

## STRATCO® Grease Manufacturing Process Description

The heart of the **STRATCO® lubricating grease manufacturing process** is the proprietary STRATCO® Contactor™ reactor. The outstanding feature of the Contactor™ reactor is its high turbulent circulation in a closed cycle path. All energy input through the mixing impeller is expended within the materials being mixed and there is virtually no pressure differential between the Contactor reactor's inlet and outlet.

The Contactor™ reactor is first charged with the specified base oil which is at its storage temperature. A hinged opening at the top of the Contactor™ reactor is used for charging the active chemical ingredients used in the grease formula. Once the specified amount of the raw chemicals is loaded, the charge opening is closed and the Contactor™ reactor is heated.



The high dispersion mixing in the Contactor™ reactor is achieved by the hydraulic head assembly. The impeller forces frequent changes in the velocity and direction of flow through the Contactor™ reactor. The oil and chemical ingredients are pulled down through the inside of the circulation tube via the impeller. Turbulence is established between the stationary shear vanes and the blades of the impeller, resulting in a zone of high shear and intense mixing.

As the material passes through the impeller, its velocity is greatly increased. At the discharge side of the impeller, the stream is impinged against the diffuser vanes. The direction of the flow is reversed at the bottom of the hydraulic head where the vanes force an axial turbulent flow as the dispersion passes through the annular space formed by the circulation tube and Contactor reactor wall. The liquid then flows over the top of the circulation tube and back into the impeller.

Once circulation is established, the Contactor™ reactor is heated, typically using a hot oil heating system. The Contactor reactor is equipped with two jackets, an external jacket and an internal jacket. Heat transfer oil is circulated in both the internal and external heating jackets. High heat transfer coefficients are achieved by the high circulation rates across the heating surface. The saponification reaction is exothermic and the combination of applied heat and reaction heat results in a rapid temperature rise. The entire contents of the Contactor™ reactor reach a temperature in excess of 400°F (204.4°C) in less than an hour. At this temperature, the saponification reaction is complete.

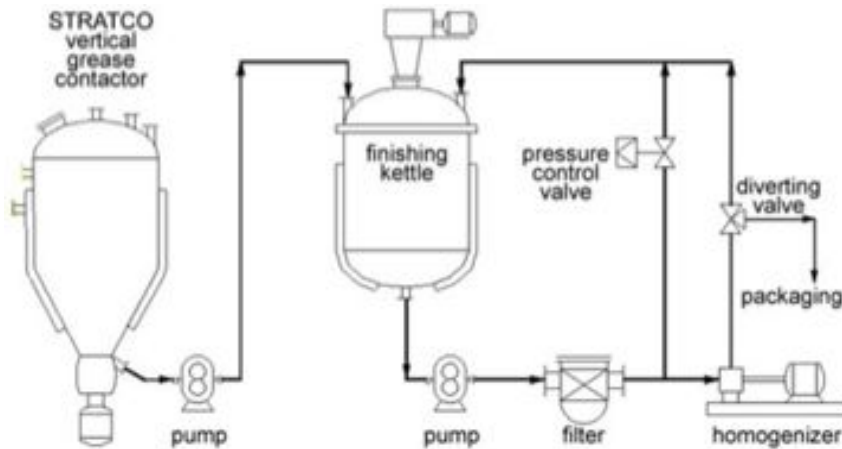
As the saponification reaction proceeds to completion, water is generated as a product of the reaction. Pressures in the range of 70-100 psig (482.7-689.5 Kpa gauge) are typical of those used for efficient and complete saponification. This pressure prevents foaming of the soap concentrate as well as accelerates the

saponification reaction. The Contactor reactor pressure is maintained by manually venting or by automatic controls as the temperature rises.

The next step involves the addition of cooling or quench oil used to reduce the temperature below the soap crystallization temperature. At this point, the Contactor™ reactor contents are pumped into a finishing kettle. These are large mixing vessels, typically either pressure or open atmospheric types. The kettles are equipped with large slow speed mixing assemblies, whose function is to provide a gentle blending action and aid in cooling of the semi-finished product. Cooling is typically accomplished by cooling water circulation in a shell jacket.

When the final amount of finishing oil has been added and the kettle contents are cooled to an acceptable temperature, additives are typically introduced and blended into the cooled finished grease. Since many additives are temperature sensitive, they are added in the cooled kettles rather than in the Contactor reactor.

Some greases require milling. Milling (sometimes referred to as homogenizing) is performed to ensure that the grease product is truly homogeneous. Once the finished grease passes the quality control tests, it may be sent to packaging.



An alternate procedure is to partially or completely finish the grease in the Contactor reactor. This option takes advantage of the high shear milling action of the Contactor reactor's impeller. Lighter greases can be completely finished in the Contactor™ reactor and then directly packaged.

In summary, the Contactor™ reactor permits the grease manufacturer to use a great

variety of raw materials. The ability to perform these operations under pressure accelerates saponification while allowing complete control of all the manufacturing variables. This includes minimizing the amount of excess water required to accomplish complete and efficient saponification.