

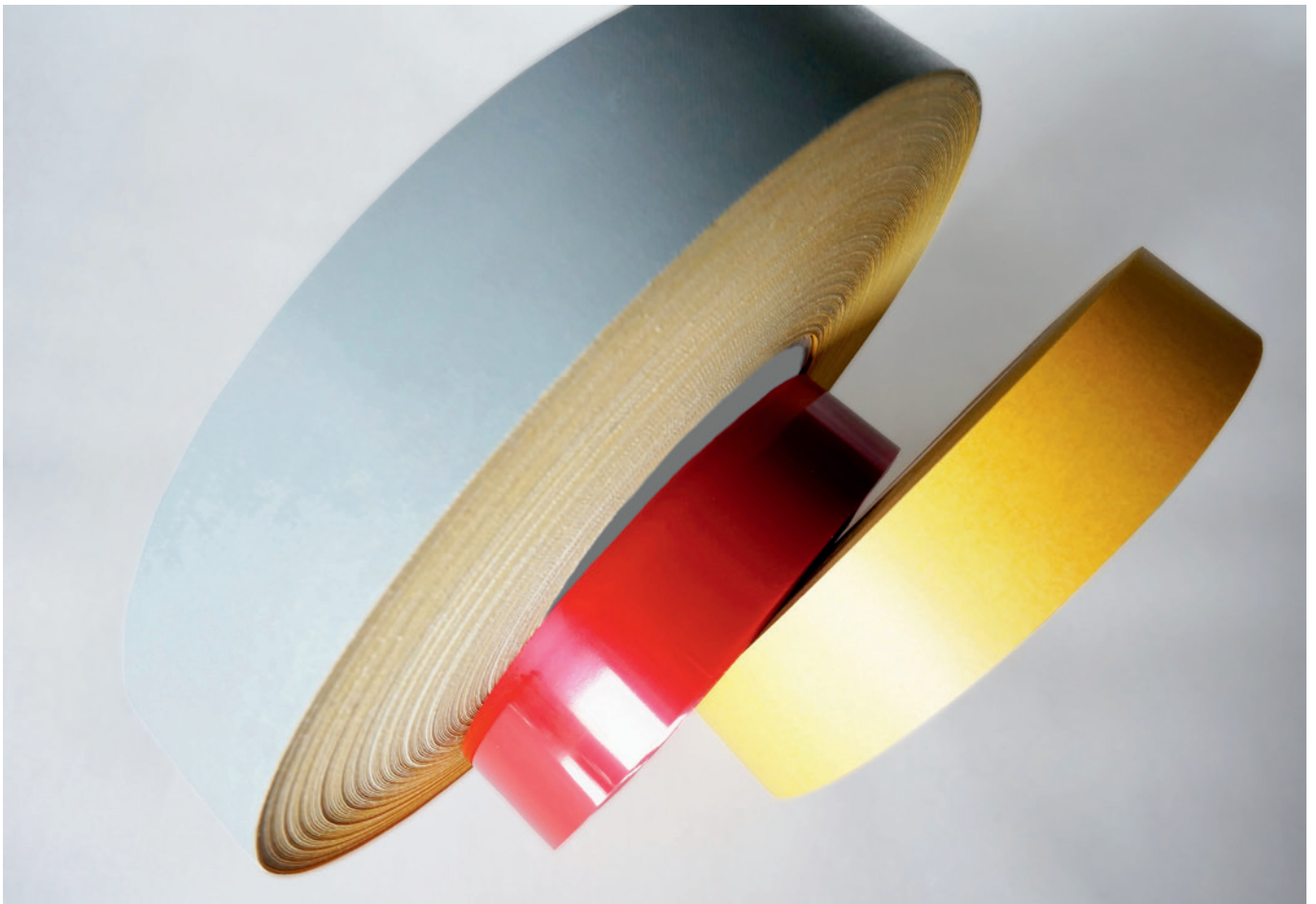
In-line coating with TEGO® RC Silicones



Introduction

Thirty years ago, as the pioneer for UV free radical curable silicone technology, Evonik has continuously developed innovative solutions for the tape and label market. Through cooperations with equipment manufacturers for converting and coating as well as material suppliers Evonik's TEGO® RC team strives for continuous improvement of processes, making us the partner of choice for in-line siliconizing. TEGO® RC Silicones guarantee successful in-line converting of entire labels. The patented UV radical technology allows for instant cure meaning no post cure, efficient operation and high quality. A global network of experts and local test facilities allow a smooth start with in-line siliconizing.

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MANY GOOD REASONS FOR IN-LINE SILICONIZING

The traditional way of producing a pressure sensitive adhesive label uses a pre-manufactured laminate, consisting of a siliconized liner, and adhesive together with a face sheet to print on. Modern technology, products and equipment allow the label producers to customize their selection of raw materials for face stock and liner, paper

or film, adhesive and UV silicone. Through in-line coating every step of the label making process is under your control; design, coating and printing gives you 100% flexibility and 100% control. This makes in-line siliconizing the right choice when it comes to independence, cost and time management.



TEGO® RC SILICONES FOR IN-LINE SILICONIZING

Self-adhesive products such as labels and tapes are sophisticated, multilayer systems. In addition to the adhesive and the face stock material, a laminated label also includes a backing known as a release liner. This liner is made of paper, plastic or other materials. If the label is to work properly, an invisible yet crucial fourth layer, the silicone, also comes into play: Thanks to this silicone layer, pressure sensitive adhesive products can be peeled off of backings the liner with exact precision and fast.

TEGO® RC UV radical curing silicone is

the latest innovation of silicone coating technology offering many advantages. Coating at room temperature means less consumption of energy and no stress to the substrate. Heat sensitive substrates can be used. Paper shows excellent lay-flat behavior. Thin gauge substrates, recycled material, plant based substrates and even linerless labels can be coated successfully. TEGO® RC Silicones consist of 100% active material and contain no solvent.

Because of the cold cure technology TEGO® RC Silicones offer the advantage

to print before siliconizing. They will not compromise the print of the facestock or thermal activated ink. The before mentioned properties makes TEGO® RC Silicones especially suitable for the production of linerless labels for both Variable Information Print (VIP) and prime label applications.

TEGO® RC Silicones allow also for production of tapes. Applications in electronics, construction and composites are the driving growth and innovations in the tape sector. The UV curing technology provides many advantages as capability



to fine-tune of release properties, narrow processing window and flexibility in choice of substrate. TEGO® RC Silicones can be used to achieve excellent release coating including foam tapes, reflective films, security tamper evident tapes or diaper tapes.

After application the silicone coating passes through a UV chamber where the liquid product undergoes a free radical polymerization process and instantly forms into a solid, flexible layer of less than a micron thickness. On the same converting line one can immediately

apply the adhesive, laminate the facestock, die cut, slit and rewind the final product all in one pass. High line speeds up to several hundred m/min are standard.

TEGO® RC Silicones mean an advantage to the environment and efficient production.

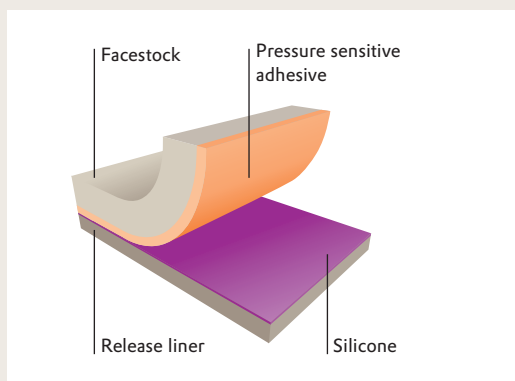
The release value, the force to peel off the label from the liner, depends on both the adhesive and the type of TEGO® RC products used. Release values can be adjusted ranging from

Premium/Easy to Controlled/Tight.

Typically a silicone release coating consists of an anchorage component (A), release component (R) and a photoinitiator (PI). By changing the ratio of the individual components the release values can be adjusted. In addition one component systems (O) facilitate handling during production as they are used without the need for blending.

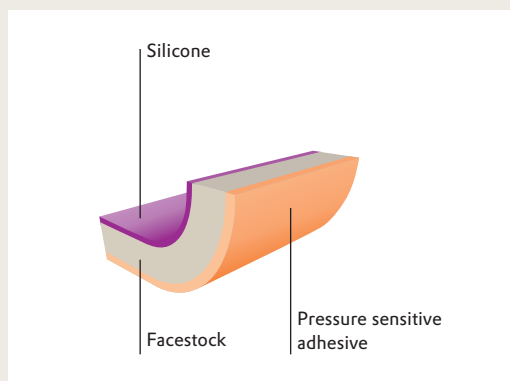
PICTURE 1

Structure of a standard pressure sensitive adhesive laminate



PICTURE 2

Structure of a linerless label or one-sided tape

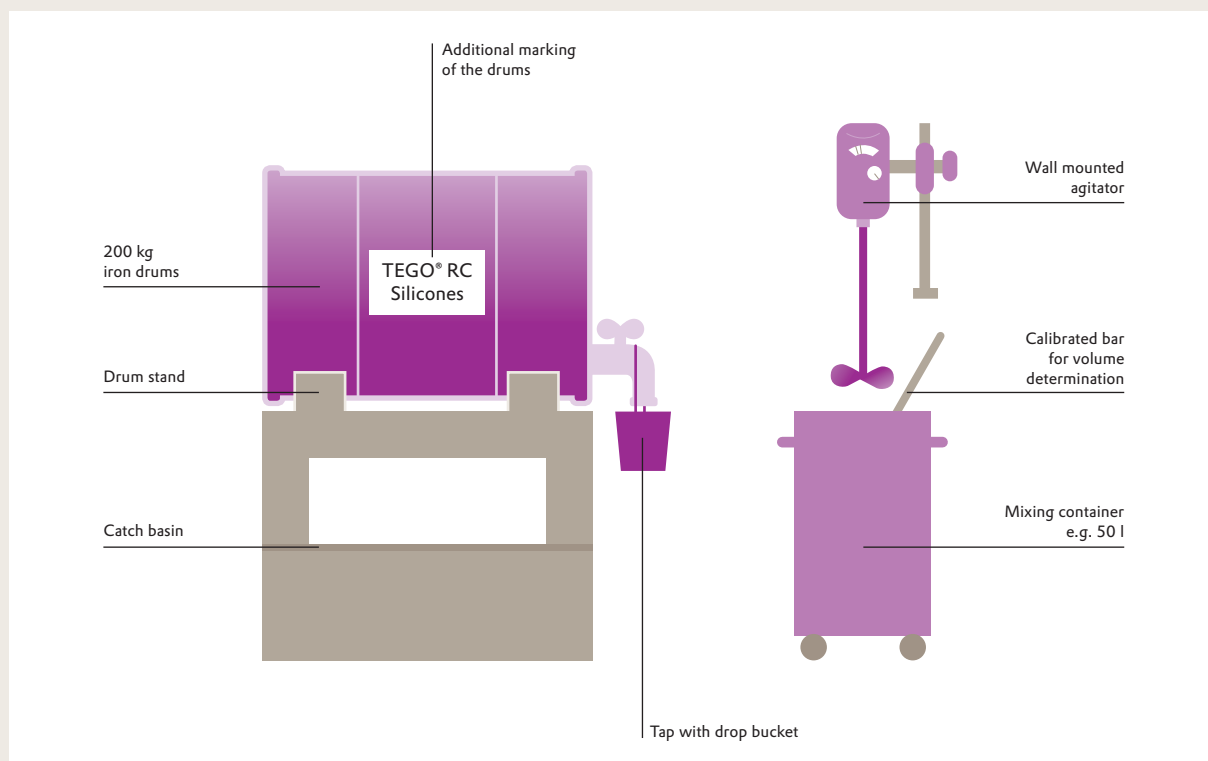


HANDLING OF TEGO® RC SILICONES

Prior to use, TEGO® RC Silicones are blended in the appropriate ratio to achieve the desired release value. The photoinitiator should be added accurately, e. g. 2.0 +/- 0.2%. For one component products blending is not required.

The recommended mixing equipment is dependent on the daily volumes used. For small amounts of silicone (e.g. up to 30 kg), a drill with a paddle stirrer usually is sufficient. For higher volumes continuous mixing and metering equipment is commercially available.

PICTURE 3
Blending of TEGO® RC Silicones



SUBSTRATES AND ADHESIVES



PICTURE 4
5-roll coating head

TEGO® RC Silicones allow manufacturers to coat on wide selection of substrates. On paper, on temperature sensitive films (incl. PE, PP or PVC), bio engineered films or non-woven materials. Changing between substrates in production may require optimization of blends and machine settings. To ensure performance and quality, silicone coat-weight and release values should be checked before starting full production.

Evonik's TEGO® RC Silicones offer Technical Service with vast experience and expertise when it comes to all kind of substrates for liner and adhesives, such as hot melt and acrylic systems.

COATING EQUIPMENT

For applying the silicone and the adhesive to the substrate, specially designed equipment is widely available in the market. Equipment and machine suppliers offer total system solutions or customized modules to retrofit existing equipment.

Prior to the application of the silicone the substrate is treated with Corona

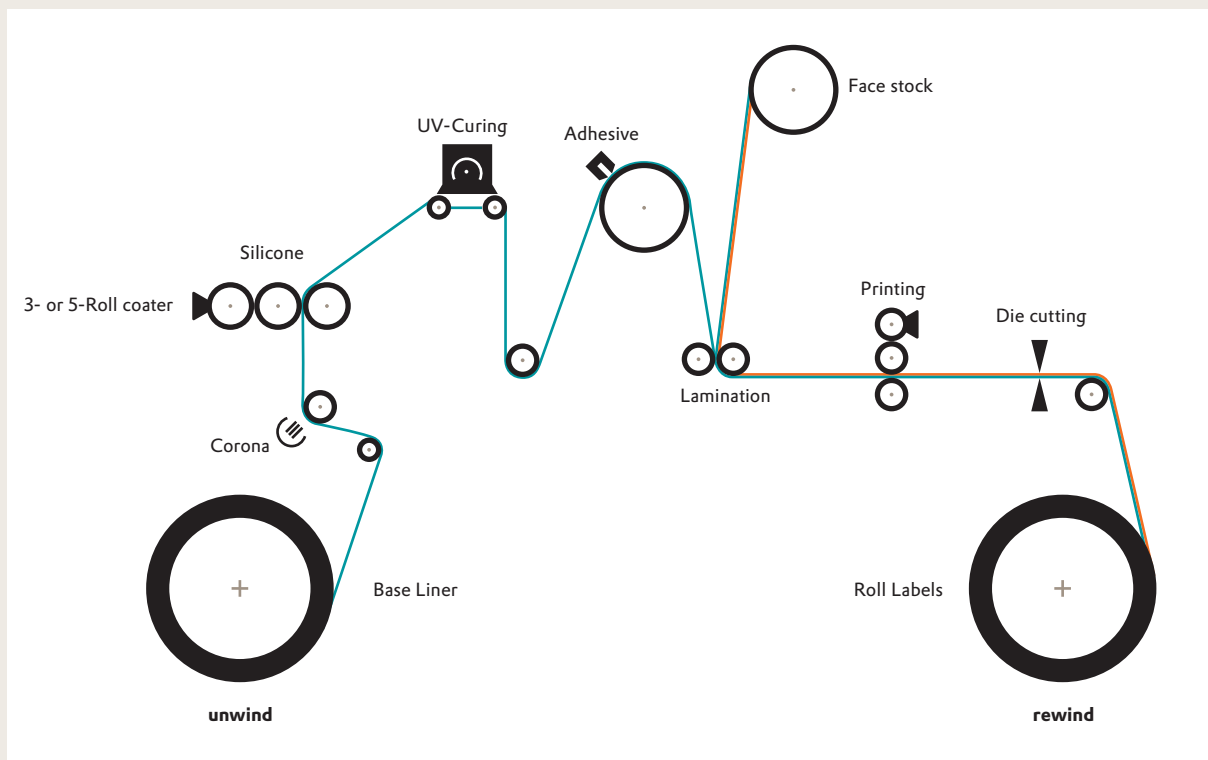
surface treatment. Corona surface treatment ensures good wetting and anchorage of the silicone on the substrate. To apply TEGO® RC Silicones a 3 or 5-roller gravure coating system is standard.

The silicone is cured by passing through a UV chamber, with nitrogen atmosphere. The UV chamber is fitted

with medium pressure mercury lamps. Such units are available from several suppliers. Once the liner leaves the UV chamber the silicone is completely cured with no post-cure and the adhesives can be applied. Printing can take place prior or after the silicone coating. Converting steps, as slitting and die-cutting usually follow silicone coating.

PICTURE 5

Schematic sequence of label production applying in-line silicone and adhesive coating





PICTURE 6

Storage tank for liquid nitrogen. Nitrogen is safe to use. The air we breathe consists of approximately 80% of nitrogen. The remaining 20% oxygen calculates to 200,000 ppm (parts per mil). To properly cure the silicone coating one needs to remove the oxygen to less than 50 ppm through nitrogen inerting in the UV chamber.



PICTURE 7

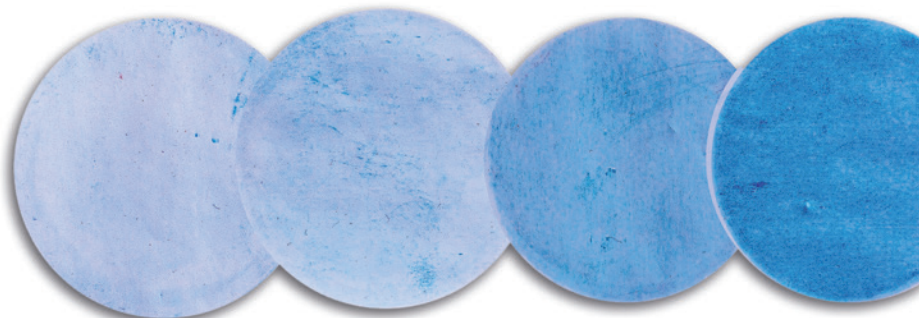
The UV chamber contains the medium pressure mercury lamps which are covered by quartz plates.

TESTING EQUIPMENT

Testing equipment and test methods are important for process and quality control. Tests can and should be run both on and off line. Evonik training can be provided to ensure your team runs these tests properly. We have also capabilities to run tests for our customers at our test facilities.

SELECTION OF QUALITY AND PERFORMANCE TESTS

- Oxygen analyzer to monitor the level of oxygen in the UV chamber. Level of oxygen must be under 50 ppm.
- Smear test to check if the silicone is cured.
- Rub off test to check if the silicone is rubbing or flaking off.
- Dye stain test to check coverage across the web (paper only).
- QSA – Subsequent Adhesion Test to check for curing performance.
- TESA Tape 4154-loop test to check for curing performance.
- Microscope, to check surface quality.
- TLMI & FINAT testing procedures provide detailed test method descriptions.



PICTURE 8

Dye stain test of different paper substrates

GETTING STARTED – CHECKLIST FOR OPERATION AND MAINTENANCE

SECTION	BEFORE PRODUCTION	MAINTENANCE SCHEDULE (REFER ALSO TO MANUFACTURER)
TEGO® RC Silicones	Start coater heating (40 to 60 °C) to control viscosity, ensure silicone mixing and charging level in holding tank during production	Check shelf life of TEGO® RC Silicones components
Coating head	- Check rollers to be clean and smooth - Check roller speeds and nip settings depending on substrate - Check silicone coating aspect	Make sure that all rollers are freely turning down web of the silicone coater – no dragging. Dragging can cause scratches and defects
UV unit	- Start UV lamps - Start nitrogen purging, monitor Oxygen readings to be < 50 ppm	- Clean and replace UV lamps after lifetime - Clean quartz windows and reflectors - Clean gap and blades of Nitrogen knife using plastic chim - Check water and air cooling system (filters) - Calibrate Oxygen analyzer annually
Corona treater	Activate for better wetting and better anchorage	Clean electrodes from dust and make sure grounding roll is clean
Adhesive coating	Check slot die, clean particles, check coat weight, maintain adhesive temperature as recommended by manufacturer.	

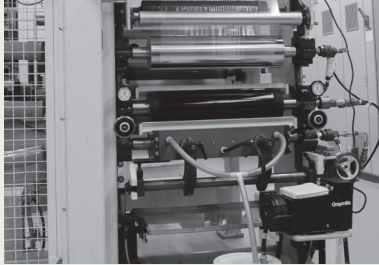


More information can be found on the global web page: www.evonik.com/tego-rc



GLOBAL PRESENCE

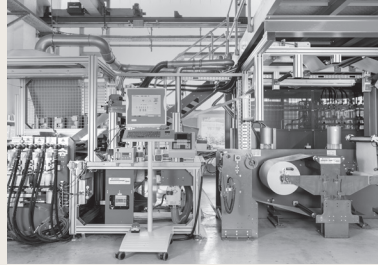
THE AMERICAS



Richmond, VA USA

- FAUSTEL 3 roll offset gravure coater
- ELTOSCH inerted UV unit with 2 x 160 W/cm UV lamps
- Web width 610 mm
- Substrate on 3" or 6" core
- Line speed: 25-250 m/min

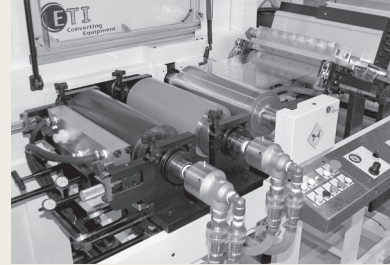
EUROPE | MIDDLE EAST | AFRICA



Essen, Germany

- COATEMA 5-roll-smooth coater
- In-line silicone and adhesive coating (dispersion or hotmelt)
- IST/HOENLE inerted UV units for silicone and hotmelt curing with 1 x 200 W/cm UV lamp each
- Web width 500mm
- Substrate on 3" or 6" core
- Line speed: 20-100 m/min

ASIA | PACIFIC



Shanghai, China

- ETI 3 roll offset gravure coating line
- ETI inerted UV unit with 160 W/cm UV lamp
- Web width 336 mm
- Substrate on 3" core
- Line speed: 150 m/min

FACE-TO-FACE PERFORMANCE

OUR GLOBAL RC-SILICONE TEAM WILL ASSIST WITH

- Training and assistance in application & processing of the TEGO® RC Silicones coating
- Technical service during start-up phase and on-going production
- Utilize our wide network of contacts to equipment and machine suppliers
- Innovative developments for future challenges
- Long-term relationships based on trust

We offer training facilities and pilot coaters around the globe for adhesive trials, release compatibility trials, substrate trials, new product developments, test methods and procedures, technical questions and operator training sessions.

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