



EXTRUDER OPERATION IN RETREAD SHOPS

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I. INTRODUCTION

This Recommended Practice (RP) addresses the operation of cold feed extruders for applying strip rubber to buffed casings. Cold strip rubber is fed into a hopper or opening in the barrel of the extruder and is transferred down the barrel by a screw-type rotating shaft. This process generates heat, which in turn plasticizes the rubber to the point where it extrudes from the die for application to the tire. Pin barrel extruders are used for tougher compounds. Pin barrel extruders contain pins that extend into the barrel to break down the compound. These pins can be arranged in different configurations based upon the type of compound used.

II. FACTORS AFFECTING EXTRUDER OPERATION

A. Extrusion Temperature

Monitoring extrusion temperature is important because if the extruded strip becomes too hot, it will scorch or start curing. This is normally seen as roughness in the strip texture and is sometimes accompanied by smoke. In addition, the extruded strip will have less tack, and it will be difficult to get it to stick to the casing.

Extrusion temperature can be checked with an inexpensive pyrometer, and is a first step in determining whether the extruder is operating correctly. Standard temperature measurements are taken on the extrudate as it leaves the die using a needle probe. Typical

extrusion temperatures are between 180°F (82°C) and 230°F (110°C), but temperatures generally vary based on extruder type and compound used.

If extrusion temperatures are beyond this range, consult the extruder manufacturer and the tread rubber manufacturer for recommendations.

B. Screw Clearance

Over time, the screw itself can decrease in size, and the inside of the barrel can increase in diameter due to wear. As the screw and/or barrel wear, the clearance increases and extrusion temperatures go up accordingly. When manufacturers' clearance specifications are exceeded, replacement of the screw and/or barrel is required to reduce the clearance and obtain satisfactory extrusion temperatures.

All extruders are water cooled. Flow and temperature must be adequate to properly cool or heat the extruder. This can be checked either by observing the flow from each chamber or using a thermometer on the outlet side of the extruder. For zone controlled extruders, check the temperature gauges and control setting. Follow manufacturers' recommendations.

C. Rubber Compound

The extrusion characteristics and overall performance of different rubber compounds varies substantially. The highest quality tread rubber is compounded for best performance on the tire and may be more difficult to extrude. Rubber manufacturers attempt to provide the best combination of properties, but if problems arise and continue even after the extruder has been thoroughly checked out, the rubber manufacturer should be contacted for recommendations.

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Some additional factors that affect extruder operation include:

Viscosity - This indicates stock toughness, usually at an elevated temperature at which the extruder operates. Mooney ML-4' or cure meter minimum torque (M_L) are the most common tests used to measure compound viscosity.

Scorch Time - The time at which the compound in the extruder starts to cure at a given temperature. Mooney, cure meter, or stress-strain data are typically used by suppliers to determine scorch time. After warm-up, if the strip becomes wavy or lumpy, this indicates the rubber has been scorched.

In addition, polymer, carbon black content, and plasticizer level of compounds all influence extrusion temperatures. These data are typically not available for proprietary reasons.

Age of Rubber - The retreader should be aware that natural rubber compounds extrude a little hotter and tend to get tougher (in viscosity) with age.

CHECKLIST OF OPERATING PROBLEMS	
CONDITION	CHECK
High Extrusion Temperature or Insufficient Tack	<ul style="list-style-type: none"> • Water flow too low/temperature too high • Screw speed too fast • Screw to barrel clearance in excess of manufacturer's specifications • High compound viscosity • Too many or plugged strainers • Inappropriate stock for extruder • Old stock
Rough Strip	<ul style="list-style-type: none"> • Excessive extrusion temperature for the extruder • Strip not feeding into the extruder properly • High compound viscosity • Compound scorch • Feed strip too cold • Extrusion temperature too low • Old stock
Non-Uniform Extrusion	<ul style="list-style-type: none"> • Strip not feeding into extruder properly • Zone temperature settings too high or too low • Incorrect die shape • Non-uniform stock or strip size • Feed strip too cold • Improperly aged stock (less than 48 hours) • Old stock • Extrusion temperature too low

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