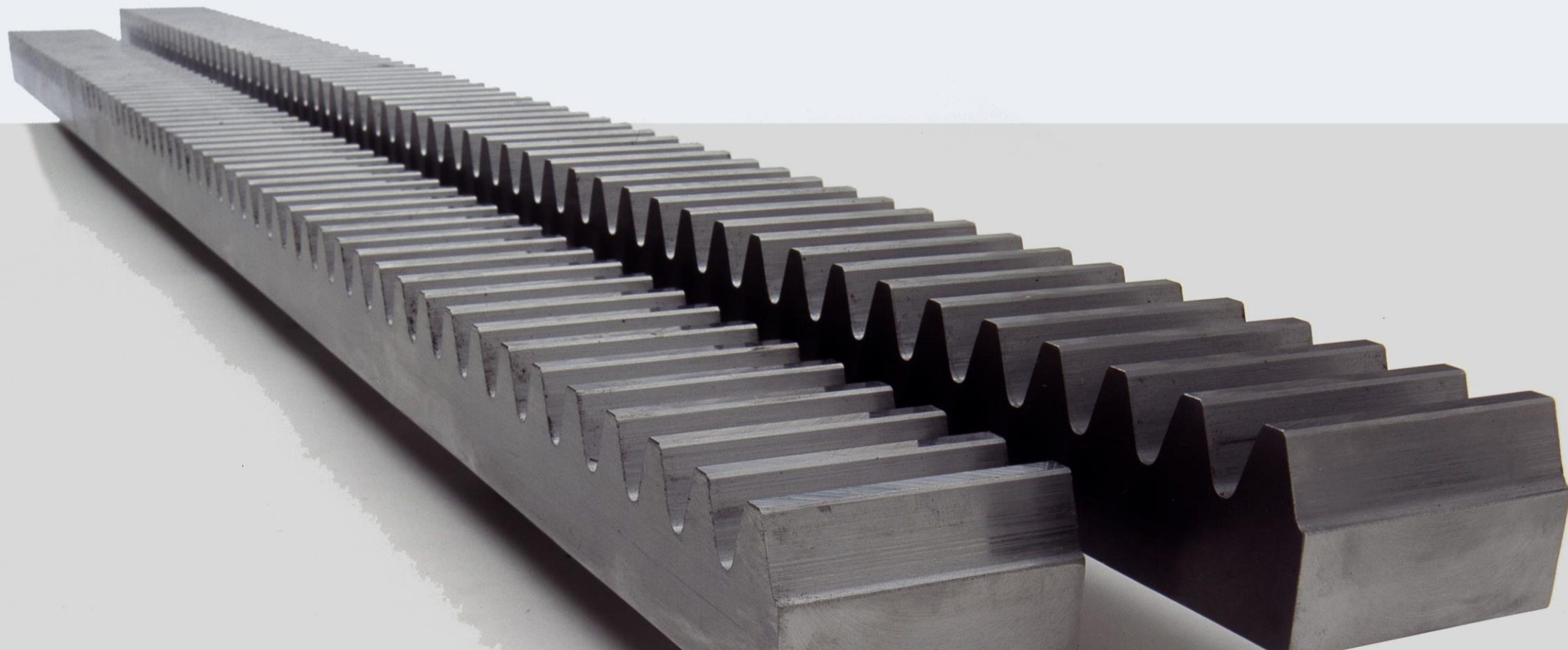




Toolox<sup>®</sup> para Cremalleras

**57** BILLION  
SEK  
annual net sales in 2015

Steel making since  
**1878**



**16,000**  
professionals  
in 50 countries

Annual steel  
production capacity:  
**8.8** MILLION  
TONNES

**OUR BUSINESSES:**

SSAB Special Steels,  
SSAB Europe,  
SSAB Americas, Tibnor,  
Ruukki Construction

**SSAB**



**STRENX™**  
PERFORMANCE STEEL

The high-  
strength, high-  
performance  
steel



**HARDOX®**  
WEAR PLATE

The renowned  
hard and tough  
steel for  
aggressive  
environments



**DOCOL®**  
THE AUTOMOTIVE STEEL

Safety for  
automotive



**TOOLOX®**  
ENGINEERING & TOOL STEEL

The premium  
engineering and  
tool steel



**ARMOX®**  
PROTECTION PLATE

Hardest steel for  
maximum  
protection



**GREENCOAT®**  
COLORFUL STEEL

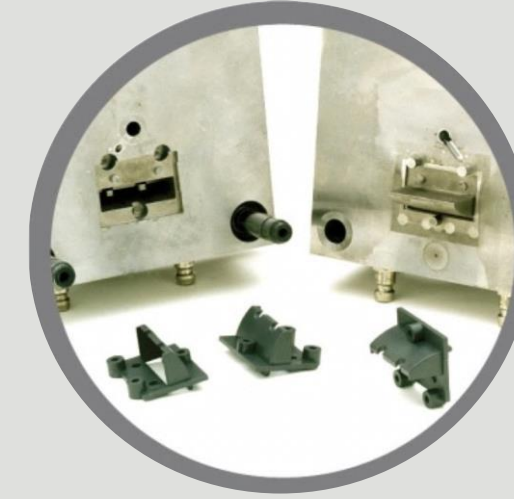
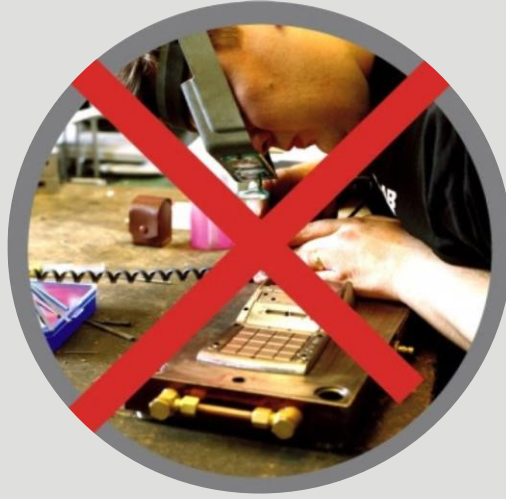
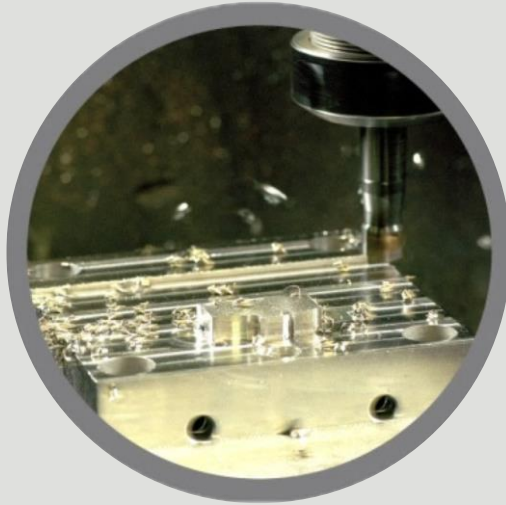
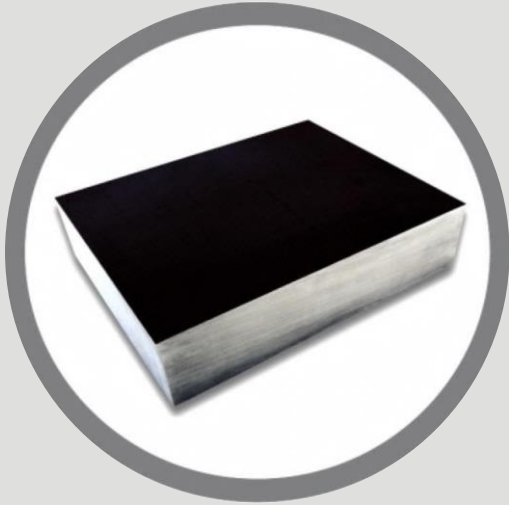
For harsh  
weather and  
greener living



**SSAB**  
DOMEX / BORON  
FORM / WEATHERING  
LASER® PLUS

Optimized  
families

**SSAB**



Toolox<sup>®</sup> 33  
300 HB

Toolox<sup>®</sup> 40  
40 HRc

Toolox<sup>®</sup> 44  
45 HRc

+

Nitruración • PVD • Temple con Laser • Temple por Inducción

| Estado del diente    | Acero                                 | Limite de Ruptura Rm MPa | Dureza                 |                        |
|----------------------|---------------------------------------|--------------------------|------------------------|------------------------|
|                      |                                       |                          | HRc                    | HV1                    |
| Sin tratar           | C45                                   | ~ 650                    |                        |                        |
| Templado             | 42CrMo4 V                             | Max. 1000                |                        |                        |
| Temple por induccion | C45<br>42CrMo4 V<br>Toolox 44         |                          | 55...60<br>56-62<br>55 |                        |
| Cementacion          | 16MnCr5                               |                          | 55-61                  |                        |
| Nitruracion          | 42CrMo4 V<br>Toolox 44                |                          |                        | 550 – 700<br>660 - 880 |
| Endurecido           | X90CRMov 18<br>Toolox 33<br>Toolox 44 | 980<br>1450              | 54 – 58<br>45          | 300                    |



**SSAB**

# Pureza de aceros SSAB en comparison con aceros estandar

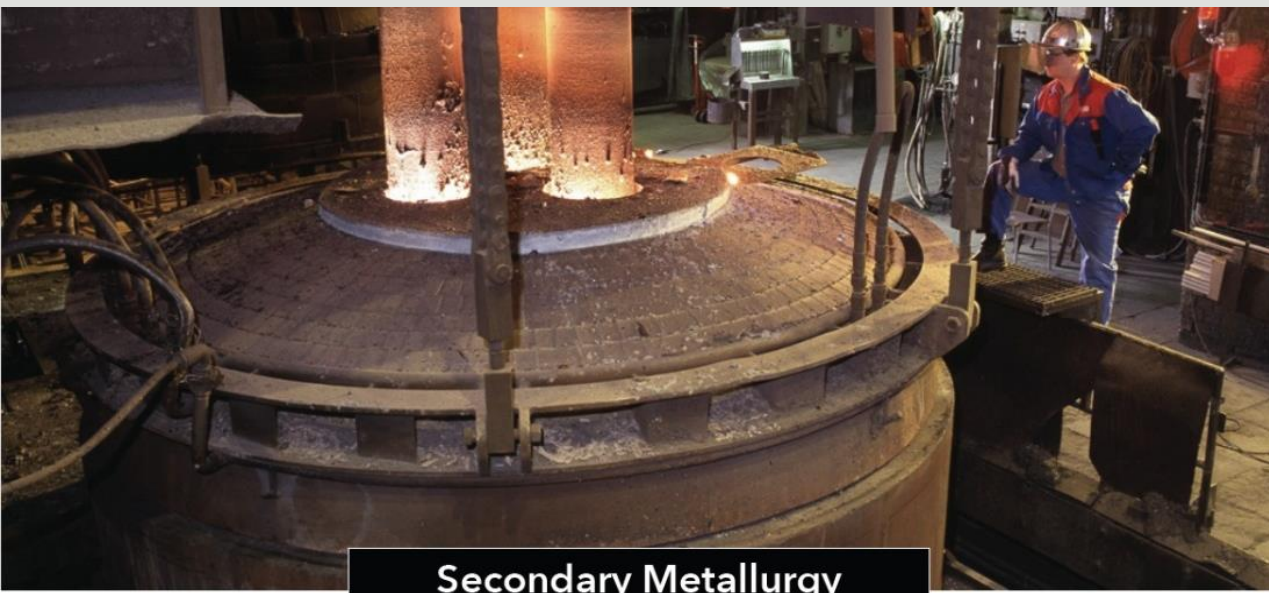


# Propiedades de fatiga

El limite de fatiga de Toolox<sup>®</sup> 44 en ensayo de fatiga por flexion ha sido determinado a  $800 \pm 25$  MPa para  $2 \times 10^6$  cycles.

H13 tratado a 45 HRC tipicamente tiene 420 MPa en ensayo de fatiga por tension. Equivalente a approx. 600 MPa en ensayo de fatiga por flexion.

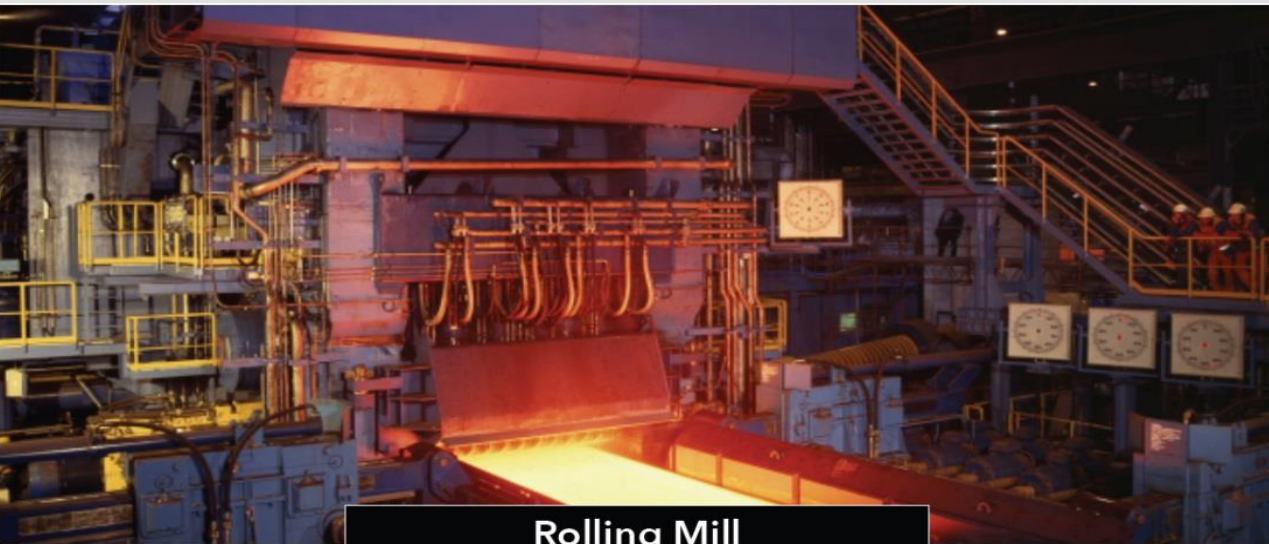
Toolox<sup>®</sup> 44 tiene un limite de fatiga parecido a un acero de rodamiento 100Cr6 tratado a approx. 60 HRC



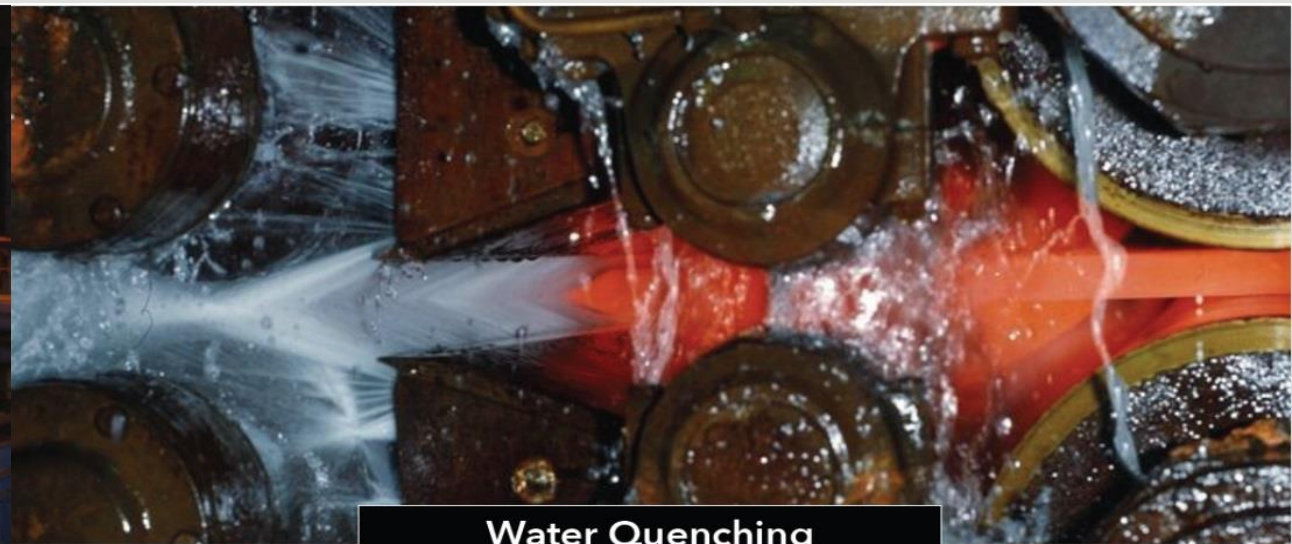
Secondary Metallurgy



CSR Casting



Rolling Mill



Water Quenching

|                         | TOOLOX® 33 | 42CrMo4/4140   | TOOLOX® 44 |
|-------------------------|------------|----------------|------------|
| R <sub>p0.2</sub> (Mpa) | 850        | 550 - 800      | 1300       |
| R <sub>m</sub> (MPa)    | 980        | 850-1000       | 1450       |
| Resiliencia             | 100 J @ RT | 60 – 90 J @ RT | 30 J @ RT  |
| Elongation, A5 (%)      | 16         | 13             | 13         |
| C                       | 0.23       | 0.40           | 0.32       |
| Mo                      | 0.30       | 0.22           | 0.80       |
| CE <sub>IIW</sub>       | 0.66       | 1.27           | 0.96       |



**SSAB**

|                                                                                     |  |                                                                                                           |                                               |                                          |                                                     |                                                             |  |                       |                    |                                                    |  |
|-------------------------------------------------------------------------------------|--|-----------------------------------------------------------------------------------------------------------|-----------------------------------------------|------------------------------------------|-----------------------------------------------------|-------------------------------------------------------------|--|-----------------------|--------------------|----------------------------------------------------|--|
|                                                                                     |  |                                                                                                           |                                               |                                          | SSAB EMEA AB, SE-613 80 OXELÖSUND, Sweden A01       |                                                             |  |                       |                    |                                                    |  |
| Inspection certificate<br>EN 10 204 - 3.1 A02                                       |  | Issuing department<br>Quality inspection A05                                                              |                                               | Purchaser order no<br>Toolox week 03 A07 |                                                     | Our order no<br>10296325-80 A08                             |  | Invoice no A19        |                    | Certificate no and date<br>17214600 2018-04-07 A03 |  |
| Purchaser<br><br>SSAB EMEA AB, BELGIUM<br><br>0000 .<br>Belgium<br><br>A11<br>46172 |  | Product<br>Tool steel B01                                                                                 |                                               |                                          | Marking (Stamping)<br>Manufacturer, MATERIAL ID B06 |                                                             |  |                       | Customer marks B15 |                                                    |  |
|                                                                                     |  | Quantity B08<br>1                                                                                         | Dimensions [mm] B09-B11<br>T 50 W 2070 L 5614 |                                          |                                                     | Weight [kg] B12<br>4613                                     |  | Deliv. Cond. B04<br>Q |                    | Internal code B16<br>22216                         |  |
|                                                                                     |  | Consignee A06<br>SSAB EMEA AB Toolox Antwerp C/o Bvba Thor Shipping & Transport<br>2030 Antwerpen Belgium |                                               |                                          |                                                     | Standard/rules B02<br>OX TOOLOX 33<br>Steel grade TOOLOX 33 |  |                       |                    |                                                    |  |
|                                                                                     |  | MATERIAL ID B07<br>124313-677048                                                                          |                                               |                                          |                                                     |                                                             |  |                       |                    |                                                    |  |

|                      |     |      |     |      |      |      |     |      |      |      |     |      |      |      |         |                       |         |
|----------------------|-----|------|-----|------|------|------|-----|------|------|------|-----|------|------|------|---------|-----------------------|---------|
| Chemical composition |     |      |     |      |      |      |     |      |      |      |     |      |      |      | C71-C92 | Carbon equivalent etc | C93-C99 |
| Heat no              | C   | Si   | Mn  | P    | S    | Cr   | Ni  | Mo   | V    | Ti   | Cu  | Al   | Nb   | B    | N       |                       |         |
| 124313               | .23 | 1.11 | .82 | .008 | .001 | 1.04 | .06 | .202 | .099 | .011 | .01 | .008 | .018 | .002 | .003    |                       |         |

| Testtype            | C04 | Millcode | C00 | Specimen position | C01 | Direction | C02 | Treatment          | B05 | Specimen type     | C10 | Temp [degr C] | C03 | Test results              |                         |                      |                      |
|---------------------|-----|----------|-----|-------------------|-----|-----------|-----|--------------------|-----|-------------------|-----|---------------|-----|---------------------------|-------------------------|----------------------|----------------------|
| Tensile test        |     | 330516   |     | Top end           |     | Transvers |     | Delivery condition |     | Round             |     |               |     | C11<br>Rp0.2 [MPa]<br>924 | C12<br>Rm [MPa]<br>1020 | C13<br>A50 [%]<br>21 |                      |
| Impact test         |     | 330516   |     | Top end           |     | Transvers |     | Delivery condition |     | Charpy-V<br>10x10 |     | -20           |     | C42<br>E [J]<br>37        | C42<br>E [J]<br>44      | C42<br>E [J]<br>39   | C43<br>Ave [J]<br>40 |
| Impact test         |     | 330516   |     | Top end           |     | Transvers |     | Delivery condition |     | Charpy-V<br>10x10 |     | 20            |     | C42<br>E [J]<br>73        | C42<br>E [J]<br>67      | C42<br>E [J]<br>67   | C43<br>Ave [J]<br>69 |
| Hardness test (HBW) |     | 330529   |     | Top end           |     |           |     | Delivery condition |     |                   |     |               |     | C32<br>Ave<br>318         |                         |                      |                      |

ULTRASONIC INSPECTION ACCORDING TO EN 10 160 WITH EXTRA DEMANDS ACCORDING TO SPECIFICATION SSAB V6

|                                                                                     |                                                                   |     |  |  |                                                                                                       |     |  |  |     |                                                            |
|-------------------------------------------------------------------------------------|-------------------------------------------------------------------|-----|--|--|-------------------------------------------------------------------------------------------------------|-----|--|--|-----|------------------------------------------------------------|
|  | This certificate is produced with EDP and valid without signature | Z02 |  |  | It is hereby certified that the material described above complies with the requirements of the order. | Z01 |  |  | A22 | <b>TOOLOX®</b><br>PREHARDENED TOOL STEEL<br>www.toolox.com |
|                                                                                     | Quality Inspection Department/ A Backlund / S Koelkoek            |     |  |  |                                                                                                       |     |  |  |     |                                                            |



Espesor  
6 – 165 mm

**TOOLOX<sup>®</sup>**  
ENGINEERING & TOOL STEEL

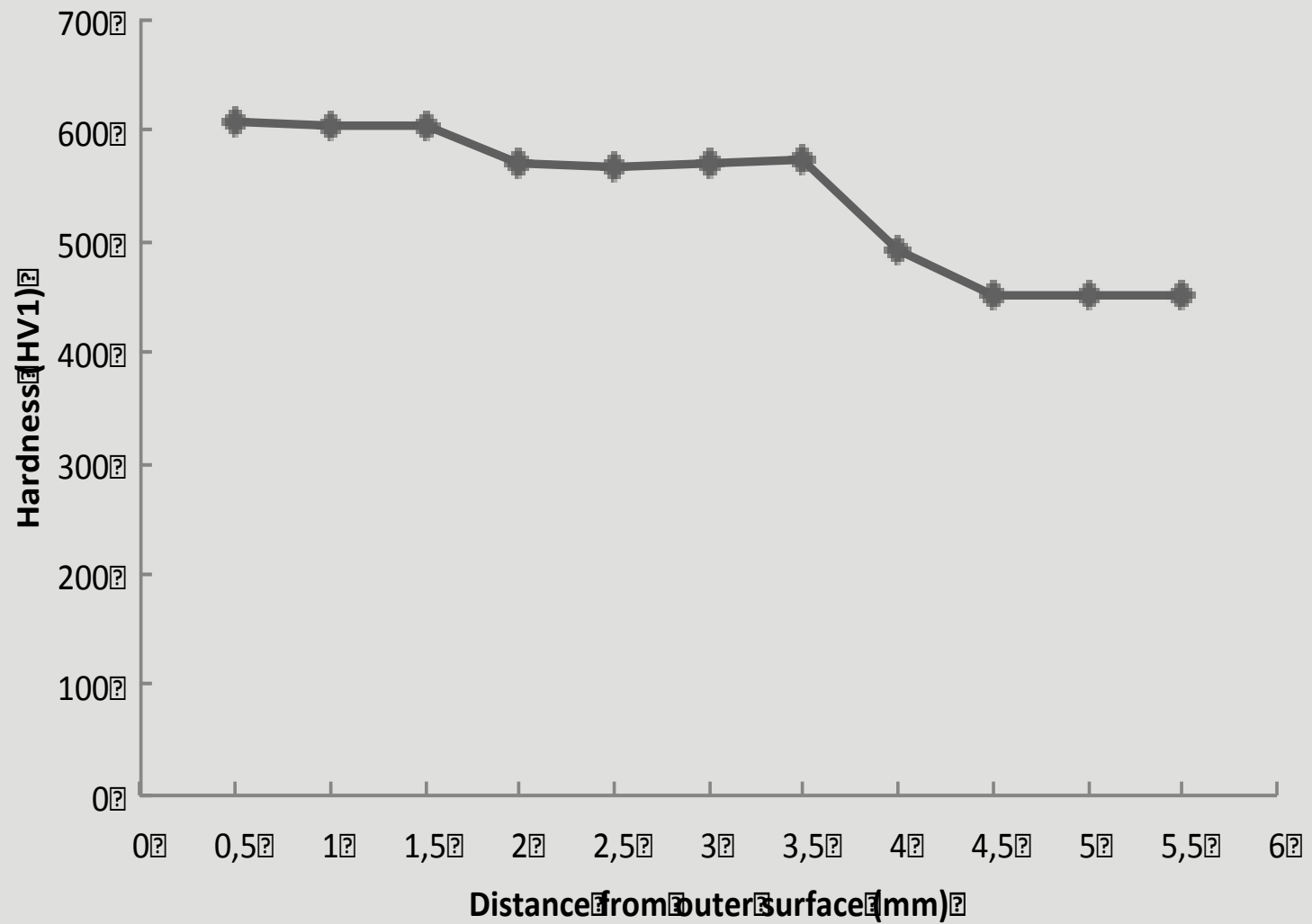


Diametro  
16 – 353 mm

---

**TOOLOX<sup>®</sup>**  
ENGINEERING & TOOL STEEL

|            | Tipo de nitruración              | Temp. (C°) | Tiempo de tratamiento(hrs) | Dureza superficial (HV <sub>1</sub> ) | Espesor de la capa nitrurada (mm) |
|------------|----------------------------------|------------|----------------------------|---------------------------------------|-----------------------------------|
| Toolox® 33 | Nitro-carburizado en baño de sal | 580        | 1.75                       | 790                                   | 0.18                              |
|            | Nitro-carburizado en baño de sal | 580        | 1.5                        | 800                                   | 0.19                              |
|            | Nitro-carburizado con gas        | 580        | 4                          | 780                                   | 0.27                              |
|            | Nitruración con gas              | 520        | 12                         | 760                                   | 0.23                              |
|            | Nitruración con gas              | 520        | 30                         | 720                                   | 0.64                              |
|            | Nitruración con plasma           | 540        | 8                          | 780                                   | 0.55                              |
|            | Nitruración con plasma           | 540        | 12                         | 800                                   | 0.44                              |
|            | Nitruración con plasma           | 540        | 30                         | 810                                   | 0.51                              |
| Toolox® 44 | Nitro-carburizado en baño de sal | 580        | 1.5                        | 820                                   | 0.18                              |
|            | Nitro-carburizado con gas        | 580        | 4                          | 840                                   | 0.27                              |
|            | Nitruración con gas              | 520        | 12                         | 750                                   | 0.19                              |
|            | Nitruración con gas              | 520        | 30                         | 660                                   | 0.55                              |
|            | Nitruración con plasma           | 540        | 8                          | 840                                   | 0.31                              |
|            | Nitruración con plasma           | 540        | 12                         | 880                                   | 0.28                              |
|            | Nitruración con plasma           | 540        | 30                         | 760                                   | 0.41                              |



**Machine** Medium Frequency  
vertical induction machine  
**Frequency** 10 kHz  
**Power** 100 kW

# Beneficios Toolox<sup>®</sup>

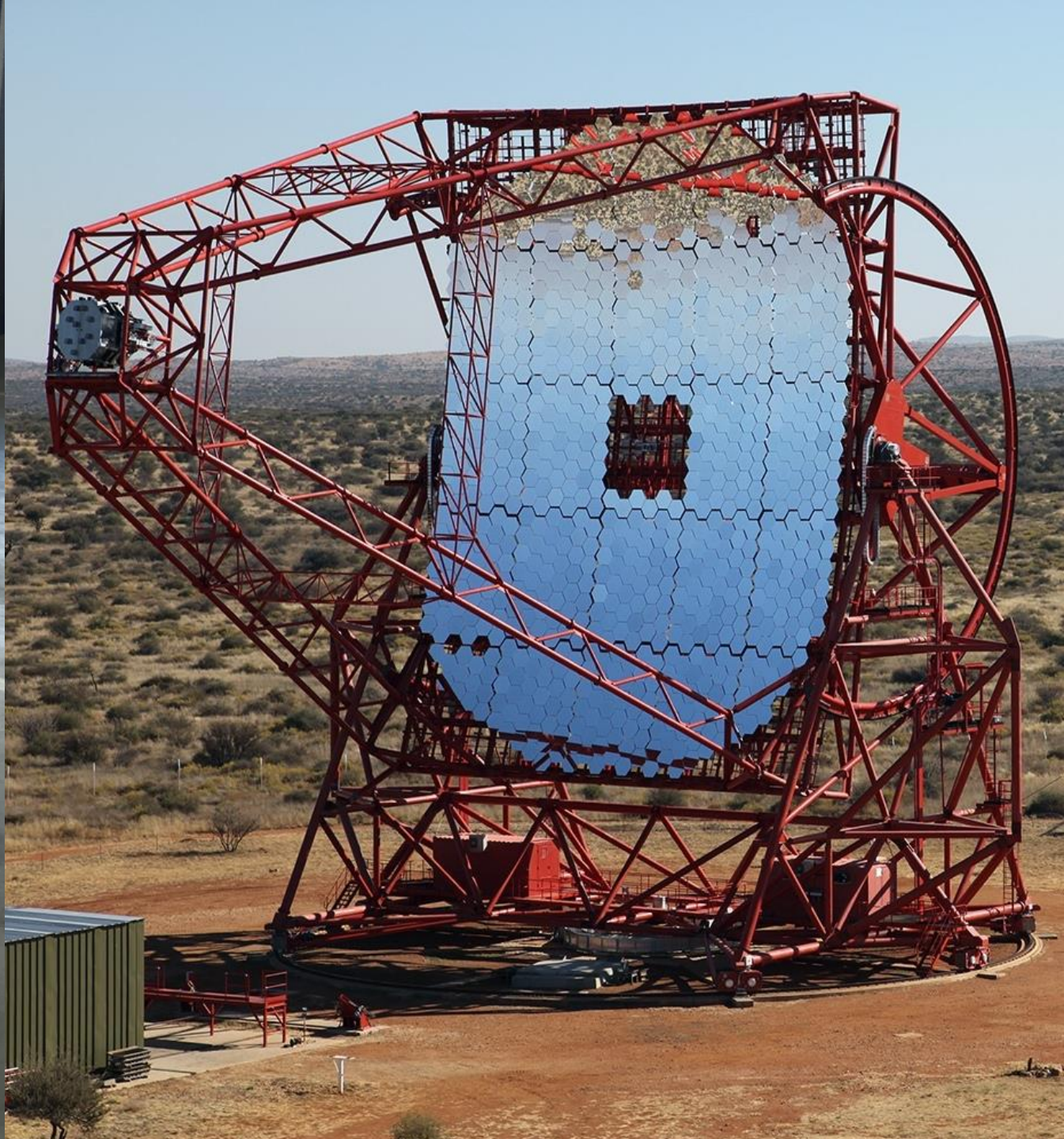
- ▶ Mecanizado excelente a tolerancias muy estrictas
- ▶ Resistencia mecanica alta COMBINADO con resistencia a fisuras y fatiga
- ▶ Limite elastico elevado lo hace posible fabricar cremalleras mas pequeñas
- ▶ Excelente para tratamientos superficiales (laser, induccion, nitruracion etc)
- ▶ Adaptado para oxicorte y soldadura

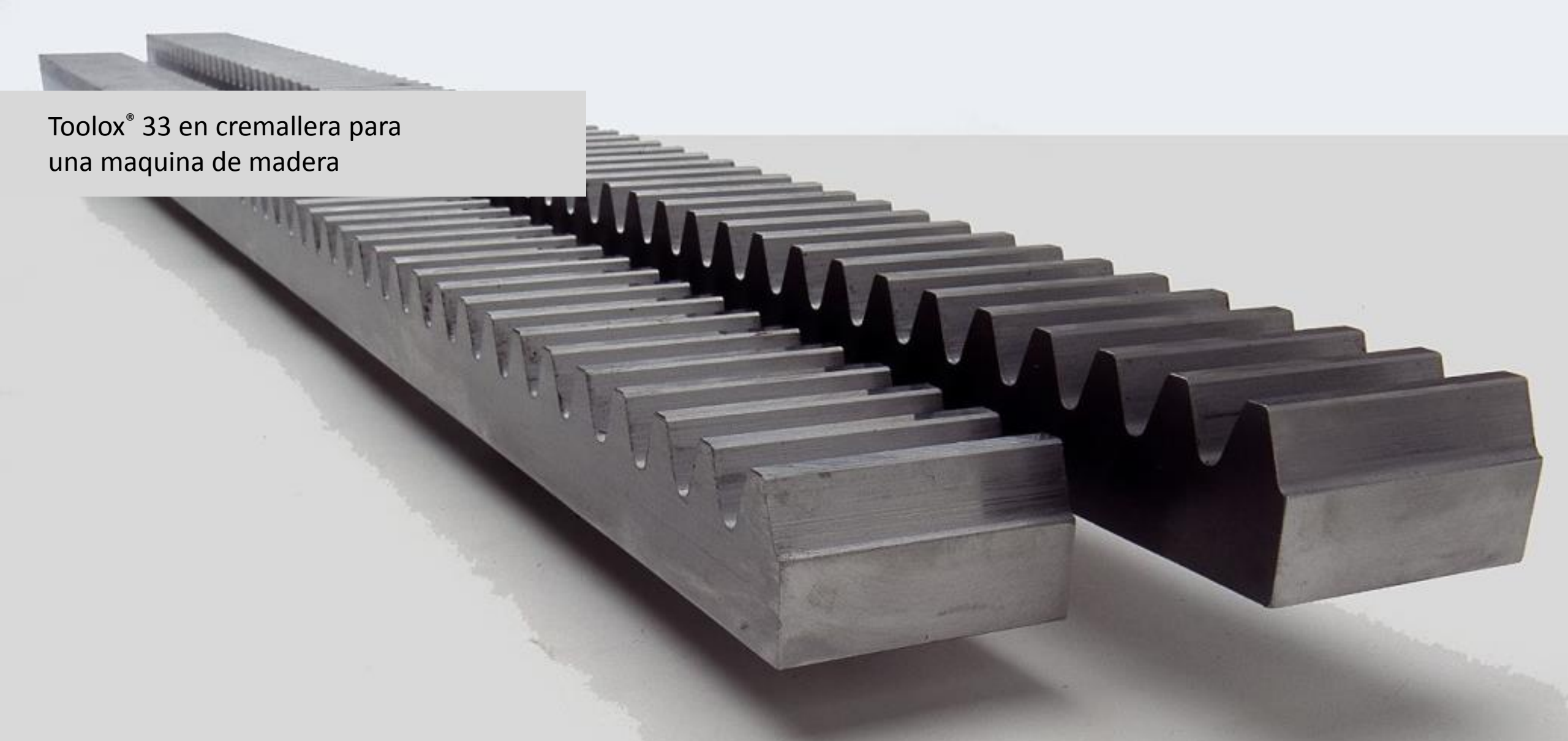
"Empezando con formado plano nos hizo ahorrar mucho tiempo de production. Las cremalleras salieron totalmente rectos; 0.004 mm deflection en lateral y 0.136 mm en longitudinal. Sobre un largo de 1.8 m!"

*Tommy Pettersson, Stena Stål*



Toolox® 33 en cremallera para telescopio





Toolox® 33 en cremallera para  
una maquina de madera

Toolox® 44 en cremallera para  
un puente

**SANDERS**  
Gears | Castings | Machining

**TOOLOX®**  
ENGINEERING & TOOL STEEL



“Somos especialistas en fabricar todo tipo de engranajes y cremalleras. Tolerancias en geometría es fundamental. Los aceros convencionales suele dar problemas durante el mecanizado y endurecimiento. Para conseguir una buena geometría combinado con unas propiedades garantizadas, elegimos Toolox® 44. Nos quedamos muy impresionados con la planitud y estabilidad dimensional. A pesar de la alta dureza, Toolox® 44 se mecanizó excelentemente”

*Olivier Stapper, jefe de producción*

**TOOLOX®**  
ENGINEERING & TOOL STEEL

Toolox® 33 para cremallera de  
elevadora



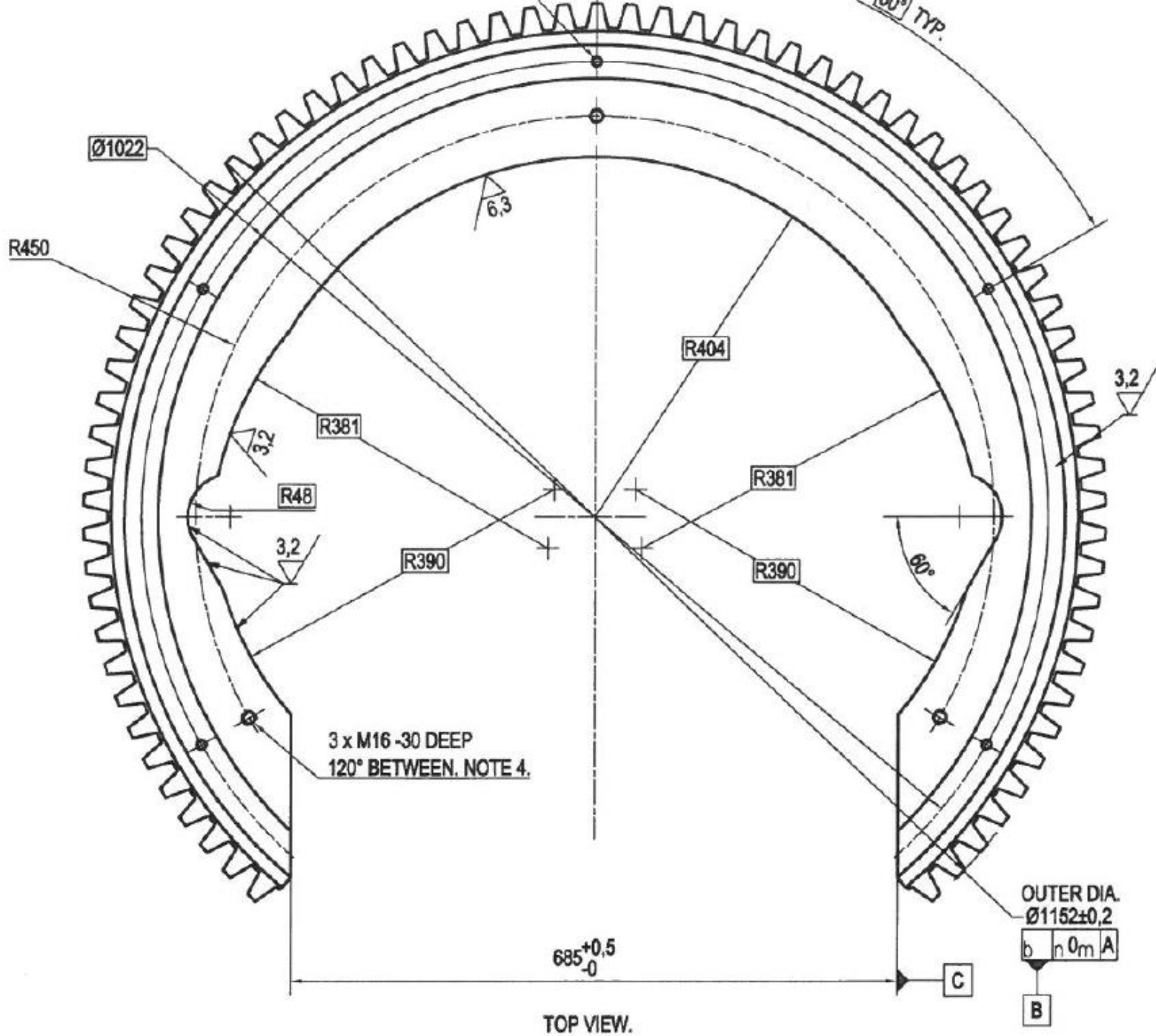
Toolox® 33 para cremallera en fabrica  
de laminado de acero



Segmentos en Toolox® 33 para una  
maquina de reciclaje de llantas de  
goma







Cremallera  
fabricado con  
oxicorte en  
Toolox<sup>®</sup> 33

***TOOLOX***<sup>®</sup>

***ENGINEERING & TOOL STEEL***