Sand CastingProcess for HeavyIron Castings:Front &Rear AxleHousings for Trucks

Gorka PáramoArgote
LoramendiS.Coop.Alibarra 26,01010,Vitoria-Gasteiz,Spain
gparamo@loramendi.com

Abstract: Thisdocumentexploresthebenefitsandvarious applicationsof the CorePackage Systemintheproductionofironcastings.
Initiallyrenownedforitsapplicationinaluminumcastingsinceth e 1990s,particularlyintheautomotivesectorfor producingengineblocks,thisinnovativeprocesshasnowexpand edtoironcastings,includingcylinderblocksand heads.The latest advancements haveextendeditscapabilitiestoheavycastingssuchasaxlehousin gsfor trucks.Furthermore,thetechnologyisevolvingtowards sustainability,shifting from thickercastingwallstothinner,moreefficientones.

Keywords:CPS,core package,sand core,iron casting, rearaxle,frontaxle,housings.

1 Introduction

TheCorePackageSystementailscreatinganentiremoldfromapa ckageof individualsandcores,includingallthe running and feeding systems.This method is especiallysuitedfor partswithhighly complexshapesandfor medium to high production volumes.

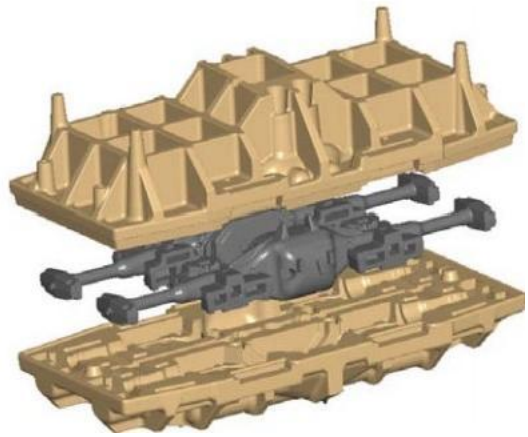

Figure 1 Example of aCore Package System to produce arear axlehousings.

2 Processdescription

ThecastingmanufacturingprocessofCPSforaxlehousingsconsi stsof thefollowingstages:
Core manufacturing:
Coreproductionutilizes an automated coldboxtechnologyprocess,operatingonacycletimeof120seco nds(upto 1.000kgof sand core).Post-production,the cores are automatically unloaded, painted,dried,andstored,adheringstrictly toLEANmanufacturingprinciples.

Core assembly:
Corepackages are predominantly assembledautomatically.Current productionlinesarecapableofassemblingonecoreorcorepackag eevery 120 seconds.Theassemblyprocessmaintainsprecisetolerancesof +/-0.15mm,facilitatingthestraightforwardintegrationof chillersandexothermic materials into thecoreorcore package.

Corepackageinpouringboxes:
Thecorepackageisplacedintoapouringboxand surrounded byloosesilicasand.Through the application ofvibration,the corepackageissecured and compressed,ensuringstabilityand readinesstowithstandferrostatic pressure duringthemetal pouring process.
Pouring:
The metalispouredintothecorepackage,which includesthecompletedesignofthepouringcup, downsprue,runners,and risers.

3 Design characteristics

The characteristics ofthe CorePackageSysteminclude:
1)Complexityof designs:
-Thesystemallowsthecreationofcomplexgeometries, offering significant flexibilitytointegratecastingsandvarioustypesofchannels.

- Itfacilitatestheincorporationoffunctionalparts,therebyreducingthenumberofcomponentsinthefinalproduct.
-Theweightof thecastpartcanbeminimizedthrough optimizeddesign.Additionally,thelowthermalconductivityofsandenablestheachievementof thinnerwall thicknesses compared to other casting methods.

2) Mechanical properties:

-Thesystempermitslocalizedcoolinginareasof highmechanicalstressthroughtheuseofchills,resultinginsuperior materialpropertiessuchastensileandyieldstrength, along with enhanced elongation characteristics.
- Castingscanbeorientedaccordingtothefinalworkingconditions, significantly extendingthecomponent'slifespanbyupto300%,from2millionoover6million cycles.

Due to these characteristics, theSandCastingProcessoffersclearcostadvantagesforparts withcomplexgeometries.

4 Advantages of the Sand CastingProcess

Introduction

The sandcastingprocessoffersnumerousbenefitsintermsofcastingquality,flexibility,efficiency,andcost-effectiveness.

Casting quality/ Flexibility:

-Facilitates the integrationof complexgeometries,suchascooling jacketsandoilpassages,alongwithadditional castings.
-Enablestheproductionofcomponentswiththinnerwalls.
- Ensureshighprecision,allowingforcastingorientationaccordingtospecificoperationalrequirements.
- Offerslow-costprototypedevelopmentandhighflexibility in production lines.
-Expandstherangeof applicationsforcastpartswithin the industry.

Casting process:

- Reducescycletime.
- Provideseaseandprecisioninassemblingcoresandintegrating inserts made from various materials..

Investment/ Cost:

-Requires lower investment compared to traditionalgreen sand processes.
- Reducesoperationalandlaborcoststhroughsimplified process automation.
- Presentsaflexibleandcost-effectivesolution.
- Ensuressimpletoolingmaintenance.

Conclusion

Whiletheprocesshas beenestablishedforover30years,evolvingtechnicalrequirements,thedevelopmentof newproducts,andstricterenvironmentalregulationshaveopened up new opportunitiesfor thesandcastingprocess. Theoutstandingdimensionalqualityand possiblecomplexityofthecastingsmakethisprocesssuitedfor themanufacturingof heavyironcastingswithhighlevelofintegratedparts and thinner walls. Additionally, thelevel ofinvestment compared to the traditionalgreensandprocess is lowso it makes thesystemsustainableand withenough flexibility for the new production challenges.

References

[1] AAM, TheAluminiumAutomotiveManual, 2002,p.18-28
[2]Smetan,H.:KernpaketverfahrenimAluminiummotorenguss, MTZ 61, 2000, No.10,P.712-715
[3] Feikus, F.J.: OptimierungeinerAlSi-Gusslegierung und anwendungsorientierte Entwicklung derGießtechnik zur Herstellung hochbelasteterMotorblöcke. Giesserei 88, 2001, No.11, p.25-32
[4]John Campbell, inCompleteCastingHandbook(SecondEdition), 2015
[5]Walton, C. F.,Opar,T. J.:IronCastingHandbook. IronCastingSociety, NewYork,1981.