

CASTING LAWS – A REVIEW

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Abstract

Laws are set of norms created for successful outcome. Similarly there are laws for casting for getting a successful prosthesis. Through this article we would like to review the casting laws.

Keywords: Casting, Laws, Defects, Spruing Laws.

Introduction

The casting to be successful it should be precise. Various casting defects like distortion, surface irregularities, porosity, incomplete or missing details can occur if proper methods are not followed. To have a flawless casting Ingersoll & Walding (1986) formulated an expanded set of 17 separate recommendations for spruing, investing,

burnout, melting & casting procedures. Collectively these guidelines are referred to as “the laws of casting”. Through this article we would like to review the laws of casting the defects obtained if not followed.

Casting Laws

1ST Law of Casting : Attach the pattern sprue former to the thickest portion of the wax pattern:

- This provides the molten metal to flow from larger diameter to thinner sections

Defect: cold shuts, short margins and incomplete casting.

2ND Law of Casting: Orient wax patterns so all the restoration margins will face the trailing edge when the ring is positioned in the casting machine:

- Add a wax dot to the crucible so that, it will guide us in placing the ring in casting machine

Defect: cold shuts and short margins

3rd Law of Casting: position the patterns in the “cold zone” of the investment and reservoir in the “heat center” of the casting ring.

Defect: shrinkage porosity

4th Law of Casting: A reservoir must have sufficient molten alloy to accommodate the shrinkage occurring within the restorations:

- Molten alloy shrinks and creates a vacuum for complete casting vacuum must be able to draw additional metal from adjacent source

Defect: Shrinkage porosity and /or suck back porosity

5th Law of Casting: Do not cast a button if a connector bar or another internal reservoir is used: • With indirect spruing the largest mass of metal should be the reservoir

- A button can draw available molten alloy from the bar, shift the heat centre and reduce the feed of the metal to the restorations • Wax patterns should not be larger than the connector bar

- Weigh the sprued patterns and use the wax pattern-alloy conversion chart.

Defect: shrinkage porosity and suck back porosity.

6th Law of Casting: Turbulance must be minimized, if not totally eliminated

- Eliminate sharp turns, restrictions, points or impingements that might create turbulence and occlude air in the casting

- Restrictions or constrictions can accelerate the metals flow and abrade the mold surface (mold wash)

Defect: voids and /or surface pitting

7th Law of Casting: Select a casting ring of sufficient length and diameter to accommodate the patterns to be invested

- The casting ring should permit the patterns to be ¼ inch apart and ¼ inch from the top of investment and 3/8 inch of investment between pattern and ring liner

Defect: mold fracture, casting fins and shrinkage porosity

8th Law of Casting: Increase the wettability of wax pattern

- Wetting agent should be brushed or stained on the patterns and dried before investing

- Too much wetting can weaken the investment and produce bubbles or fins on the casting

Defect: bubbles (due to air entrapment)

9th Law of Casting: Weigh any bulk investment and measure the investment liquid for precise powder liquid ratio

- A thick mix of investment increases investment expansion and produces loose fitting castings

- Thinner mix yields less expansion with tighter fitting castings

Defect: ill fitting casting

10th Law of Casting: Eliminate the incorporation of air in the casting investment and remove the ammonia gas by – product of phosphate bonded investments by mixing under vacuums

- Vacuum mixing removes air and gas providing an uniform mix without large voids

- Entrapped air can affect the expansion at various sites of the investment

Defect: small nodules, weak mold and distortion of the casting

11th Law of Casting: Allow the casting investment to set completely before initiating the burn out procedure

- The mold may not withstand steam expansion during burnout if the mold is not set

- Advise to wait till the recommended setting time by the manufacturer

Defect: mold cracking/ blowout or fins on the casting.

12th Law of Casting: Use a wax elimination technique that is specific for the type of patterns involved and recommended for the particular type of casting alloy selected

- Plastic sprues should be heated slowly, so they can soften gradually and not exert pressure, so use a two stage burnout
- Recommended atleast a 30 min heat soaking at 800F for the first burnout

Defect: cold shuts, short margins, cold welds, mold cracks and/or casting fins

13th Law of Casting: Adequate heat must be available to properly melt and cast the alloy

- Selected heat source should be capable of melting the alloy to the point of sufficient fluidity
- Too much heat or high temperature can burn off minor alloying elements and /or oxidation (burned metal)

Defect: cold shuts, short margins and cold welds (too little heat) or rough castings and investment breakdown (too much heat)

14th Law of Casting: When torch casting, use the reducing zone of the torch to melt the alloy and not the oxidizing zone

- Melt achieved by the exclusive use of the reducing zone minimizes the likelihood of metal oxidation and gas absorption and ensures the proper melt

Defect: Gas porosity

15th Law of Casting: Provide enough force to cause the liquid alloy to flow into the heated mold • Low density metal generally needs four winds of a centrifugal casting arm as compared to higher density, gold based alloys

- Do not over wind

Defect: cold shuts, short margins, cold welds (insufficient force), or mold fracture and fins (too much force)

16th Law of Casting: Cast towards the margins of wax patterns

- Place the heated ring in the casting cradle using the orientation dot, so the pattern margins face the trailing edge

Defect: cold shuts, short margins and otherwise incomplete castings

17th Law of Casting: Do not quench the ring immediately after casting

Uneven cooling and shrinkage between alloy and the investment can apply tensile forces to the casting dot

It can reduce strength

Defect: hot tears

Conclusion

As, Marilyn Vos Savant said “a person who doesn’t know the rules thoroughly is at a great disadvantage” dental personnel without knowing the casting laws would result in a failed casting.

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