Z Tech Design-Zlatko Salihbegovic graduated mechanical engineer

# High pressure GLV patents: US 11,845,120 B2, US 11,242,732 B2, US 11,686,185 B2, US 11,643,910 B2

By Z tech design-Zlatko Salihbegovic

GLV per Z Tech Design are available from **ELC Energy** Tomball/Houston

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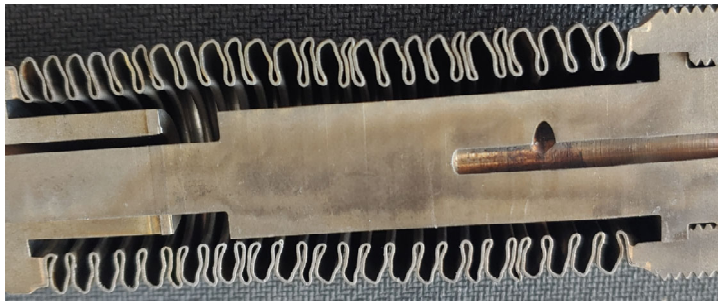
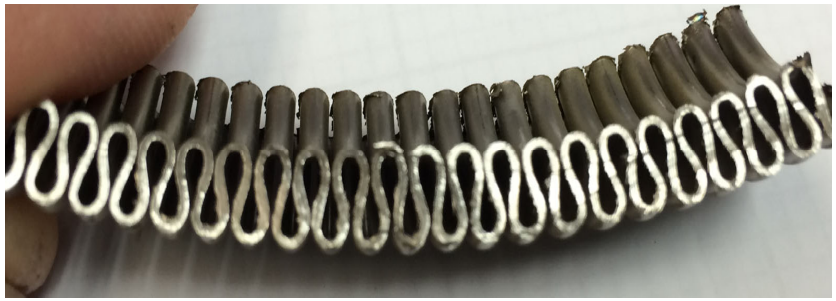
# Patent US 11,845,120 B2-Bellow internal-external pressure crimping method and crimping-compression device.

- First step is proper bellow crimping.
- Most GLV manufacturers crimp bellows after soldering to mating parts, this is wrong method.



Wrong



Right, per my patent

- Second, let's see what is the wrong way to design a gas lift valve.
- GLV are using either formed or edge welded bellows. First GLV designs were using formed bellows. Bellows used in GLV are made from three 0.005" thick layers/plys by rolling or hydro forming, usually rated by manufacturers to 250 PSI working pressure. Material used is usually Monel 400, Inc 625 and 718.
- **As far as I am aware, first GLV designs are the only engineered product on the market that are intentionally using a component, in this case formed bellow, exposed to extremely higher pressures, up to 2500 PSI, 10 times higher than recommended by bellow manufacturers. This is absolutely wrong approach. It appears to me that gas lift is the only oil industry segment where operators are stuck in the past and simply ignore every progress made in this filed by using old wrong designs.**
- Different methods are used in GLV designs to address high pressure issues as bellow crimping, GLV ageing and bellow hydraulic protection.
- Bellow crimping is correct process, but most GLV manufacturer usually use wrong method, crimping bellow after soldering it, in free length, to mating parts. Bellows should be crimped as standalone component.
- GLV ageing is wrong process that should not be performed and results in deformed bellow shapes.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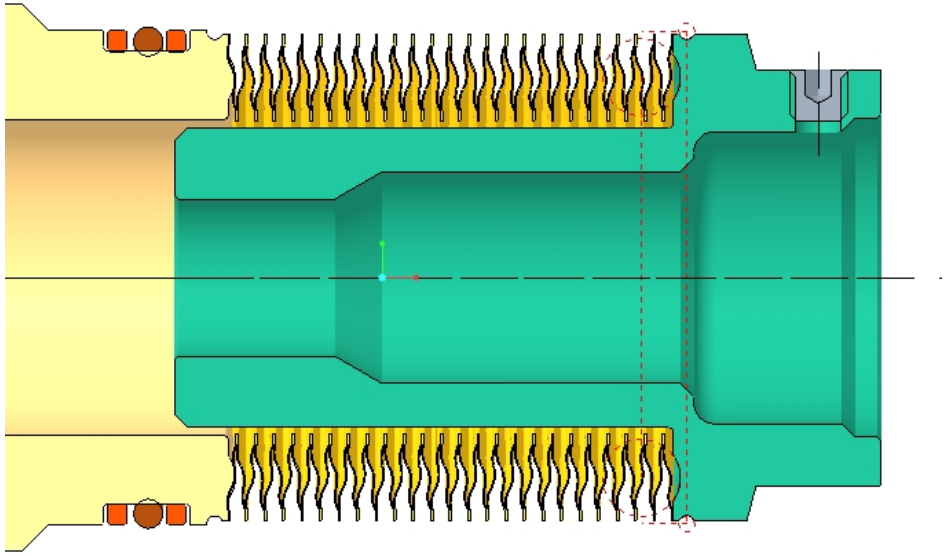
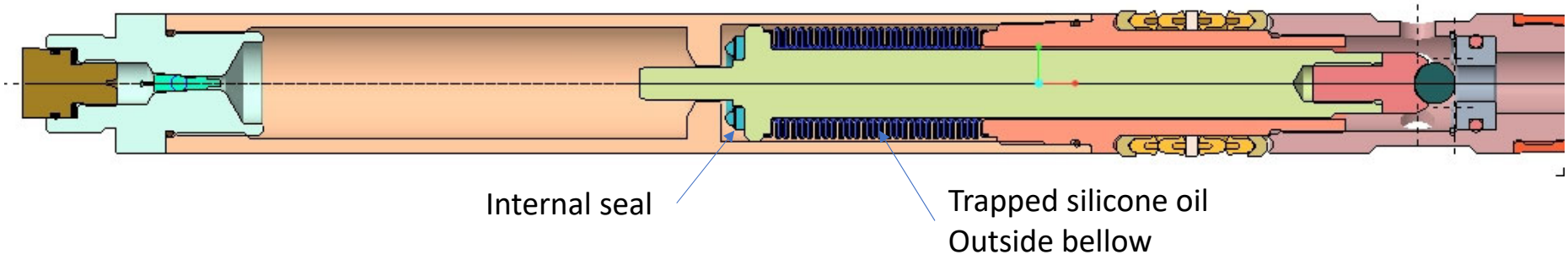
Formed bellow cross section crimped per my patent

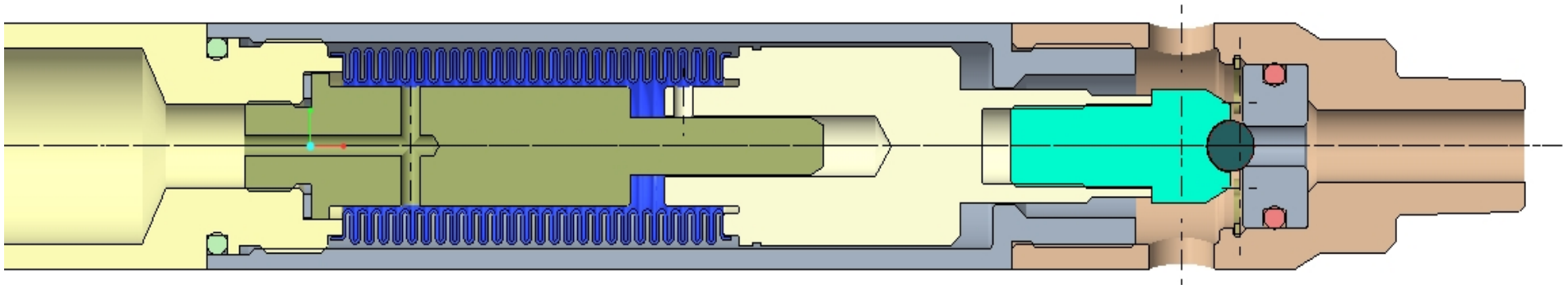


EWB-edge welded bellow cross section no crimping is required




So called, bellow hydraulic protection is based on wrong principle where bellow is “protected” from high pressures by trapping “non compressible” silicone oil outside of the bellow with internal seal. This allows high injection pressure to enter the bellow which is wrong approach. However, silicone oil in GLV is in direct contact with pressurized Nitrogen, which is permanent gas that dissolves in oil rendering it compressible mixture of oil and Nitrogen. Permanent gas remains in gaseous state all the time and never liquifies, it doesn’t matter how high the pressures is. This renders “ hydraulic bellow protection” false assumption. Still this method is better than no any bellow protection.

- Drawing below shows one of the first GLV designs. This valve does not have any bellow protection from high injection or dome pressure. Unfortunately, this is best selling valve. Everybody is cloning this valve.
- This is the cheapest valve on the market particularly if cloned in Asia.

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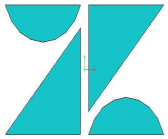

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- Third, by design, GLV bellow should never be exposed to differential pressure higher than manufacturer recommended working pressure, usually 250 PSI for formed bellows. There is no GLV today that meets this criteria except my gas lift valve design with dual fortress seal.
- ***Introducing most advanced GLV on the market today, dual Fortress™ seals valve per my patent # US11,242,732.***
- Dual Fortress™ seal GLV features formed bellow that is never exposed to differential pressure higher than 200-250 PSI.
- Bellow in this GLV is completely protected from high injection and dome pressure by Fortress™ seals.
- Bellow in this valve is crimped per my patent # US 11,845,120 B2 resulting in perfectly crimped bellow.
- This GLV can be exposed to 15 KSI injection pressure without any danger for bellow.
- This GLV features spring loaded telescoping stem, which is complex, however applying my patent # US 11,643,910 B2-"GLV with two simultaneous mechanical stops" telescoping stem is not needed and is eliminated from design resulting in simpler and more reliable design.
- This gas lift valve is not aged, ageing is wrong and unnecessary procedure. Valve is prepared for use by charging dome with Nitrogen, where max dome pressure is 3000 PSI depending on bellow material used.

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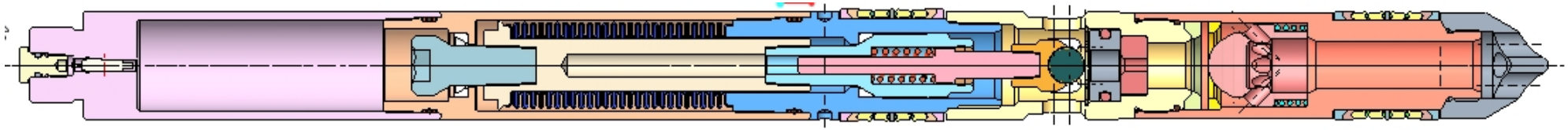
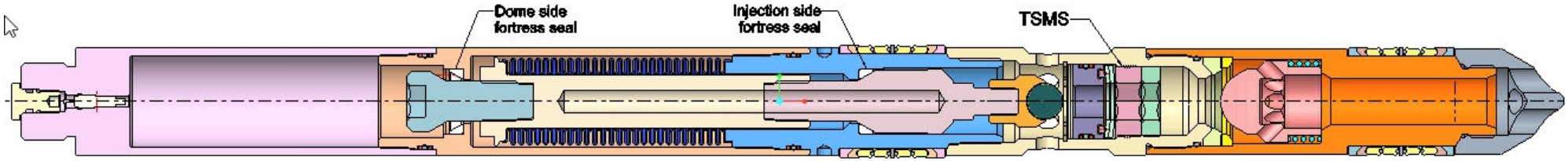
# Patent US 11,242,732 B2-GLV with dual fortress seal

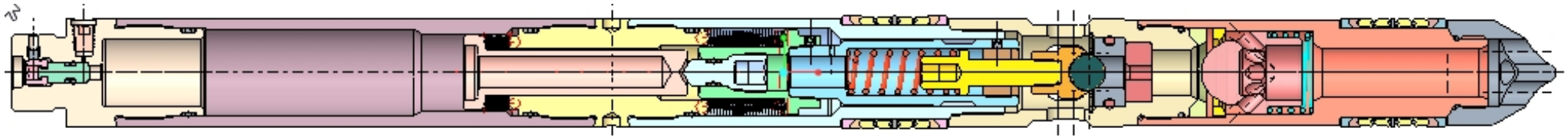


DFS-dual fortress seal valve

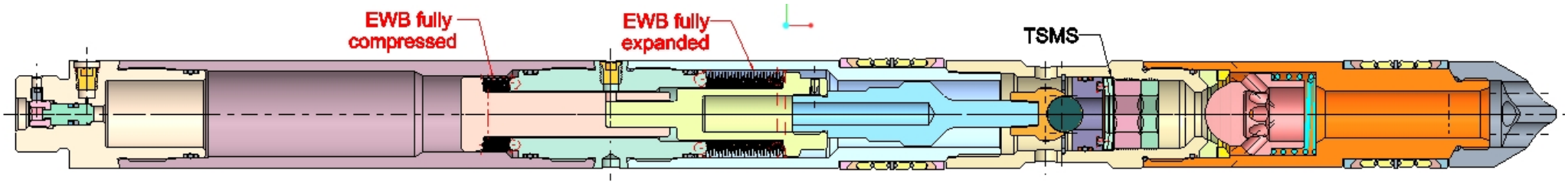



DFS + TSMS-two simultaneous mechanical stops valve, spring loaded telescoping stem is eliminated. Maximum dome pressure is 3000 PSI.

# Patent US 11,686,185 B2-High pressure gas lift valve with dual edge welded bellows.



DEWB with telescoping stem




DEWB valve with TSMS, spring loaded telescoping stem eliminated, max dome pressure 10KSI.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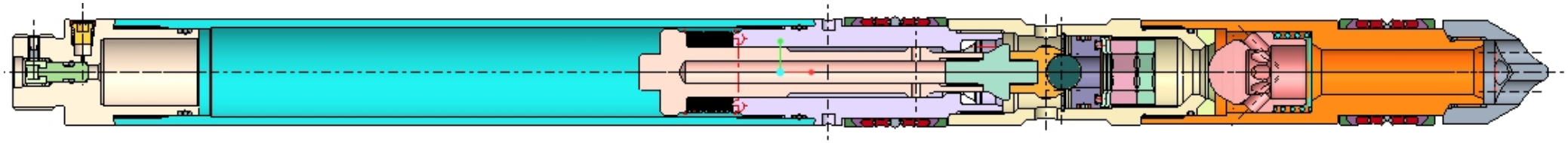
# Patent US 11,643,910 B2, gas lift valve with two simultaneous mechanical stops-TSMS



- SEWB gas lift valve with injection side fortress seal and TSMS, no spring loaded telescoping stem is required since TSMS is used.
- Maximum dome pressure 10 KSI
- TSMS patent can be used for any valve type.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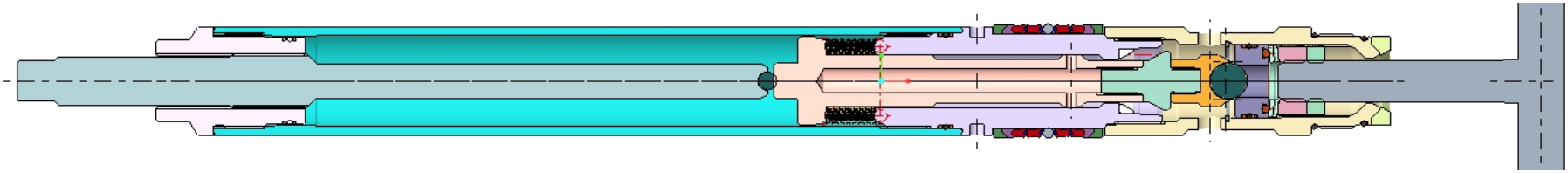
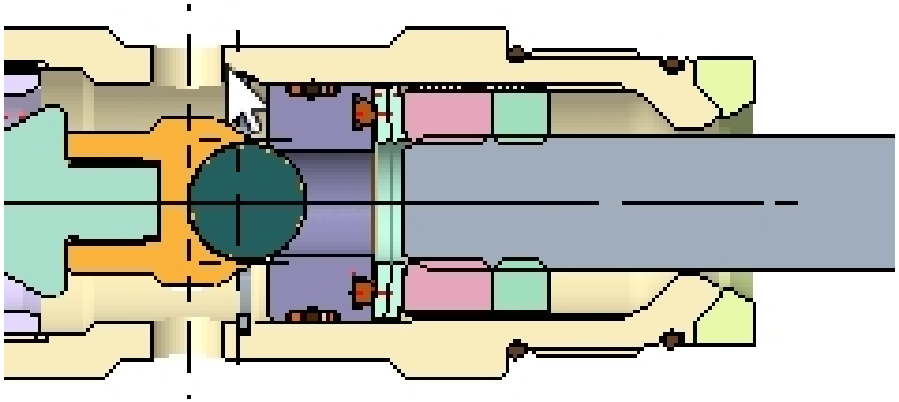


TSMS setting procedure



TSMS detail



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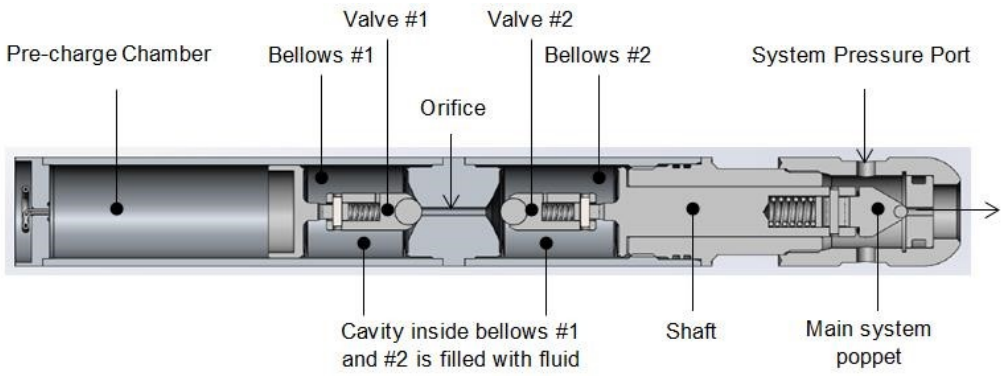
# Existing high pressure gas lift valves on the market  valve with DEWB




- EWB-edge welded bellows do not compress to solid. This is wrong bellow type.
- Valve features spring loaded internal check valves with metal-to-metal sealing, these always leak.
- Valve feature spring loaded telescoping stem, this is very complicated to set right way.

- Monster 1.75” gas lift valve, this valve is using 4 bellows filled with silicone oil. This is extremely complicated gas lift valve. I think this valve simply is not working even at 3000 PSI dome pressure as advertised.
- Dome side bellows subassembly and injection side bellow subassembly is filed with silicone oil. Bellows are of two different sizes.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