑO			
						#3		A4	
						MATERIALES			
						MATERIALES			

Base Tapa

#3

A4





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 A MENOS QUE SE INDICAR  
 OTRA UNIDAD

ACERADO

ESTRIBAR Y  
 BOMBEAR LAS  
 VERTICES

NO CAMBIAR ESCALA

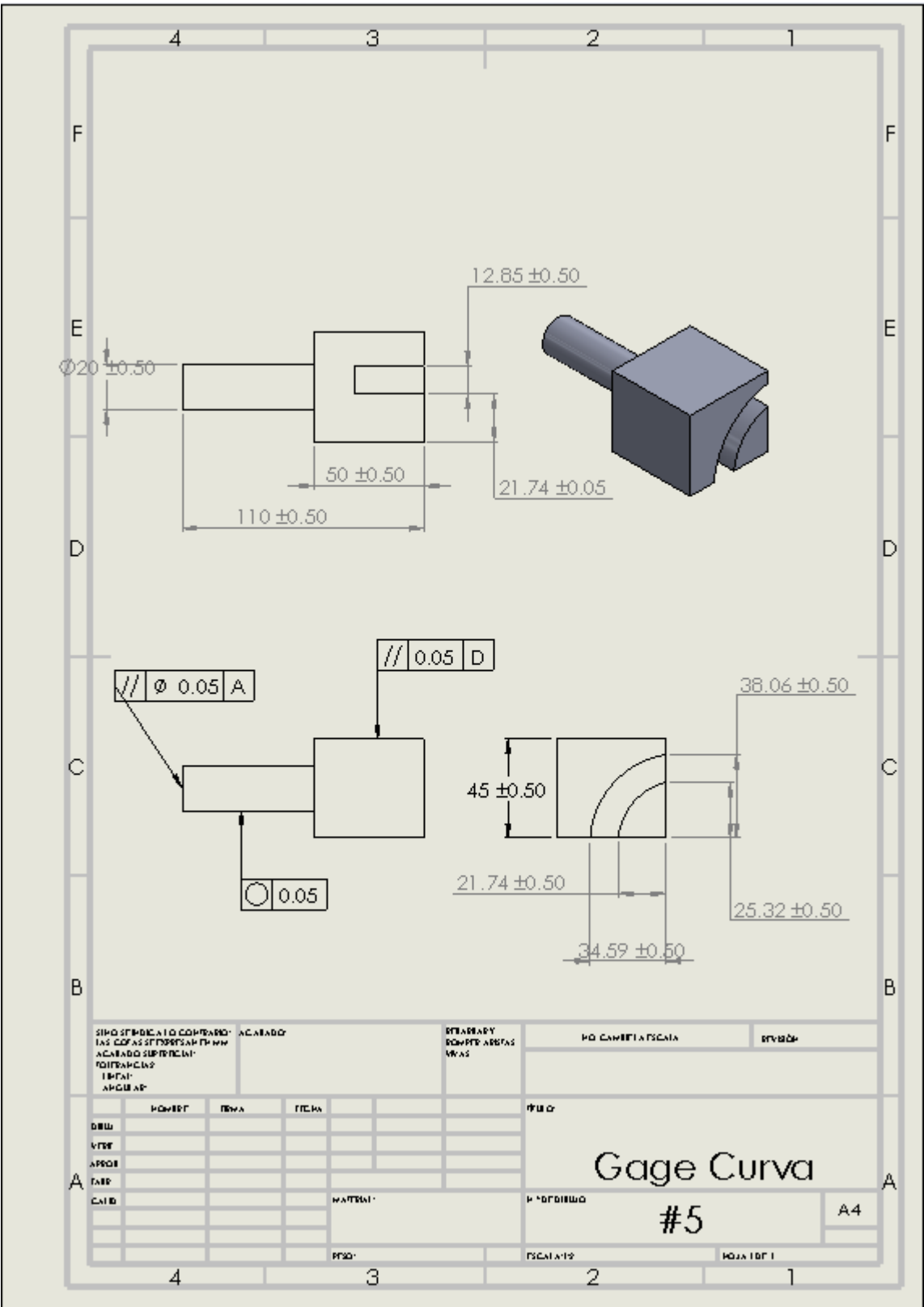
REVISO

NO	FECHA	ITEM	REVISIÓN

Base Gage Curva

#4

A4



SEMO SPERDICA TO COMPENDIO  
 LAS COPIAS SE TENDRAN EN CUENTA  
 ACABADO SUPERFICIE  
 QUITANDOLAS  
 TIRADAS  
 APROBADO

ACABADO  
 ACABADO SUPERFICIE  
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 TIRADAS  
 APROBADO

REVISADO  
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 VERAS

NO CAMBIAR ESCALA

REVISOR

REVISOR	FECHA	FECHA	FECHA	FECHA

FIG. 0

**Gage Curva**

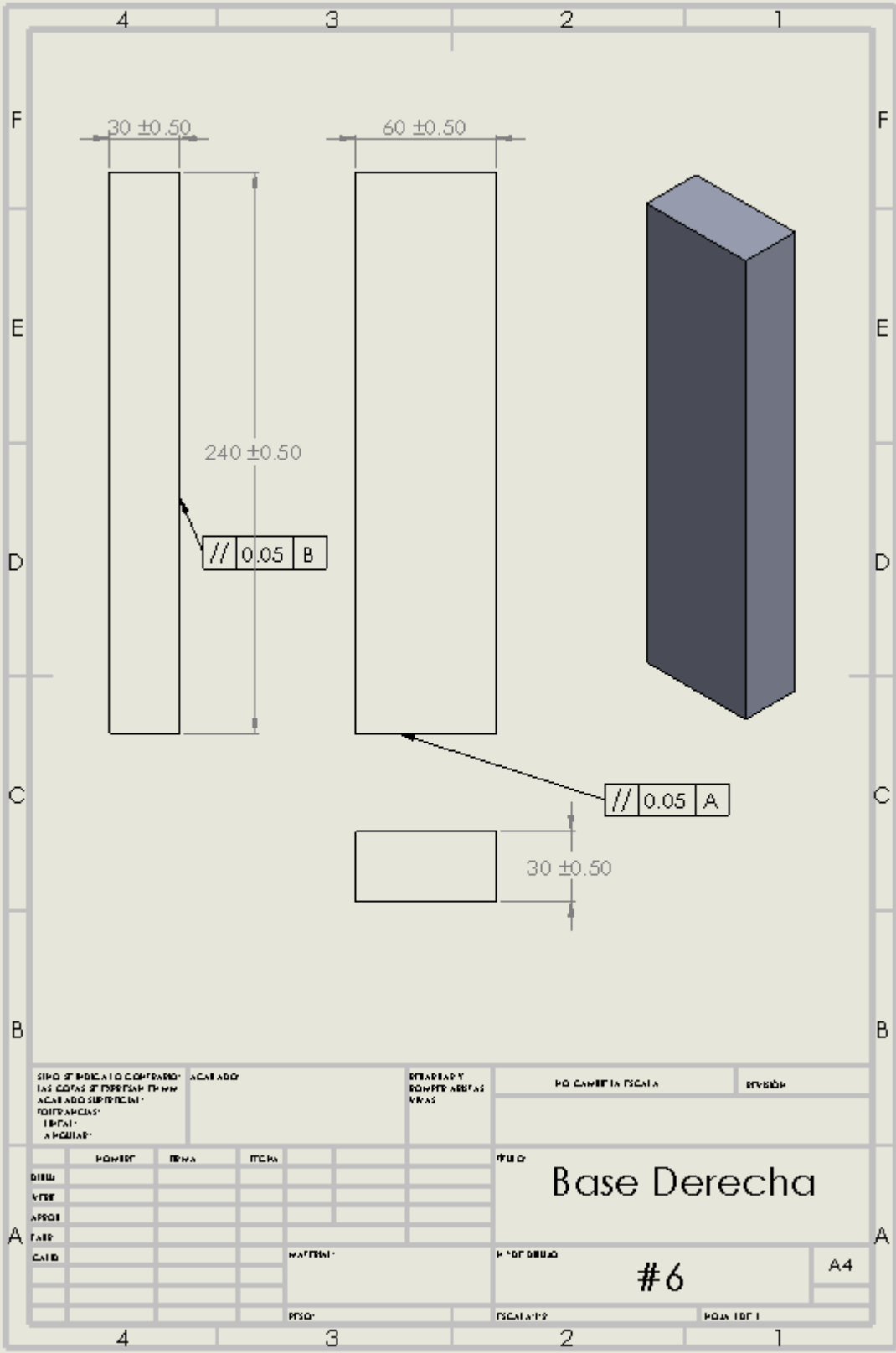
**#5**

PROBADO

ESCALA 1:1

HOJA 1 DE 1

A4

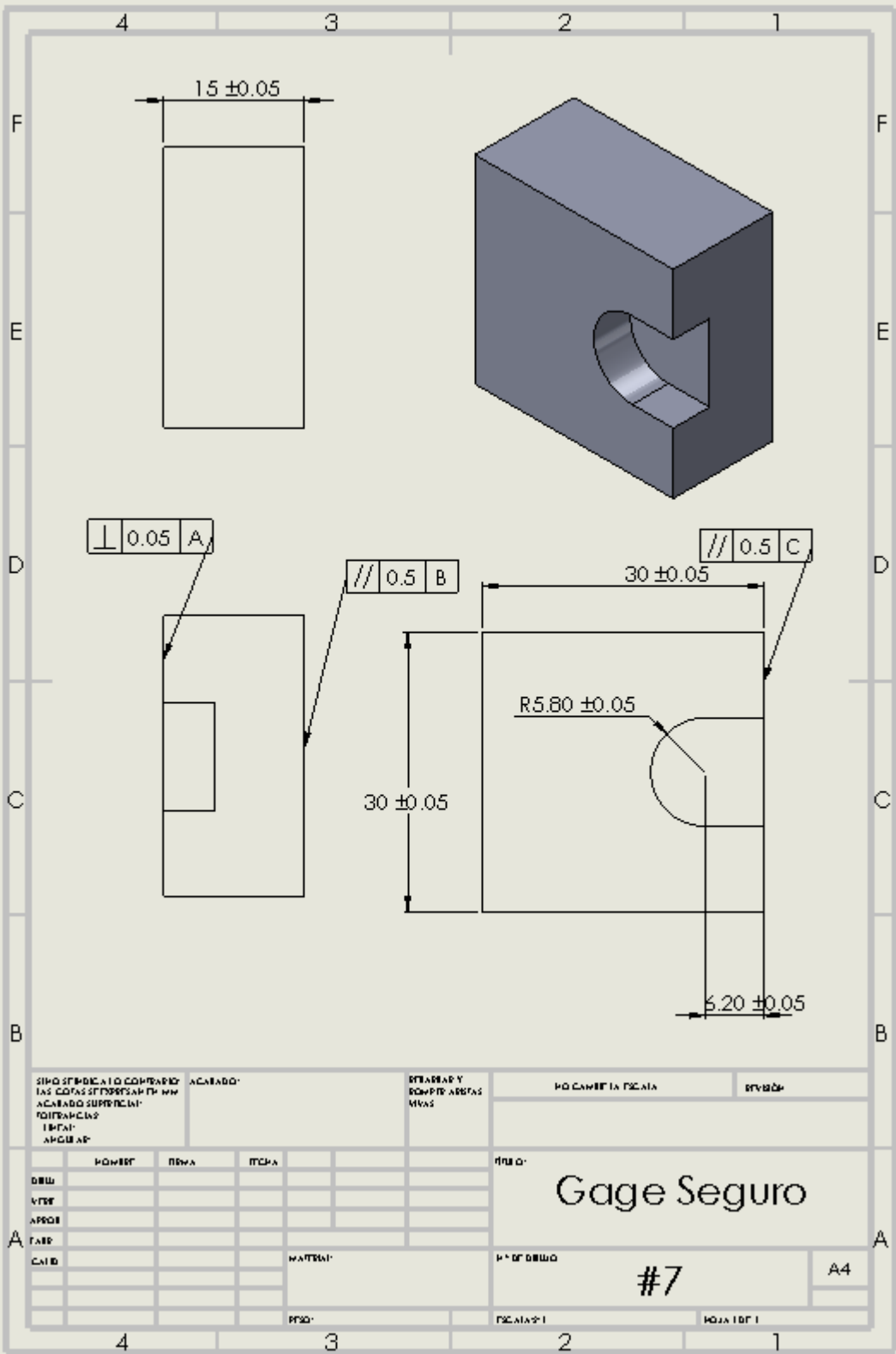


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VERIFICADO		VERIFICADO		VERIFICADO		VERIFICADO		VERIFICADO	
APROBADO		APROBADO		APROBADO		APROBADO		APROBADO	
ELABORADO		ELABORADO		ELABORADO		ELABORADO		ELABORADO	
CALIBRE		CALIBRE		CALIBRE		CALIBRE		CALIBRE	
MATERIA		MATERIA		MATERIA		MATERIA		MATERIA	
PROYECTO		PROYECTO		PROYECTO		PROYECTO		PROYECTO	
ESCALA		ESCALA		ESCALA		ESCALA		ESCALA	
N.º DE DIBUJO		N.º DE DIBUJO		N.º DE DIBUJO		N.º DE DIBUJO		N.º DE DIBUJO	
N.º DE HOJA		N.º DE HOJA		N.º DE HOJA		N.º DE HOJA		N.º DE HOJA	

Base Derecha

#6

A4



SI NO SE INDICA LO CONTRARIO  
 LAS COTAS SE ENTENDEN EN MM  
 ACABADO SUPERFICIAL  
 FUENTES DE INFORMACION  
 TITULO  
 ANGELES

ACABADO:  
 ESTADOS Y  
 EQUIVALENCIAS  
 MAS

NO CAMBIA LA ESCALA

invade

PROYECT	REVISA	RECHA	FECHA	PROYECT

TITULO:  
**Gage Seguro**

Nº DE DIBUJO:  
**#7**

ESCALA: 1

HOJA 1 OF 1

A4





## ESTIMATED COST ANALYSIS VERSUS REAL COST

### ESTIMATED COST:

<u>Materials</u>	
1 placa de duraluminio/ aluminio 60 x 80 cm $\frac{3}{4}$ " de grosor	<u>\$ 2,690</u>
1 placa de duraluminio/ aluminio 30 x 40 cm $\frac{3}{4}$ " de grosor	<u>\$ 1,120</u>
1 placa de Nylamid/ Nylacero 60 x 80 cm $\frac{3}{4}$ " de grosor	<u>\$ 2,813.50</u>
1 placa de Nylamid/ Nylacero 30 x 40 cm $\frac{3}{4}$ " de grosor	<u>\$ 1,321.50</u>
<b><u>MATERIAL TOTAL COST</u></b>	<b><u>\$ 7,945</u></b>

### ESTIMATED COST:

<u>SKILLED LABOR</u>	<u>WAGES</u>
<u>ING. MARITZA GÓMEZ</u>	
<ul style="list-style-type: none"> <li>• GESTIÓN, PLANIFICACIÓN Y OPERADORA DE ACTIVIDADES</li> <li>• 143 HRS. A \$ 80.04</li> </ul>	<u>\$ 11,445.72</u>
<u>ING. JORGE DÁVILA</u>	
<ul style="list-style-type: none"> <li>• MANUFACTURA Y ENSAMBLE</li> <li>• 180 HRS. A \$ 80.04</li> </ul>	<u>\$ 14,407.02</u>
<u>ING. GABRIEL CUAMATZI</u>	
<ul style="list-style-type: none"> <li>• DISEÑO Y METROLOGÍA</li> <li>• 144 HRS. A \$ 80.04</li> </ul>	<u>\$ 11,525.76</u>
<u>LIC. JESÚS RUBIO</u>	<u>\$ 10,645.32</u>
<ul style="list-style-type: none"> <li>• ADMINISTRADOR Y FINANZAS</li> <li>• 133 HRS. A \$ 80.04</li> </ul>	
<b><u>SKILLED LABOR TOTAL COST</u></b>	<b><u>\$ 48,023.82</u></b>

**REAL COST:**

***Proveedor Aceros Y***

***Baleros Dgo. S.A DE C.V***

1 PLACA DE DURALUMINIO/ ALUMINIO DE 60 X 80 CM 3/4" DE GROSOR.	<u>\$</u> 5,380 P/N
1 PLACA DE DURALUMINIO/ ALUMINIO DE 30 X 40 CM 3/4" DE GROSOR.	<u>\$</u> 1,206.40 P/N
1 PLACA DE NYLAMID/ NYLACERO 60 X 80 CM 3/4" DE GROSOR	<u>\$</u> 2,268 P/N
1 PLACA DE NYLAMID/ NYLACERO 30 X 40 CM 3/4" DE GROSOR	<u>\$</u> 1,534 P/N
<b><u>MATERIAL TOTAL COST</u></b>	<b><u>\$</u> 10,778.40</b>
➤ <u>TARDARIAN 3 DIAS AL MOMENTO DE PEDIR EL MATERIAL.</u>	
<i>PROVEEDOR REBASA DGO S.A DE C.V</i>	
1 PLACA DE NYLAMID/ NYLACERO 60 X 80 CM 3/4" DE GROSOR	<u>\$</u> 2959 (+ IVA)
1 PLACA DE NYLAMID/ NYLACERO 30 X 40 CM 3/4" DE GROSOR	\$ 1,109 (+ IVA)
<b><u>MATERIAL TOTAL COST</u></b>	<b><u>\$</u> 4,068</b>



PROVEEDOR CENTRALUM S.A DE  
C.V MONTERREY

1 PLACA DE DURALUMINIO/ ALUMINIO DE 60 X 80 CM 3/4" DE GROSOR.	<u>\$ 5,527</u>
1 PLACA DE DURALUMINIO/ ALUMINIO DE 30 X 40 CM 3/4" DE GROSOR.	<u>\$ 2,244</u>
1 PLACA DE NYLAMID/ NYLACERO 60 X 80 CM 3/4" DE GROSOR	<u>\$ 3,875</u>
1 PLACA DE NYLAMID/ NYLACERO 30 X 40 CM 3/4" DE GROSOR	<u>\$ 2,244</u>
<b><u>MATERIAL TOTAL COST</u></b>	<b><u>\$14, 336</u></b>

Tardarían de 3 a 4 días al momento de pedir el material.

**REAL COST:**

<b><u>SKILLED LABOR</u></b>	<b><u>WAGES</u></b>
<b><u>ING. MARITZA GÓMEZ</u></b>	
<ul style="list-style-type: none"> <li>• GESTIÓN, PLANIFICACIÓN Y OPERADORA DE ACTIVIDADES</li> <li>• 130 HRS. A \$ 80.04</li> </ul>	<u>\$ 10,406</u>
<b><u>ING. JORGE DÁVILA</u></b>	
<ul style="list-style-type: none"> <li>• MANUFACTURA Y ENSAMBLE</li> <li>• 150 HRS. A \$ 80.04</li> </ul>	<u>\$ 12,000</u>
<b><u>ING. GABRIEL CUAMATZI</u></b>	
<ul style="list-style-type: none"> <li>• DISEÑO Y METROLOGÍA</li> <li>• 115 HRS. A \$ 80.04</li> </ul>	<u>\$ 9,205</u>
<b><u>LIC. JESÚS RUBIO</u></b>	<u>\$ 12,166</u>
<ul style="list-style-type: none"> <li>• ADMINISTRADOR Y FINANZAS</li> <li>• 152 HRS. A \$ \$ 80.04</li> </ul>	
<b><u>SKILLED LABOR TOTAL COST</u></b>	<b><u>\$ 43,777</u></b>

## **CONCLUSIONS**

We present our prototype as the final product of this project, we describe each of the steps that were carried out to be able to finish our checking fixture to check the measures and functionality of the part that was assigned to us is the lid of the pump the gas. All the plans involved in the development of the same were annexed as well as the sequence of steps that followed from the inscription to the contest until the final finishing of checking.

Having the device finished are both with the scope and purpose of our device and so we can ensure that the parts that are reviewed with this device can know if they are correct or incorrect as marked.

With the help of reverse engineering, design and administration this project could be successfully completed.

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