

## Tractor Console, RH Lower



**Molder:** Innovative Injection Technologies, Inc.

**Moldmaker:** MSI Mold Builders

**Material Supplier:** Lanxess Corporation

**Designer:** John Deere Dean Boyce

**OEM:** John Deere

### **Product Description**

The tractor console is a key structural component for the right hand controls on an agricultural tractor with an open operator station. The console provides control locations for up to three(3)selective hydraulic control valves, mechanical or electric hydraulic hitch control for optimum positioning and draft sensing functions of the hitch, power take off control and



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mechanical or electric hand throttle control. The console was developed for a tractor product line with a 75 to 105 horse power rating and is primarily used for utility applications, such as mowing, hay baling, feedlot loader, light tillage, orchard and vineyard activities. Additional non-agricultural applications are road maintenance, landscaping, and snow removal. The console design and usage is global in scope and is built in multiple facilities around the world.

## **Why is the product innovative?**

In the past, it has been an industry practice to mount mechanical controls in sheet metal brackets due to the higher forces that are present when operating mechanical controls. This new console incorporates a structural plastic material with a unique rib and mounting system in the design of the part to address the mounting requirements and loads generated by the operator actuating the controls. The part design provides the anchor points for the control cables used with the mechanical controls. These anchor points are required to withstand the reaction loads in two directions through multiple cycles of the control levers, as well as, the high load instances that the operator may input into the control system. The new console design eliminated eleven sheet metal parts and fasteners, as well as, assembly time and labor cost associated with the metal parts. The new part design lends itself to producing a sub-assembly of the required control elements based upon vehicle options ordered therefore reducing the production line content. Ergonomic optimization for the operator actuating the controls, as well as, the working environment factor and control function specifications all heavily influenced the final part design. Throughout the design process, the geometry was analyzed by Innovative Injection Technologies' engineering to ensure a robust processing window that would consistently meet the specified tight tolerances and minimize tool design issues. Lanxess, the resin material supplier, completed mold flow, shrink, warp and fiber orientation analysis that was used to optimize part design and gate configuration. John Deere engineering performed multiple Finite Element Analysis of the CAD model assembly containing all the controls. The FEA was based on material data curves supplied by the material supplier to include environmental conditions the material would be subjected to during vehicle operation. Design changes were made based upon mold flow and FEA results then verified in subsequent analysis of the model. Complete control assemblies were lab tested with each control being actuated in excess of one million(1,000,000)cycles. Each control assembly was subjected to a high load condition which correlated to the maximum force a strong man can create on the control lever based upon ergonomic charts. Multiple field test vehicles with this control design installed have completed the equivalent of several years of customer use in actual field conditions. Through all the tests, the structural plastic console RH lower design did not experience a single failure. The up front design work from multiple disciplines has resulted in a robust structural plastic console part that replaced multiple sheet metal brackets while providing the end customer with a high quality functional mechanical control system for extended vehicle operation.