

# **Integrated fully automated forming line for the production of Thermal Interface Materials (TIM)**

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# Thermal Interface Materials (TIM)

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- TIM are polymers that are very good thermal *conductors*, and at the same time they have very good electrical *insulation* properties.
- It is used primarily in the electronic industry to remove excess heat from electronic components, while keeping them electrically insulated.

# Thermal Interface Materials (TIM)

*(cont.)*

- As electronic components are getting smaller, it becomes more and more important to ensure that the excess heat that is generated during their operation, is removed, in order to ensure proper operation and to maximize their life.
- The heat removal rates have to be precise.

# Thermal Interface Materials (TIM)

*(cont.)*

- The chemical properties and the thickness of the TIM have to be tightly controlled in order to ensure the heat removal rates, during The operation of the various electronic components.
- TIM are found in cell phones, laptop and desktop computers and in many other electronic devices.

# Thermal Interface Materials (TIM)

*(cont.)*



Thermal pad between the component and the heat sink

# Thermal Interface Materials (TIM)

*(cont.)*

## Manufacturing of TIM

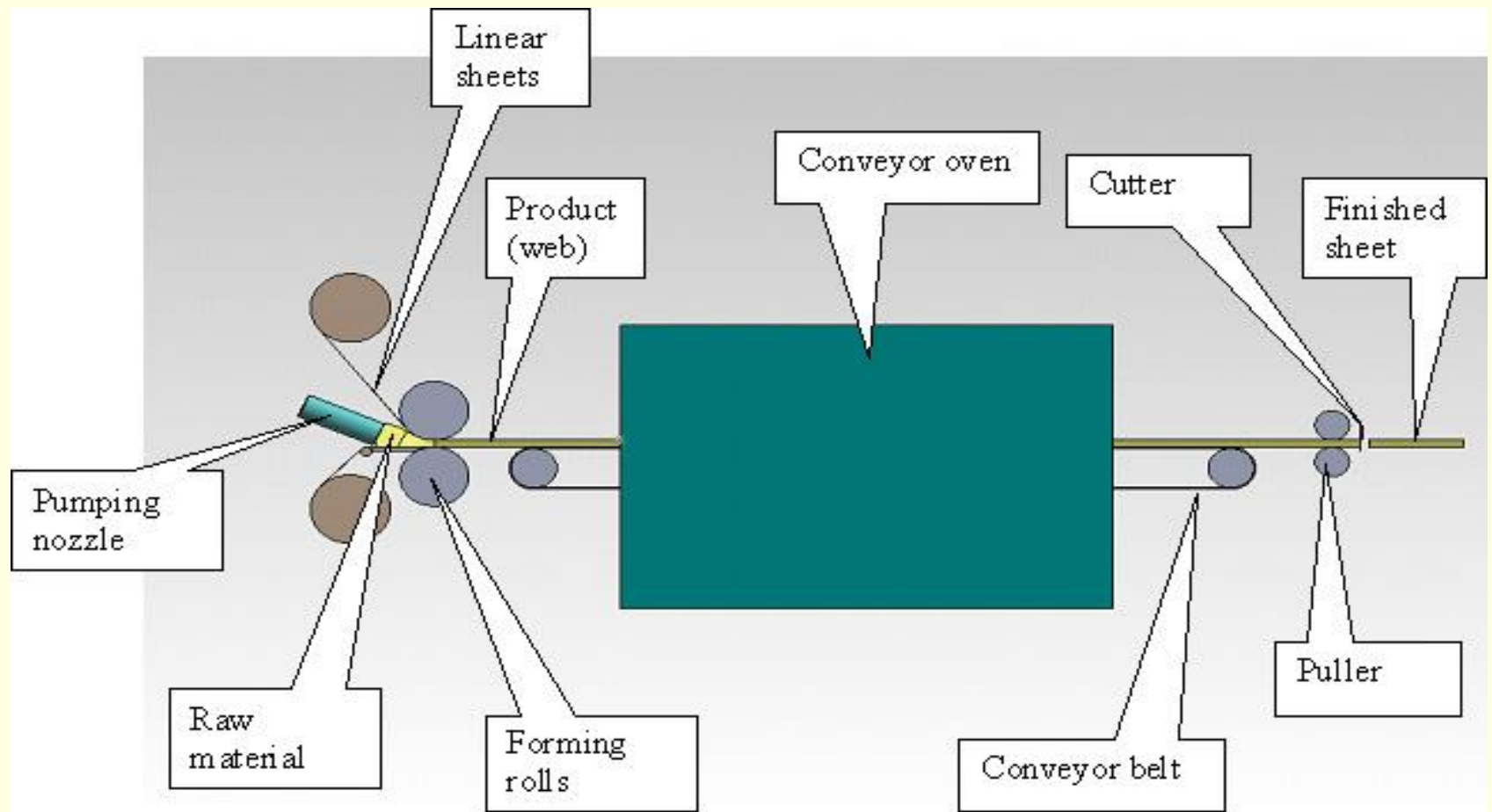
- By Compression Molding where mix is placed in a mold and cured under heat and compression. Only few pads can be produced at the time. This results in low production rates.
- By roll forming where a long web is produced in a short amount of time. The final pads are “die cut”. This process yields very high production rates.

# **Automated Forming line for the production of TIM Web and Sheets**

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- Web is formed in roll former machine.
- Web enters curing oven.
- Web exit oven and enters sheeter.
- Sheet is cut to desired length off the Web.

# Forming line for the production of TIM Web and Sheets (cont.)



**OVERALL VIEW OF FORMING LINE**



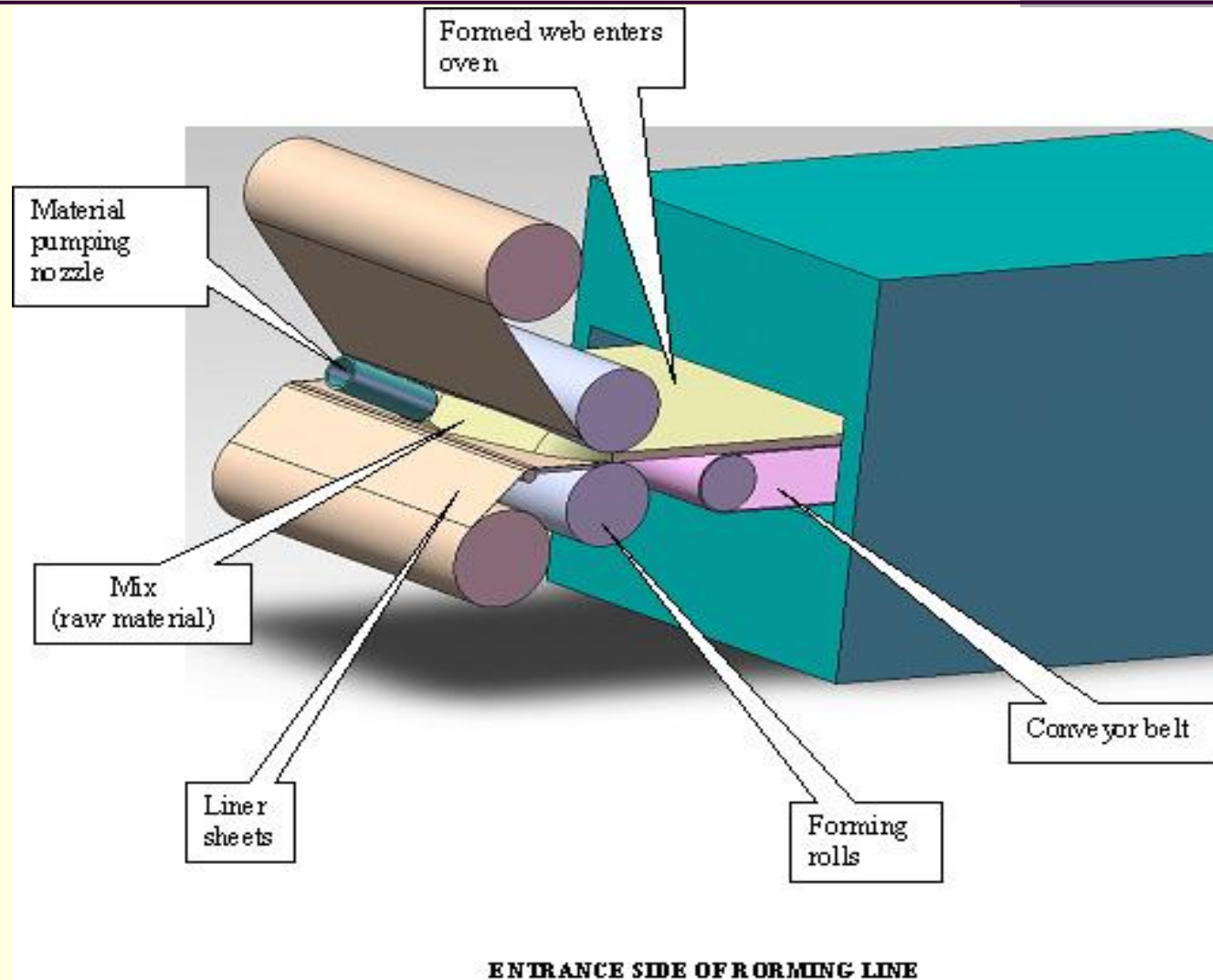
# Forming line for the production of TIM Web and Sheets (cont.)

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## FORMER

- Mix is placed between 2 forming rolls (which are chromed polished and ground), to form a web.
- Desired thickness is achieved by controlling the gap between the forming rolls (using servo motors).
- Laser sensors are used for feed back web thickness control (thickness correction).
- Web enters oven.

# Forming line for the production of TIM Web and Sheets (cont.)



# Forming line for the production of TIM Web and Sheets (cont.)

## FORMER



- Precision hardened chromed ground and polished rollers.
- Servo motors for precision gap setting.
- Gap setting by entering the desired values into the touch screen.
- Gap tolerance <10%.
- Real time close loop gap feedback control using laser sensors (optional).
- AC variable speed for precision line-speed control.
- High line-speed.
- Air shafts for liners with magnetic brakes for liner tension control.
- Analog output for control of mix pumping system (optional).
- Touch screen control.
- Web width customized to your needs.

# Forming line for the production of TIM Web and Sheets (cont.)

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## Oven

- The heat is generated by large platens with embedded electrical heaters.
- A thin conveyor belt, which is carrying the product (web), is moving across the platens and transfer the heat directly to the product.
- No need to heat the ambient air, thus this results in lower electrical consumption.
- A PID control is used to tightly control the temperatures.

# Forming line for the production of TIM Web and Sheets (cont.)

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- Temperature variations are very small.
- Desired temperatures can be reached in a very short amount of time.

# Forming line for the production of TIM Web and Sheets (cont.)

## oven



- **NARROW TEMPERATURE VARIATIONS FROM SET POINT.**
- *PRECISION **PID** CONTROL.*
- ***SET POINT ENTRANCE THROUGH TOUCH SCREEN***
- **REAL TIME DISPLAY OF ACTUAL TEMPERATURES FOR EACH ZONE** (on touch screen).
- *DIRECT HEAT STRANSFER FROM PLATTENS TO MATERIAL.*
- **CONSUMES LESS ENERGY.**
- *NO NEED TO HEAT AMBIENT AIR.*
- **SHORT TIME TO SET POINT VALUES.**
- *VAIRALBE SPEED FOR CONVEYOR BELT.*

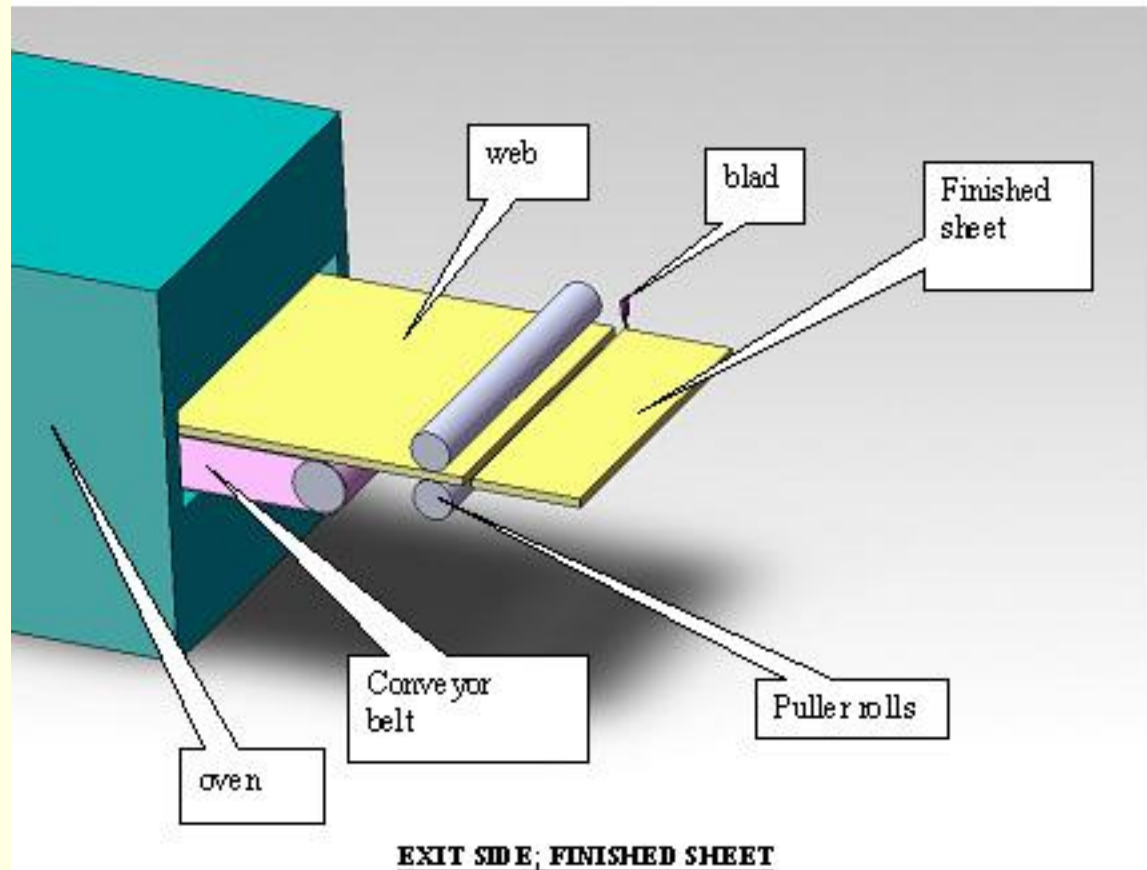
# Forming line for the production of TIM Web and Sheets (cont.)

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## SHEETER

- Web exits oven and enters sheeter, while pulled in by the sheeter's pinch rolls.
- When end of web is seen by the sensor, which is adjustable (for the sheet's desired length), the cutter assembly is cycled across the web. The direction of the cutter alternate from one cutting cycle to the other.
- The pinch rolls vertical position is adjustable following the material thickness.

# Forming line for the production of TIM Web and Sheets (cont.)





# Forming line for the production of TIM Web and Sheets (cont.)

## SHEETER



- **HIGH LINE-SPEED - DIRECT ENTERED INTO TOUCH SCREEN.**
- **HIGH CUTTING-SPEED.**
- **CUTTER ASSEMBLY TRAVELS WITH WEB AT SAME SPEED TO ENSURE SQUARE CUT WHILE CUTTING ACCROSS.**
- **TOUCH SCREEN CONTROL.**
- **SERVO DRIVE FOR CUTTER.**
- **STEPPER DRIVE FOR TRAVELING CUTTER ASSEMBLY.**
- **PRECISION LINEAR BEARING SLIDES FOR PINCH ROLL GAP SETTING.**
- **PRECISION DIGITAL READOUT FOR PINCH ROLL GAP SETTING.**
- **AUTOMATED SLITTER ASSEMBLY TO TRIM WEB TO FINAL WIDTH.**
- **WEB ENTERS DIRECTLY FROM OVEN.**

# Forming line for the production of TIM Web and Sheets (cont.)

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## CONTROL

- All machines are inner-connected via Ethernet cables.
- A large HMI (master) is controlling the entire system.
- There is another smaller, local, HMI unit on the sheeter, which also reports to the main master HMI.
- Each machine is equipped with its own PLC, but they all report to the main one on the former