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STUDIJA SLUČAJA:

IMPLEMENTACIJA MES RJEŠENJA U TVRTKI IMPOL-TLM

# Impol – ključne informacije

- Sjedište: Slovenska Bistrica, Slovenija
- Neto prihodi u 2019.: 683M Eur
- 5-ti najveći slovenski izvoznik
- Impol-TLM, Šibenik – dio Impol grupe
- Impol-TLM – proizvodnja 100.000 tona god.
- Impol-TM – 450 zaposlenih

# 8 Sigma – ključne informacije

- Osnovali 2015. ABB Global Sales, Global Product i R&D Manager
- Prvi MES u 2004.
- Iskustvo 50+ projekata na raznim kontinentima
- MES software company - razvoj vlastitog proizvoda
- ISO 9001:2015 i ISO 27001:2013 do kraja 2020.

# 8 Sigma klijenti

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# Što je MES?

- **M**anufacturing **E**xecution **S**ystem - softver
- Karika koja (ponekad) nedostaje
- **Planiranje i nadzor kompletne proizvodnje**
- **Povezivanje proizvodnje** (automatizacije) **s poslovnim sustavom (ERP)**
- Prevodi poslovne ciljeve u proizvodne operacije
- **Trenutačne informacije**, trenutačna kontrola i rezultati
- Alat za Industry 4.0 i Smart factory

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MES
software

# Što je 8Sigma MES?

- Vlastiti MES proizvod, razvijan “in-house”
- Baziran na **ANSI/ISA-95** međunarodnom standardu
- Iznimno **konfigurabilan** i fleksibilan
- Primjenjiv **za različite tipove industrija**
- Industry 4.0 i Smart factory

# MES u Impol-TLM - proces

- Kompleks valjačkih stanova – proces obrade aluminija
- 1 x stroj za toplo valjanje,
  2 x stroj za hladno valjanje,
  1 x stroj za valjanje folije
- Od bloka aluminija debljine 0,5 m do aluminjske folije debljine 8 µm

# MES u Impol-TLM – zašto?

**Process in control**
**small variation**

Process in control
but **variation too big**

Process **out of control**

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# MES u Impol-TLM – zašto?

- Trenutačni pristup informacijama
- Analize zastoja
- Povećanje brzine
- Lakše održavanje
- Smanjenje troškova

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# MES u Impol-TLM – kako?

- Prikupljanje podataka direktno sa strojeva
- Povezivanje s različitim sustavima automatizacije (ABB, Siemens, SMS)
- Brzine komunikacije i do 500 ms
- Spremanje i analiza velike količine podataka
- Klijent uključen u dizajn

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# MES u Impol-TLM – rezultati

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# MES u Impol-TLM – rezultati

8SIGMA MES impol Aluminium Industry — Online — Sep 29, 2020, 3:54:57 PM — administrator

1 of 2 — 100% — Find | Next

| Seq In Shift | Material Sublot Id | Coil report | Pass report | Segment Response Oid | Eqpt OID | No | V24Profile Class | V24Wedge Class | V24Class | Alloy Code | Pass No | Double Pass | Speed Average (m/min) | Speed Max (m/min) | Tension Average (N/mm2) | Tension Min (N/mm2) | Force Per Width (kN/m) | Force Average (kN) | Force Max (kN) | Width | Width (mm) | Target Width (mm) | Reduction (%) | L1Entry Thickness | L1Entry Thickness (um) | L1Exit Thickness (um) | Exit Thickness Average | Exit Thickness Average (um) | Exit Thickness2Sigma (um) | Thickness Tolerance (%) | Thickness In05P-d (%) | Thickness In10P-d (%) | Thickness In2P-d (%) | Thickness In5P-d (%) | Thickness In Tolerance | Thickness In Tolerance (%) | Mill Power Average (kW) | Mill Power Max (kW) | Exit Tension Average (N/mm2) | Coolant Temperature Average (°C) | Coolant Pressure Average (bar) | Start Date | Start Time | End Date | End Time | Month (start) | Year (start) | Operator |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 4 | 29849 | COIL | PASS | 231782 | 1 | 4 | 1 | A | 1A | AF40 | 1 | False | 111 | 120 | 13,2 | 0,20 | 9.101 | 13.368 | 18.619 | | 1.469 | 1.470 | 99% | | 515.000 | 5.000,0 | | 5.002,4 | 46,1 | 1,25 | 93 | 96 | 98 | 100 | ✓ | 96,0 | 0 | 0 | 12,2 | 54 | 20,8 | 28.09.2020 | 6:50:47 | 28.09.2020 | 7:07:45 | rujan | 2020 | BabicNe BulatMari |
| 5 | 29848 | COIL | PASS | 231785 | 1 | 5 | 1 | A | 1A | AF40 | 1 | False | 111 | 120 | 13,1 | 0,20 | 9.343 | 13.725 | 18.849 | | 1.469 | 1.470 | 99% | | 515.000 | 5.000,0 | | 5.007,3 | 63,4 | 1,25 | 90 | 93 | 97 | 100 | ✓ | 93,9 | 0 | 0 | 12,2 | 54 | 20,8 | 28.09.2020 | 7:09:08 | 28.09.2020 | 7:26:37 | rujan | 2020 | BabicNe BulatMari |
| 6 | 30022 | COIL | PASS | 231788 | 1 | 6 | 1 | A | 1A | AF40 | 1 | False | 111 | 120 | 13,2 | 0,20 | 9.757 | 14.332 | 19.403 | | 1.469 | 1.470 | 99% | | 515.000 | 5.000,0 | | 5.008,7 | 64,1 | 1,25 | 92 | 95 | 97 | 100 | ✓ | 94,9 | 0 | 0 | 12,3 | 55 | 20,8 | 28.09.2020 | 7:29:25 | 28.09.2020 | 7:46:36 | rujan | 2020 | BabicNe BulatMari |
| 7 | 30021 | COIL | PASS | 231790 | 1 | 7 | 1 | A | 1A | AF40 | 1 | False | 111 | 120 | 13,2 | 0,20 | 9.844 | 14.459 | 19.567 | | 1.469 | 1.470 | 99% | | 515.000 | 5.000,0 | | 5.009,5 | 68,9 | 1,25 | 93 | 95 | 96 | 100 | ✓ | 94,9 | 0 | 0 | 12,3 | 55 | 20,8 | 28.09.2020 | 7:47:57 | 28.09.2020 | 8:05:16 | rujan | 2020 | BabicNe BulatMari |
| 8 | 29931 | COIL | PASS | 231792 | 1 | 8 | 1 | A | 1A | AF40 | 1 | False | 111 | 121 | 13,1 | 0,20 | 9.771 | 14.352 | 19.051 | | 1.469 | 1.470 | 99% | | 515.000 | 5.000,0 | | 5.011,0 | 76,9 | 1,25 | 91 | 95 | 95 | 99 | ✓ | 94,9 | 0 | 0 | 12,2 | 55 | 20,8 | 28.09.2020 | 8:07:18 | 28.09.2020 | 8:24:28 | rujan | 2020 | BabicNe BulatMari |
| 9 | 29759 | COIL | PASS | 231795 | 1 | 9 | 1 | A | 1A | AF40 | 1 | False | 111 | 120 | 13,2 | 0,20 | 9.645 | 14.166 | 18.892 | | 1.469 | 1.470 | 99% | | 515.000 | 5.000,0 | | 5.008,4 | 64,9 | 1,25 | 92 | 94 | 98 | 100 | ✓ | 94,9 | 0 | 0 | 12,3 | 55 | 20,8 | 28.09.2020 | 8:25:49 | 28.09.2020 | 8:42:55 | rujan | 2020 | BabicNe BulatMari |
| 10 | 30046 | COIL | PASS | 231798 | 1 | 10 | 1 | A | 1A | AF40 | 1 | False | 111 | 120 | 13,2 | 0,20 | 9.727 | 14.290 | 18.991 | | 1.469 | 1.470 | 99% | | 515.000 | 5.000,0 | | 5.009,1 | 65,5 | 1,25 | 91 | 94 | 97 | 100 | ✓ | 94,9 | 0 | 0 | 12,2 | 54 | 20,8 | 28.09.2020 | 8:44:20 | 28.09.2020 | 9:01:37 | rujan | 2020 | BabicNe BulatMari |
| 11 | 30191 | COIL | PASS | 231800 | 1 | 11 | 1 | A | 1A | AF40 | 1 | False | 111 | 120 | 13,1 | 0,20 | 9.734 | 14.299 | 19.255 | | 1.469 | 1.470 | 99% | | 515.000 | 5.000,0 | | 5.010,8 | 77,8 | 1,25 | 91 | 95 | 95 | 100 | ✓ | 94,9 | 0 | 0 | 12,2 | 54 | 20,8 | 28.09.2020 | 9:02:58 | 28.09.2020 | 9:20:13 | rujan | 2020 | BabicNe BulatMari |
| 12 | 30045 | COIL | PASS | 231802 | 1 | 12 | 1 | A | 1A | AF40 | 1 | False | 111 | 120 | 13,2 | 0,20 | 9.614 | 14.122 | 18.501 | | 1.469 | 1.470 | 99% | | 515.000 | 5.000,0 | | 5.010,0 | 78,5 | 1,25 | 90 | 93 | 95 | 100 | ✓ | 94,9 | 0 | 0 | 12,2 | 54 | 20,8 | 28.09.2020 | 9:22:18 | 28.09.2020 | 9:39:58 | rujan | 2020 | BabicNe BulatMari |
| 13 | 29591 | COIL | PASS | 231804 | 1 | 13 | 1 | A | 1A | AF40 | 1 | False | 111 | 120 | 13,2 | 0,20 | 9.736 | 14.302 | 18.921 | | 1.469 | 1.470 | 99% | | 515.000 | 5.000,0 | | 5.008,1 | 67,3 | 1,25 | 92 | 95 | 97 | 100 | ✓ | 94,9 | 0 | 0 | 12,2 | 54 | 20,8 | 28.09.2020 | 9:41:21 | 28.09.2020 | 9:58:32 | rujan | 2020 | BabicNe BulatMari |
| 14 | 29590 | COIL | PASS | 231806 | 1 | 14 | 1 | A | 1A | AF40 | 1 | False | 111 | 120 | 13,2 | 0,20 | 9.867 | 14.497 | 19.586 | | 1.469 | 1.470 | 99% | | 515.000 | 5.000,0 | | 5.009,2 | 74,4 | 1,25 | 89 | 93 | 96 | 100 | ✓ | 94,8 | 0 | 0 | 12,2 | 54 | 20,8 | 28.09.2020 | 9:59:53 | 28.09.2020 | 10:18:08 | rujan | 2020 | BabicNe BabicNe |
| 15 | 30192 | COIL | PASS | 231808 | 1 | 15 | 1 | B | 1B | AF40 | 1 | False | 111 | 120 | 13,2 | 0,20 | 9.801 | 14.399 | 19.053 | | 1.469 | 1.470 | 99% | | 515.000 | 5.000,0 | | 5.012,9 | 96,6 | 1,25 | 91 | 94 | 95 | 99 | ✓ | 94,9 | 0 | 0 | 12,2 | 54 | 20,8 | 28.09.2020 | 10:19:31 | 28.09.2020 | 10:37:36 | rujan | 2020 | BabicNe BabicNe |
| 16 | 30047 | COIL | PASS | 231810 | 1 | 16 | 1 | B | 1B | AF40 | 1 | False | 111 | 120 | 13,2 | 0,20 | 9.938 | 14.600 | 19.442 | | 1.469 | 1.470 | 99% | | 515.000 | 5.000,0 | | 5.009,0 | 87,5 | 1,25 | 89 | 93 | 95 | 99 | ✓ | 93,9 | 0 | 0 | 12,2 | 54 | 20,8 | 28.09.2020 | 10:40:54 | 28.09.2020 | 10:58:54 | rujan | 2020 | BabicNe BabicNe |
| 17 | 29760 | COIL | PASS | 231812 | 1 | 17 | 1 | A | 1A | AF40 | 1 | False | 111 | 120 | 13,1 | 0,20 | 9.823 | 14.433 | 19.260 | | 1.469 | 1.470 | 99% | | 515.000 | 5.000,0 | | 5.010,0 | 77,5 | 1,25 | 90 | 94 | 95 | 99 | ✓ | 94,9 | 0 | 0 | 12,2 | 53 | 20,8 | 28.09.2020 | 11:01:36 | 28.09.2020 | 11:18:53 | rujan | 2020 | BabicNe Mijalic |
| 18 | 29614 | COIL | PASS | 231814 | 1 | 18 | 1 | A | 1A | AF40 | 1 | False | 111 | 120 | 13,1 | 0,20 | 9.814 | 14.417 | 19.366 | | 1.469 | 1.470 | 99% | | 515.000 | 5.000,0 | | 5.008,8 | 66,8 | 1,25 | 91 | 94 | 96 | 100 | ✓ | 94,9 | 0 | 0 | 12,2 | 53 | 20,8 | 28.09.2020 | 11:20:30 | 28.09.2020 | 11:37:54 | rujan | 2020 | BabicNe Mijalic |
| 19 | 29613 | COIL | PASS | 231817 | 1 | 19 | 1 | A | 1A | AF40 | 1 | False | 111 | 120 | 13,2 | 0,20 | 9.975 | 14.650 | 19.363 | | 1.469 | 1.470 | 99% | | 515.000 | 5.000,0 | | 5.004,7 | 69,0 | 1,25 | 91 | 93 | 97 | 100 | ✓ | 93,9 | 0 | 0 | 12,2 | 54 | 20,8 | 28.09.2020 | 12:53:02 | 28.09.2020 | 13:13:25 | rujan | 2020 | BabicNe Mijalic |
| 20 | 30811 | COIL | PASS | 231819 | 1 | 20 | 2 | A | 2A | AF40 | 1 | False | 111 | 120 | 13,3 | 0,20 | 9.765 | 13.403 | 17.937 | | 1.373 | 1.370 | 99% | | 515.000 | 5.000,0 | | 5.005,8 | 60,2 | 1,25 | 91 | 93 | 97 | 100 | ✓ | 93,9 | 0 | 0 | 12,3 | 54 | 20,8 | 28.09.2020 | 13:15:05 | 28.09.2020 | 13:32:36 | rujan | 2020 | BabicNe Mijalic |
| 21 | 30810 | COIL | PASS | 231821 | 1 | 21 | 1 | A | 1A | AF40 | 1 | False | 111 | 120 | 13,2 | 0,20 | 9.895 | 13.583 | 17.988 | | 1.373 | 1.370 | 99% | | 515.000 | 5.000,0 | | 5.008,0 | 72,7 | 1,25 | 89 | 94 | 96 | 100 | ✓ | 94,9 | 0 | 0 | 12,3 | 54 | 20,8 | 28.09.2020 | 13:33:59 | 28.09.2020 | 13:51:25 | rujan | 2020 | BabicNe Mijalic |
| 1 | 30809 | COIL | PASS | 231823 | 1 | 1 | 1 | A | 1A | AF40 | 1 | False | | | | | | | | | 1.374 | 1.370 | 99% | | 515.000 | 5.000,0 | | | | 1,25 | | | | | | | | | | | | 28.09.2020 | 13:53:41 | 28.09.2020 | 14:06:20 | rujan | 2020 | JuricAnte. |
| 2 | 30812 | COIL | PASS | 231824 | 1 | 2 | 1 | A | 1A | AF40 | 1 | False | 111 | 120 | 13,3 | 0,20 | 6.653 | 9.134 | 16.437 | | 1.373 | 1.370 | 99% | | 515.000 | 5.000,0 | | 5.000,4 | 36,8 | 1,25 | 92 | 96 | 99 | 100 | ✓ | 98,0 | 0 | 0 | 12,3 | 55 | 20,8 | 28.09.2020 | 14:17:50 | 28.09.2020 | 14:36:42 | rujan | 2020 | JuricAnte. |
| 3 | 30056 | COIL | PASS | 231826 | 1 | 3 | 1 | B | 1B | TF43 | 1 | False | 123 | 138 | 11,3 | 0,17 | 8.534 | 11.264 | 15.851 | | 1.320 | 1.320 | 99% | | 430.000 | 6.000,0 | | 6.021,0 | 136,1 | 1,25 | 88 | 90 | 93 | 100 | ✓ | 91,3 | 0 | 0 | 11,1 | 55 | 20,8 | 28.09.2020 | 14:40:06 | 28.09.2020 | 14:57:25 | rujan | 2020 | JuricAnte. |
| 4 | 30058 | COIL | PASS | 231827 | 1 | 4 | 1 | A | 1A | TF43 | 1 | False | 123 | 138 | 11,3 | 0,17 | 8.443 | 11.144 | 15.736 | | 1.320 | 1.320 | 99% | | 430.000 | 6.000,0 | | 6.022,0 | 133,5 | 1,25 | 86 | 91 | 93 | 99 | ✓ | 91,3 | 0 | 0 | 11,1 | 54 | 20,8 | 28.09.2020 | 14:59:14 | 28.09.2020 | 15:15:45 | rujan | 2020 | JuricAnte. |



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# MES u Impol-TLM – rezultati

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1 of 3 100% Find | Next

| Start Time | Total coils | Total coils | In Run Mode (min) | In Run Mode | In Stop Mode | In Stop Mode (min) | Total Weight (t) | Total Length (km) | Average Thickness | Average Thickness (µm) | Average Width | Average Width (mm) | Efficiency (%) | Rolled Surface (km2) | Rolled Volume (km3) | In Stop Mode/Number of coils | In Stop Mode/Number of coils (min/coils) |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 31.07. | | 50 | 887 | | | 553 | 406 | 18 | | 5.912 | | 1.188 | 61,6% | 0,021 | 0,000127 | | 11,1 |
| 01.08. | | 40 | 705 | | | 735 | 279 | 15 | | 6.025 | | 1.052 | 49,0% | 0,016 | 0,000096 | | 18,4 |
| 02.08. | | 37 | 753 | | | 687 | 334 | 17 | | 5.388 | | 1.338 | 52,3% | 0,022 | 0,000120 | | 18,6 |
| 03.08. | | 32 | 593 | | | 847 | 249 | 13 | | 5.812 | | 1.203 | 41,2% | 0,015 | 0,000090 | | 26,5 |
| 04.08. | | 26 | 485 | | | 955 | 211 | 11 | | 5.567 | | 1.257 | 33,7% | 0,013 | 0,000075 | | 36,7 |
| 05.08. | | 59 | 892 | | | 548 | 507 | 23 | | 6.282 | | 1.298 | 62,0% | 0,029 | 0,000184 | | 9,3 |
| 06.08. | | 38 | 666 | | | 774 | 354 | 17 | | 5.158 | | 1.425 | 46,3% | 0,024 | 0,000124 | | 20,4 |
| 07.08. | | 56 | 964 | | | 476 | 479 | 21 | | 6.388 | | 1.252 | 66,9% | 0,026 | 0,000166 | | 8,5 |
| 08.08. | | 52 | 1.004 | | | 436 | 460 | 20 | | 6.110 | | 1.328 | 69,8% | 0,026 | 0,000161 | | 8,4 |
| 09.08. | | 40 | 665 | | | 775 | 353 | 17 | | 5.502 | | 1.300 | 46,2% | 0,022 | 0,000123 | | 19,4 |
| 10.08. | | 42 | 616 | | | 824 | 336 | 15 | | 6.364 | | 1.166 | 42,8% | 0,018 | 0,000114 | | 19,6 |
| 11.08. | | 47 | 639 | | | 801 | 386 | 19 | | 5.509 | | 1.273 | 44,3% | 0,024 | 0,000130 | | 17,1 |
| 12.08. | | 30 | 503 | | | 937 | 222 | 13 | | 5.588 | | 1.075 | 34,9% | 0,014 | 0,000076 | | 31,2 |
| 13.08. | | 46 | 891 | | | 549 | 428 | 18 | | 5.567 | | 1.453 | 61,8% | 0,026 | 0,000147 | | 11,9 |
| 14.08. | | 34 | 641 | | | 799 | 225 | 15 | | 5.313 | | 1.042 | 44,5% | 0,015 | 0,000081 | | 23,5 |
| 15.08. | | 0 | 0 | | | 1.440 | 0 | 0 | | 0 | | 0 | 0,0% | 0,000 | 0,000000 | | ∞ |
| 16.08. | | 47 | 846 | | | 594 | 443 | 20 | | 5.384 | | 1.440 | 58,7% | 0,029 | 0,000155 | | 12,6 |
| 17.08. | | 58 | 997 | | | 443 | 526 | 24 | | 5.858 | | 1.293 | 69,2% | 0,031 | 0,000184 | | 7,6 |
| 18.08. | | 37 | 571 | | | 869 | 265 | 13 | | 6.377 | | 1.117 | 39,7% | 0,015 | 0,000094 | | 23,5 |
| 19.08. | | 46 | 825 | | | 615 | 337 | 19 | | 5.565 | | 1.126 | 57,3% | 0,021 | 0,000117 | | 13,4 |
| 20.08. | | 49 | 893 | | | 547 | 416 | 18 | | 6.465 | | 1.332 | 62,0% | 0,024 | 0,000152 | | 11,2 |
| 21.08. | | 0 | 0 | | | 1.440 | 0 | 0 | | 0 | | 0 | 0,0% | 0,000 | 0,000000 | | ∞ |
| 22.08. | | 10 | 215 | | | 1.225 | 110 | 4 | | 5.000 | | 1.603 | 15,0% | 0,007 | 0,000035 | | 122,5 |
| 23.08. | | 49 | 933 | | | 507 | 423 | 22 | | 5.140 | | 1.287 | 64,8% | 0,029 | 0,000148 | | 10,4 |
| 24.08. | | 21 | 373 | | | 1.067 | 163 | 10 | | 5.011 | | 1.079 | 25,9% | 0,011 | 0,000055 | | 50,8 |
| 25.08. | | 0 | 0 | | | 1.440 | 0 | 0 | | 0 | | 0 | 0,0% | 0,000 | 0,000000 | | ∞ |
| 26.08. | | 16 | 78 | | | 1.362 | 115 | 7 | | 5.006 | | 1.095 | 5,4% | 0,008 | 0,000038 | | 85,1 |
| 27.08. | | 48 | 726 | | | 714 | 322 | 20 | | 5.311 | | 1.012 | 50,4% | 0,020 | 0,000107 | | 14,9 |
| 28.08. | | 56 | 869 | | | 571 | 424 | 23 | | 5.233 | | 1.220 | 60,4% | 0,029 | 0,000150 | | 10,2 |
| 29.08. | | 52 | 887 | | | 553 | 497 | 23 | | 5.497 | | 1.402 | 61,6% | 0,033 | 0,000179 | | 10,6 |
| 30.08. | | 60 | 921 | | | 519 | 486 | 20 | | 6.816 | | 1.273 | 64,0% | 0,025 | 0,000173 | | 8,6 |
| 31.08. | | 46 | 781 | | | 659 | 303 | 17 | | 5.829 | | 1.069 | 54,2% | 0,018 | 0,000103 | | 14,3 |
| | | SUM | SUM | | | SUM | SUM | SUM | | WEIGHTED AVG | | WEIGHTED AVG | AVG | SUM | SUM | | WEIGHTED AVG |
| TOTALS | | 1.224 | 20.819 | | | 25.261 | 10.059 | 490 | | 5.729,8 | | 1.246,4 | 45,2% | 0,611 | 0,003502 | | 20,6 |



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# MES u Impol-TLM – rezultati

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# MES u Impol-TLM – rezultati

*“8Sigma nam je omogućila alat s kojim imamo pristup svim ključnim parametrima i rezultatima postignutima u svim fazama proizvodnje te priliku za poboljšanje kvalitete i rast produktivnosti”.*

***Šime Bukić***
*Rukovoditelj proizvodnje*
*Impol-TLM d.o.o.*

# Pitanja?

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