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반도체 Package 공정용 EMC Gun에 관한 연구

(A Study on the Semi-conductor Package Process Epoxy Moulding Compound Gun)

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요 약

EMC를 정량 Moulding 후 잔량 처리와 작동 시 역 차단 방식의 설계하여 기계적 동작에 의해 흡입이 일어나도록 하여 Needle Tip의 잔량과 사인 현상을 해결하였다. 본 논문에서는 Gun과 세척제 Tank를 직결하도록 설계하여 세척이 용이하며, 원하는 량을 미리 계량하여 정밀 정량을 고속으로 EMC를 Molding 할 수 있도록 개발하기 때문에 반도체 Packaging 공정에 필수적인 장비라고 사료된다.

Abstract

EMC(epoxy moulding compound) when operate with residual quantity processing after fixed quantity moulding inverse close way of designing by mechanical action inhalation so that may occur, solved of needle tip residual quantity and cause of thread extend phenomenon. In this paper, design to connect directly gun, washer tank and measuring beforehand amount that washing is easy and want minuteness fixed quantity that essential equipment in semi-conductor packaging process because develop EMC so that can molding with high speed consider.

Keywords : EMC(epoxy moulding compound), thread extend phenomenon, needle tip, gun, packaging

Ⅰ. Introduction

Packaging that connect and protect from environment round moisture or dust and endurably in mechanical hammer of semi-conductor chip input, output and Interlink power terminals as electrical with outside affects big price of integrated circuit element, dependence, performance etc.

Sudden integrate diagram of chip regard about field with necessity about increase and more inputs by multi-function anger, number of output, the fast speed, pitch that distance between minute pin and high heat special quality increase.

Packaging technology assembly process that thread completed integrated circuit package to PWB(printed wiring board) so that reduce whole necessity area and space maximum as well as percentage speed and exactly research and development become[1].

If EMC that used for package suture material has chip, connection leading wire, heat expansions coefficient that things such as pins which grow to outside differ in limit examination measuring through temperature change, crack can occur between contacted pin.

In this case, because water is impressed through aperture, result that canker bonding pad or jumpers that aluminum can caused.

Also, big stress between suture material and silicone chip happens and problem that change

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electrical characteristic of chip happens.

Must manage mixing ratio of EMC, temperature and moulding amount minutely to solve such problem[2].

EMC in case of moulding must apply pressure tank/gun way because error by tank column of water difference occurs infinitesimal fixed quantity moulding become and fixed quantity measuring way is occurring by the alternative accordingly.

Cattle capacity measuring of gun development is essential in trend that infinitesimal measuring EMC gun need semi-conductor, electricity electronic, miniaturization of ministry of Information & communication grade and precision by being uncivilized chuck field.

But, depending on imports present or work by hand work or syringe type manually, causes badness by allowable error of parts that need minuteness fixed quantity pouring in and becomes material costs invincible cause by excess pouring in[3],[4].

Also, pump way is several thousands [withdrawal] that pour infinitesimal amount (0.01~1.0 [cc/shot]) and a day or must pour high speed intermittence fixed quantity to each parts more than 10 thousand [withdrawal], as well as difficult to solve cause of thread extend phenomenon and needle tip residual quantity after pouring in when use EMC pump of washing becomes problem starting price when threefold work again moulding because is high than pressure tank way pressure tank way use must.

In this paper, design to connect directly gun and washer tank and measuring beforehand amount that washing is easy and want minuteness fixed quantity that essential equipment in semi-conductor packaging process because develop EMC so that molding with high speed consider.

Ⅱ. Theoretical ancient temple of system

When move suspending pump, when halt driving pump, without arriving driving or suspension state instantaneously because of inertia that water is stabilized via complicated state change at short time.

1. Water hammer phenomenon occur in water pipe

Occur when pump does hitch mainly but when move, animation is diameter way and water level changes occur to moving of pump, when changed dispensing amount by valve and except when suspend in suction tank.

But, transient phenomena of suspension beginning does not become big problem if consider beforehand accident of maximum flow amount usually.

2. Hammer of water

Speed of flow changes sharply in pipe line and uprising or descent of within the pipe pressure refers to state as water hammer phenomenon.

When power been giving to pump to power failure in water pipe of pump cut suddenly, when close hastily or open when pump moves hastily or valve water hammer happens[5].

Because rise of pressure or size of descent by water hammer is different even if time that want in valve open close is different according to and during time and depend to special quality etc. state of pipe line, speed of flow, pump in speed of flow change, quiescence of pump or moving method, valve reorganization, the provision method is erratic.

When intercepts hastily power that become the biggest problem among water hammer that happen in pump precinct, phenomenon that happen is as following.

가. When no valve in dispensing sides

(1) Power failure rectification starting pump driving

Pump is going to rotate continuously by rotation part inertia of pump and electric motor even if supply of power is discontinued but there is no been energy that itself has rapidly according to flowing of red snapper time very, all number of rotations of pump, dispensing pressure, outward flow amount are decreased sharply.

Fluid flowing pressure of pump is suspended in

pipe line because pump rotates but can not send water really for direction pressure of dispensing sides pipe line and the concordant moment once.

(2) Power failure flowing backward starting brake driving

Because water flow which suspend once changes by flowing backward since the next moment, pulsator of pump is been reverse rotation but dispensing sides pressure of pump begins to be ascending to resistance that not flow enough.

Reflect with power failure flowing backward starting brake driving pressure and dispensing sides pressure of pump begins to be ascending.

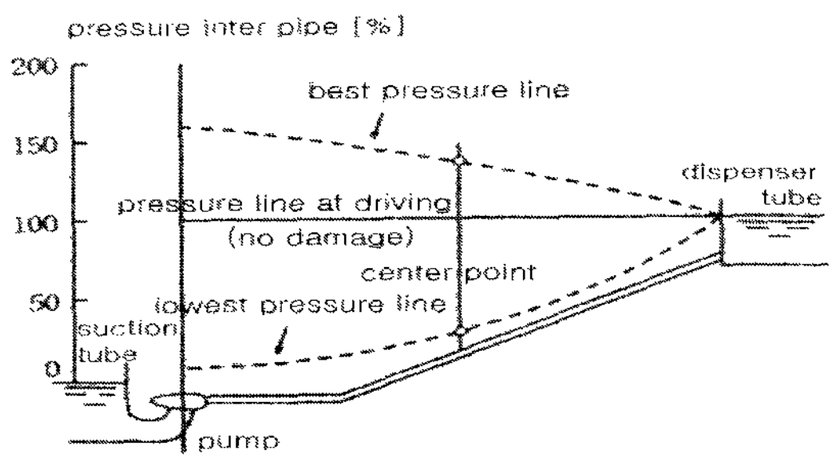
Change by rise pressure because reflecting with pressure that power failure flowing backward starting brake driving pressure descent and rise wave motion of dispensing sides pressure of pump is begun[6].

In the meantime, pump reduces turning by braking action of water that flowing backward and turning is suspended in end.

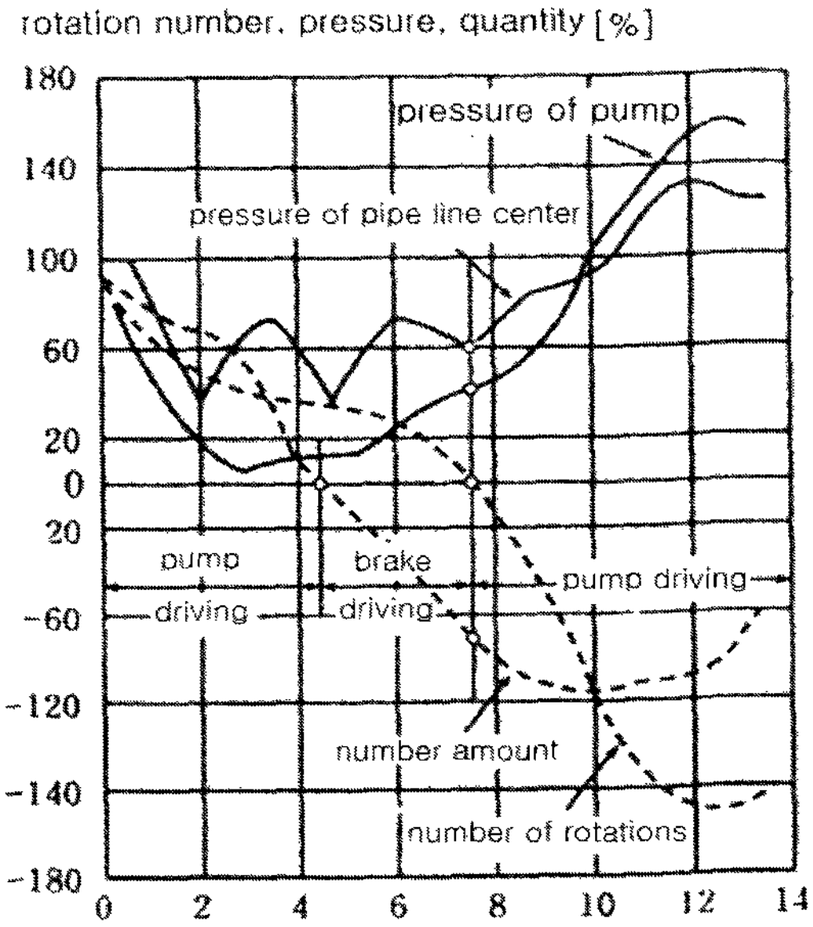
(3) Reversal flowing backward starting water mill driving

Pump flowing backward by 110~130% of formality number rotations by water mill state of no-load finally because starting reversal of a situation by no-load water mill action by water that flowing backward the moment and accelerated gradually because quantity becomes by 60~80% of formality quantity, fixed no way speed arrives in the speed of state that there is no braking.

And when transient phenomena after power interception, figure 1 (a) is structure when no dispenser side valve, (b) is expressing efficiency when no dispenser side valve.



(a) 토출 측에 valve가 없을 때 구조
(a) Structure no valve in dispensing sides.



(b) 토출 측에 valve가 없을 때 효율
(b) Efficiency no valve in dispensing sides.

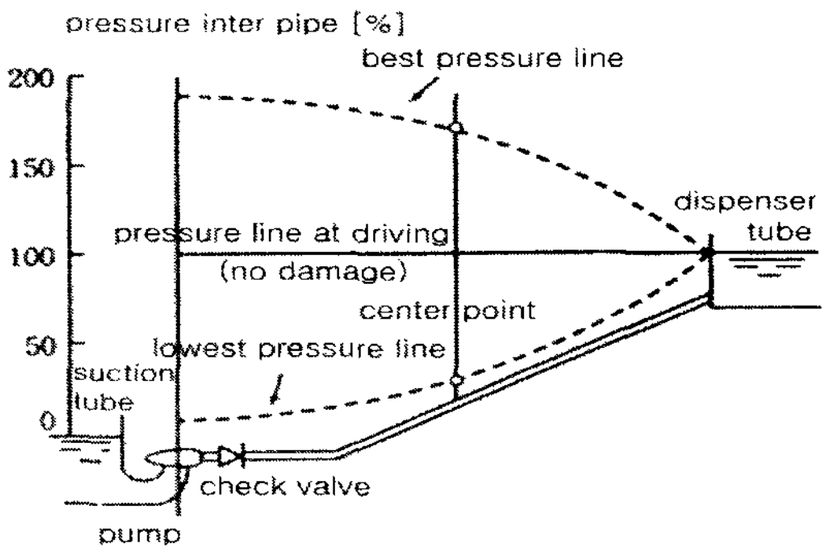
그림 1. 동력 차단후의 과도현상
Fig. 1. Transient phenomena after power close.

나. When check valve in dispensing side

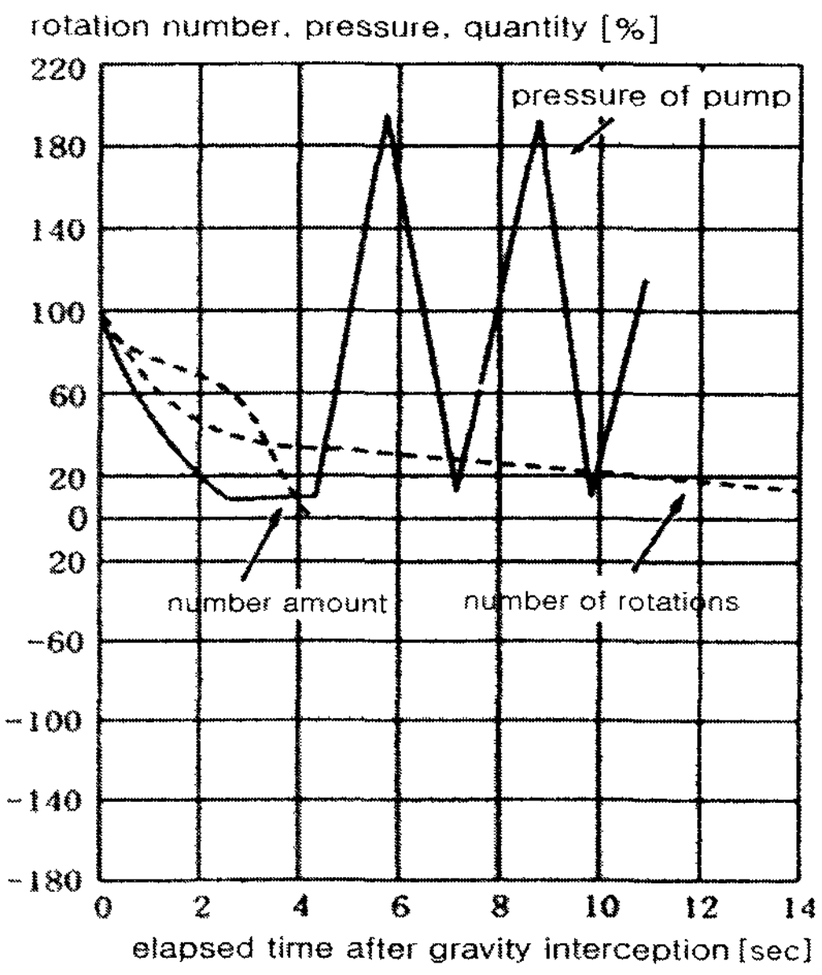
If there is check valve, because when it is power failure flowing backward starting brake driving, water is shut almost at the same time starting flowing backward, flowing backward phenomenon does not happen hardly.

Pump continues turning in water that intercepted but lose and suspend energy.

If after check valve is close, pipe line pressure rise occurs since the moment and check valve shuts at the moment that water flowing is suspended, water hammer is thought that not happen but when check valve gets closed, descent pressure that occur when it is power failure rectification starting pump driving that get thin is reflected to dispensing tank and pressure of quantity degree that fall in stationary state because come back in place that it is getting into rise pressure of same amount check valve is ascending.



(a) 토출 측에 check valve 있을 때 구조
(a) Structure when check valve in dispensing sides.



(b) 토출 측에 check valve 있을 때 효율
(b) Efficiency when check valve in dispensing sides.

그림 2. 동력 차단후의 과도현상
Fig. 2. Transient phenomena after power close.

If check valve imposes remainder of pressure rise to intercept hastily the flowing backward because get closed as flowing backward is begun, by fixed cycle after because check valve state is bad, pressure rise enlarges remarkably because is shut suddenly after flowing backward grows fairly and check valve shuts uprising, descent repeatedly piecemeal damp[7].

And when transient phenomena after power interception, figure 2(a) is structure when dispenser side check valve, (b) is expressing efficiency when dispenser side check valve.

다. When prevented valve of dispensing sides

When is valve in dispensing side, transient phenomena shows if control artificially.

Target of water hammer control by minimum pressure change in possible short time, intercept water flowing to flowing backward reversal that small become.

Because pressure decline of power failure rectification starting pump driving is decided by pipe line and pump, purpose of valve control does not augment greatly flowing backward since power failure flowing backward starting brake driving mainly and it is that becalms slowly.

Efficiency when figure 3 removed valve in dispensing side, when comparative pipe line is short and jot is steep slope, it quickens power failure rectification starting pump driving in power failure flowing backward starting brake driving manufacturing using needle valve of oil pressure manufacturing to main valve and power failure flowing backward starting brake driving close slowly and rise of pressure is displaying that flowing backward or reversal of a situation decrescent this time.

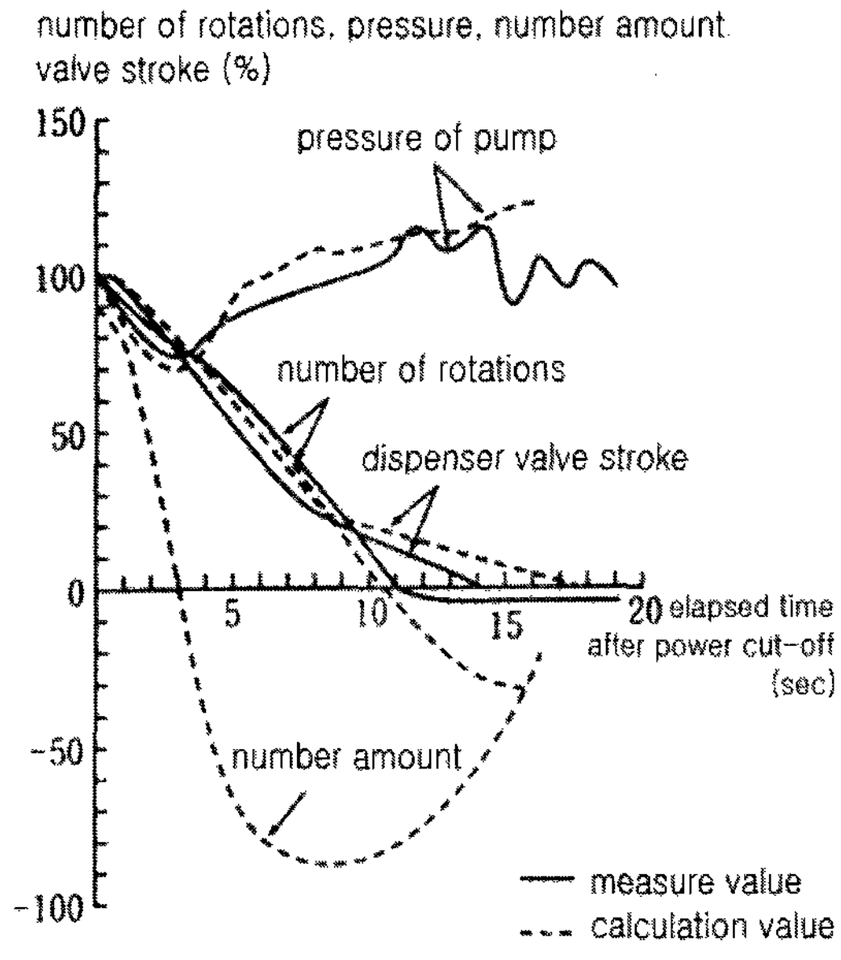


그림 3. 동력 차단후의 과도현상 일 때 효율
Fig. 3. Efficiency when transient phenomena after power prevent.

3. Reduction of water hammer

가. Damage by the water hammers

When damage expected by water hammer reduction method is as following.

(1) Pump, valve, pipe lines are damaged by water pump rise pressure.

(2) Pipe line gets pressed out of shape by pressure descent.

If vacuum pressure of some point of pipe line becomes by main air pressure low of water by pressure descent, speak as column of water separation phenomenon when cooperation part comes into being because water of within the jurisdiction is parted.

Also, when water fill again in cooperation part, as high hammer pressure happens, pipe is damaged.

When did not consideration for reversal of pump and electric motor is when raise thinking of reversal transient speed

나. Damage law of water hammer

If power failure starting water hammer rises of pressure occurs by descent , power failure flowing backward starting brake driving of pressure by power failure rectification starting pump driving and first pressure descent is big, because rise grows so much, method to shorten size must examine by order of first vacuum pressure prevention countermeasure.

(1) Prevention of vacuum pressure occurrence

Used to pump attach fly wheel and prevent that rotation speed becomes slow suddenly and absorb sudden pressure descent of power failure rectification starting pump driving.

Surge tank is method that establish surge tank and supply water to pipe line when pressure descent after hitch of pump to pipe line.

Think surge tank gang leader in pump as for water hammer of pump because is opposed of surge tank free surface with pressure that happen from pump way out.

Surge tank height need at a minimum to same water way wiring of pump driving starting and thought about rise transitional who occur at moving starting again.

Establish check valve surge tank and connection part piping of pipe line and supply water to pipe line when pressure of pipe line fell than tank high but water can not flow on the contrary.

Therefore, can lower tank height and manufactured economically more than surge tank but need water level monitor and check valve or fast water device.

Air valve uses when outpoured to water supply pipe line since air valve establishment point by inhaler to establish and inhales pipe line at vacuum pressure appearance to pipe line vacuum pressure occurrence point but air exclusion in pipe line is difficult usually.

Air tank is establish air tank near dispensing way of pump, send water or air in air tank so that pressure descent according to power failure rectification starting pump driving, dispensing amount rapid decrease may be reduced.

When send water capacity of air tank becomes as high price growing and problem to air exclusion method when send air.

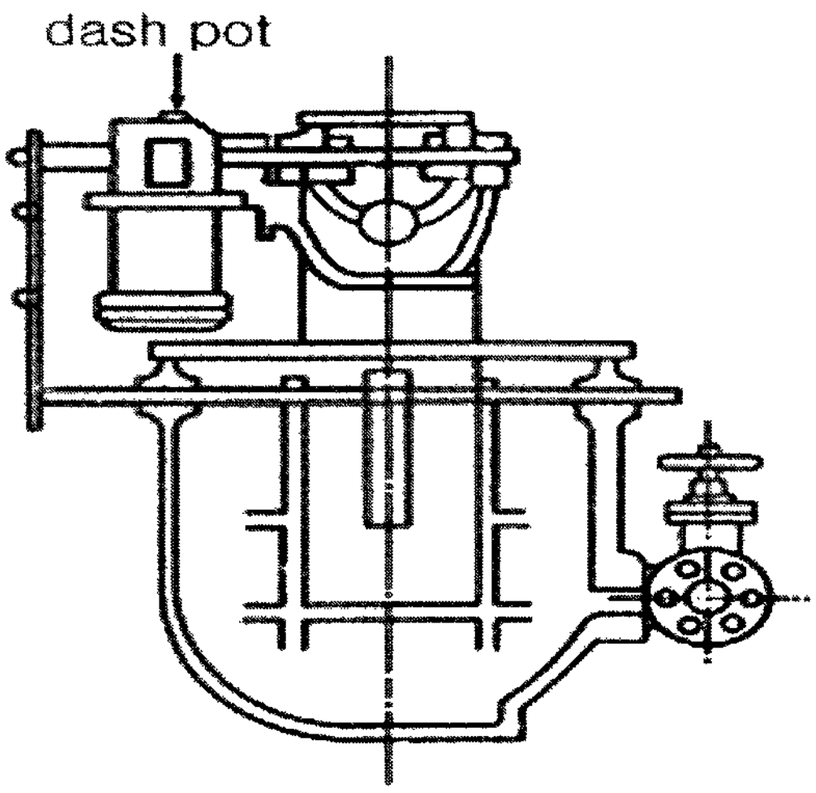
And enlarge of pipe line diameter and minish Inter pipe water of flow,

Because inertial force of column water is decrescent in pipe line, decrescent even if pressure descent.

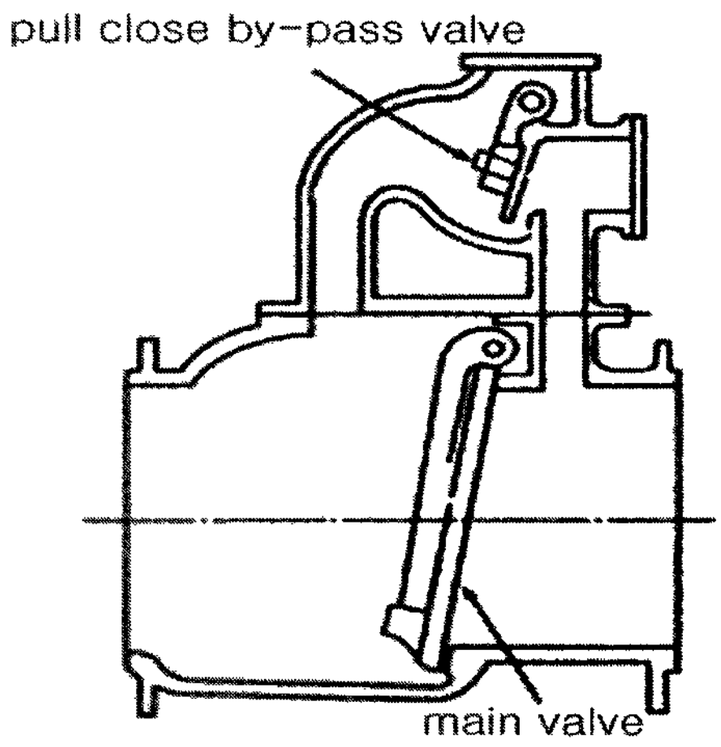
Shape alteration of pipe line is apt to cause water column separation and change piping shape of pipe line if stand straightly in pump neighborhood usually and lays pipes in near form in horizontal between pump and piping.

(2) Prevention of pressure rise

Pull close valve control law in figure 4 dividing the close speed by power failure flowing backward starting brake driving or reversal flowing backward starting water mill driving first stroke most flowing backward of pump or Inverse whole provisions and remainder pressure rise to total close driving method



(a) 덧슈 포트 구조
(b) Dash pot structure.



(b) 안전 차단 바이 패스 밸브 구조
(b) Pull close by-pass valve structure.

그림 4. 완전 차단 check
Fig. 4. Pull close check.

to do pull close slowly to reduce be.

Valve not write series check valve or foot valve, of valve type need apart write needle valve of oil pressure drive, rot valve, glove valve and oil pressure device because close compulsion with the suitable speed by oil pressure.

Because use dispensing of pipe line water flowing in opening and shutting, flowing equipment is unnecessary for one direction.

Usually, pressure rise is controlled in 30% within of common use pressure.

Safety valve take precautions because is used but when open actions are delayed and not finish function properly to remove rise pressure.

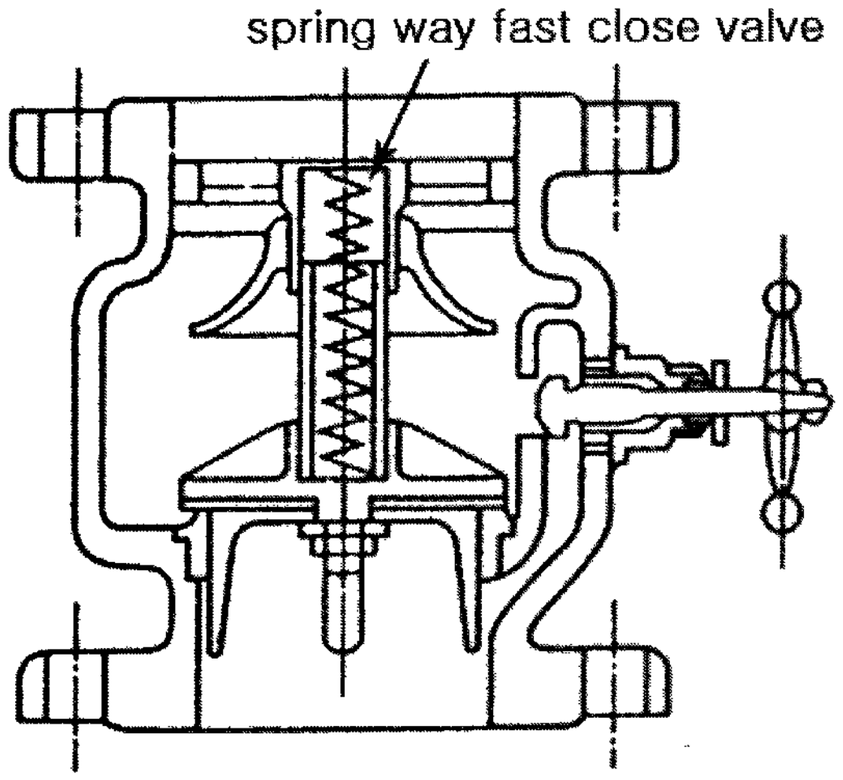


그림 5. spring 식 급폐 check valve 구조
Fig. 5. Structure spring way fast close check valve.

Because close stating at flowing backward of fast close valve control law in figure 5 is delayed by ordinary check valve, flowing backward grows and valve becomes fast close, pressure rise grows.

There is coercive valve that resist water flowing just before is flowed backward depending by spring or weight to prevent this.

And spring way fast close check valve is used in small way diameter and weight part check valve uses in big way diameter.

Number that such valve prevents original water hammer that occur in pipe line because prevent pressure rise because it is late that gotten closed increase that be.

This time, thing which close is late of check valve becomes an issue but pipe line is short and thread appreciation is fair and very profitable in building water supply pump.

Ⅲ. Experiment method and result

1. Experiment method

Circuit composition of figure 6 was composed, sets action mode selection of control unit time to "A" and sets air pressure of control unit by 4 [kg/㎠] after power switch so that "ON" by control unit, pressure tank and fluid close valve.

Open of dispensing way ball valve of pressure tank and pressure as long as is rapidly later

automatic/passivity switch in "MAN" and operated and stop as during time that set at time if follow foot switch.

After stop as set time if exchange timer to "B" mode and as "Automatic" when wish to apply automatically, again dispensing continuous control action becomes possible being this time, is intercepted if must follow foot switch this time and stop signal action is possible as "Passivity".

Dispensing amount establishment order is decided being proportional between needle inside diameter, pressure of tank and scum of dispensing launch, needle dispensing amount, viscosity of material is decided because considering mucus area and pressure of tank sets dispensing amount ratchet from low pressure after establish necessary pressure, not apply high pressure from first this time, air pressure as "0" as air-conditioner.

When use liquid, after lock drain valve and scum of dispensing way ball valve, put dispensing material, close lid, go alternately for diagonal line direction and tighten flange bolt, connect air quick coupler socket to plug of air-conditioner.

As connect main air circle, ratchet pressure of tank according to viscosity of material, open dispensing way ball valve, connect liquid hose and dispensing is confirmed, and lock cock after confirm dispensing again by same trick.

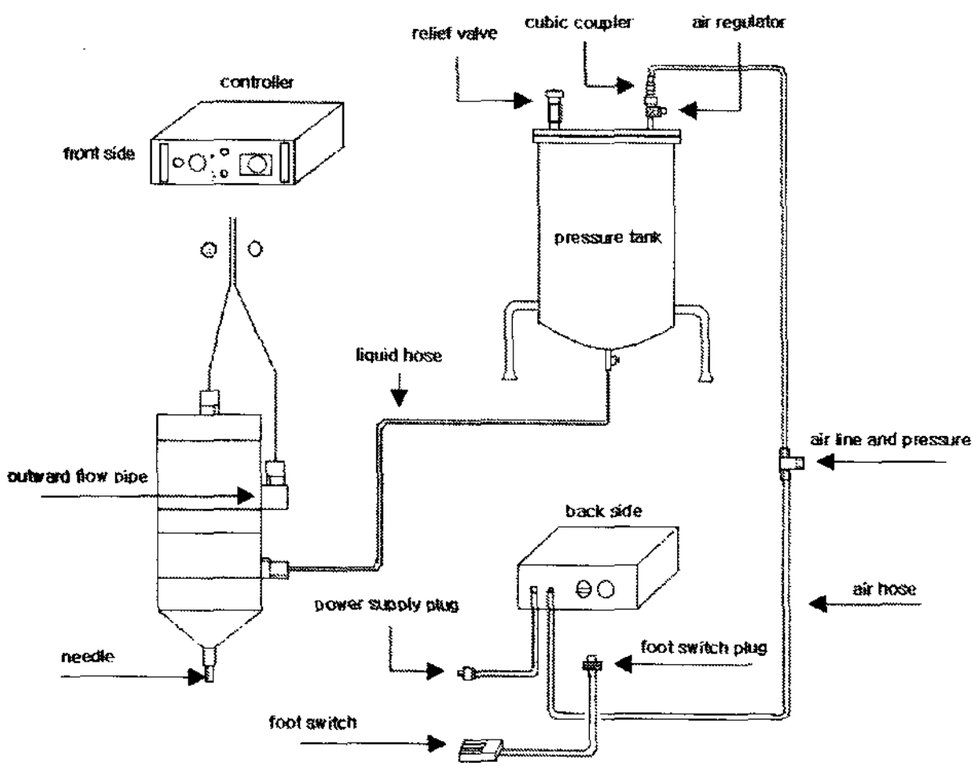


그림 6. 반도체 Package 공정용 EMC Gun 밸브 구조
Fig. 6. Semi-conductor package process EMC gun valve structure.

Liquid valve air hose of controller air out "A" to superior part of valve, speed control that connect hose of "B" to middle fitting, attached to valve superior part breaking speed, middle department connects liquid hose that linked on tank regulating the dispensing speed in valve lower column goods to aid in a funeral liquid, viscosity of material sends out and attach needle holder choosing necessary needle according to dispensing amount.

2. Experiment result

Figure 7 is expressing action special quality of EMC gun.

Liquid used silicone in figure 8, after dispensing time sets by 0.1[s]close withdrawal after 10[withdrawal] dispensing average value 0.1[cc], 20[withdrawal] average values appeared by 0.099[cc]. This time, setting pressure is 4.0[kgf/cm^2], use temperature is 20 [℃].

Liquid used silicone in figure 9, after dispensing

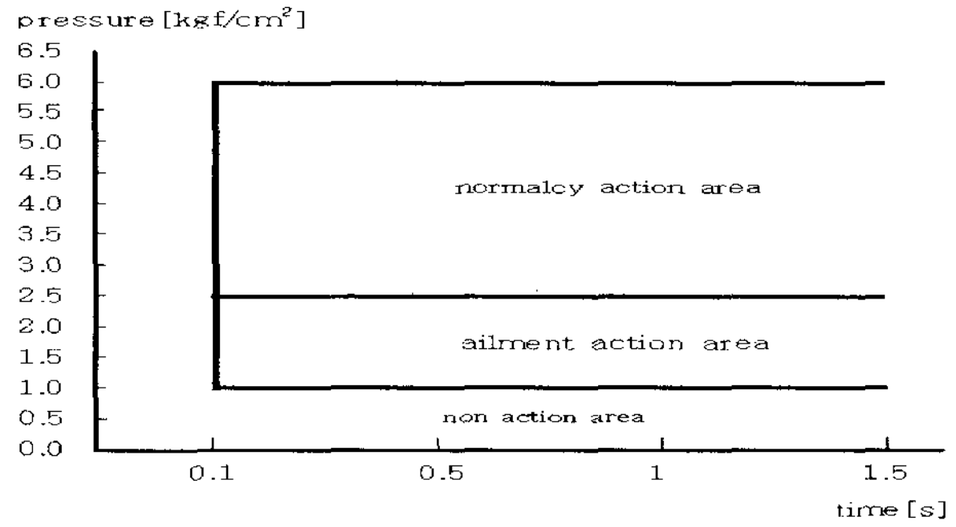


Fig. 7. EMC gun의 동작 특성
Fig. 7 Action special quality of EMC GUM.

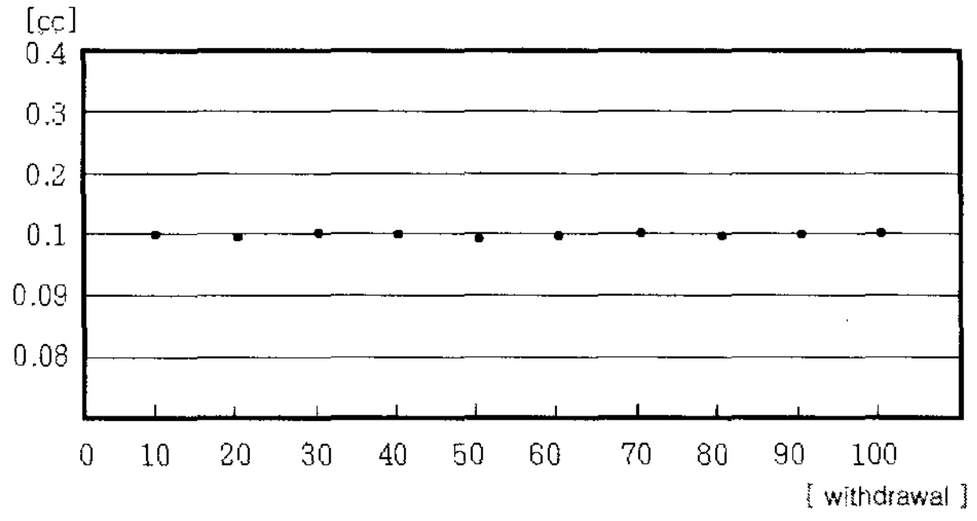


그림 8. 평균값이 0.1[cc]일 때 토출 량
Fig. 8. Dispensing amount when average value 0.1[cc].

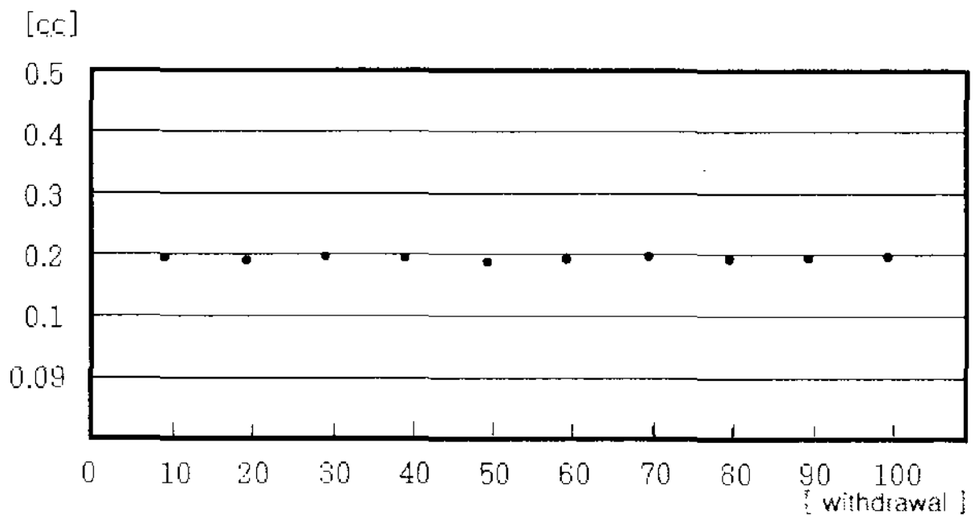


그림 9. 평균값이 0.2[cc]일 때 토출 량
Fig. 9. Dispensing amount when average value 0.2[cc].

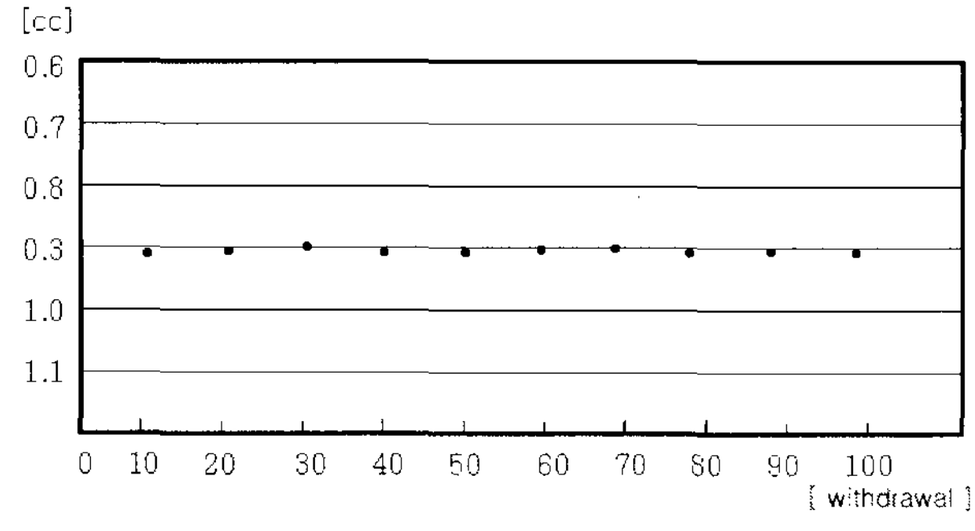


그림 10. 평균값이 0.3[cc]일 때 토출 량
Fig. 10. Dispensing amount when average value 0.3[cc].

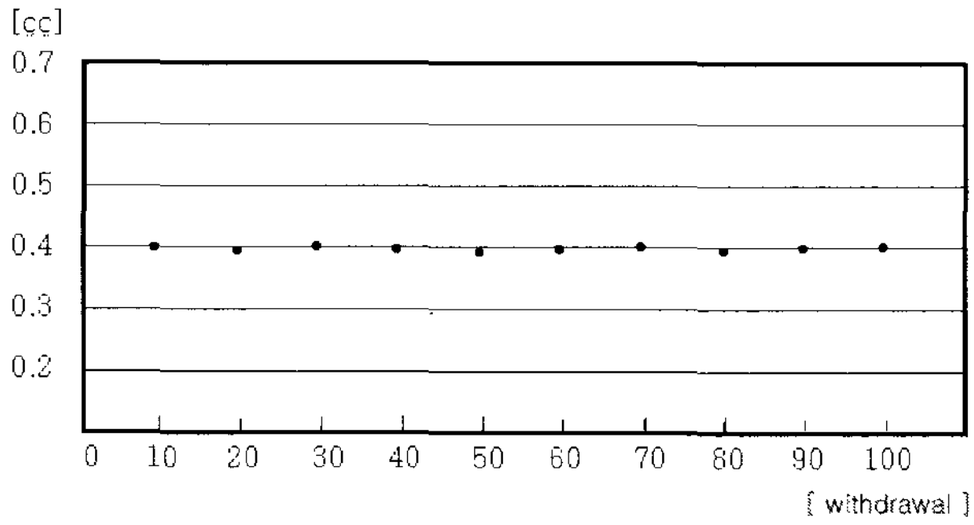


그림 11. 평균값이 0.4[cc]일 때 토출 량
Fig. 11. Dispensing amount when average value 0.4[cc].

time sets by 0.1[s]close withdrawal after 10[withdrawal] dispensing average value 0.2[cc], 20[withdrawal] average values appeared by 0.199[cc]. This time, setting pressure is 4.0 [kgf/cm^2], use temperature is 20 [℃].

Liquid used silicone in figure 10, after dispensing time sets by 0.1[s]close withdrawal after 10[withdrawal] dispensing average value 0.3[cc], 20[withdrawal] average values appeared by 0.299[cc]. This time, setting pressure is 4.0 [kgf/cm^2], use temperature is 20 [℃].

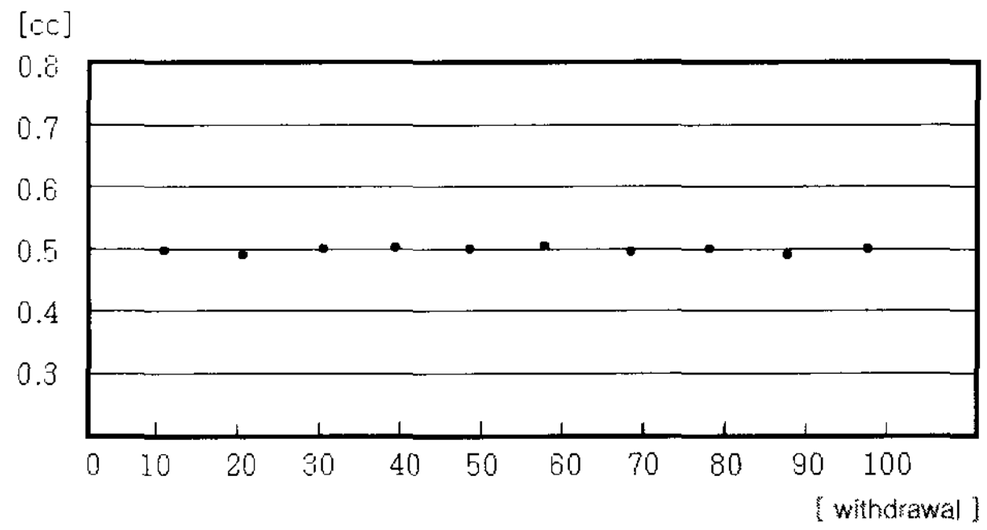


그림 12. 평균값이 0.5[cc]일 때 토출 량
Fig. 12. Dispensing amount when average value 0.5[cc].

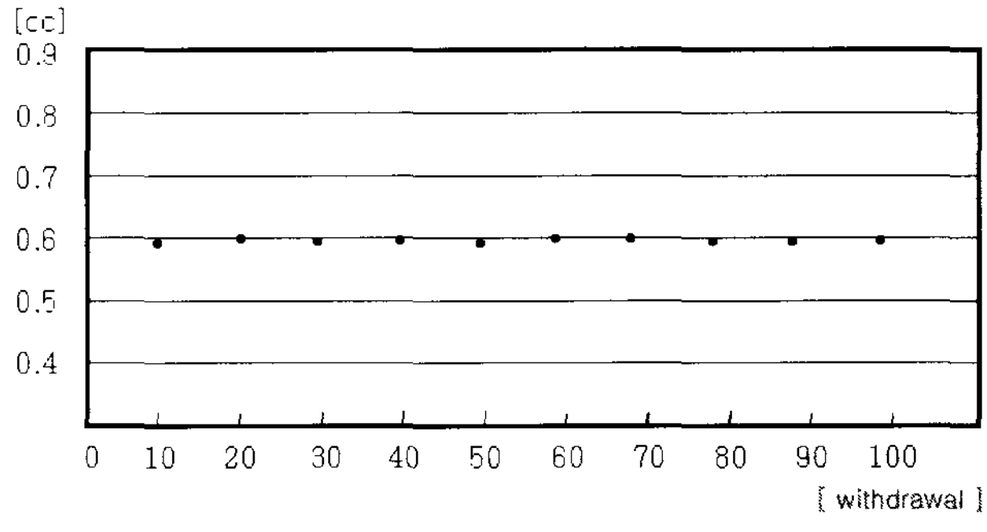


그림 13. 평균값이 0.6[cc]일 때 토출 량
Fig. 13. Dispensing amount when average value 0.6[cc].

temperature is 20 [℃].

Liquid used silicone in figure 11, after dispensing time sets by 0.1[s]close withdrawal after 10[withdrawal] dispensing average value 0.4[cc], 20[withdrawal] average values appeared by 0.399[cc]. This time, setting pressure is 4.0 [kgf/cm^2], use temperature is 20 [℃].

Liquid used silicone in figure 12, after dispensing time sets by 0.1[s]close withdrawal after 10[withdrawal] dispensing average value 0.5[cc], 20[withdrawal] average values appeared by 0.499[cc]. This time, setting pressure is 4.0 [kgf/cm^2], use temperature is 20 [℃].

Liquid used silicone in figure 13, after dispensing time sets by 0.1[s]close withdrawal after 10[withdrawal] dispensing average value 0.6[cc], 20[withdrawal] average values appeared by 0.599[cc]. This time, setting pressure is 4.0 [kgf/cm^2], use temperature is 20 [℃].

Liquid used silicone in figure 14, after dispensing time sets by 0.1[s]close withdrawal after

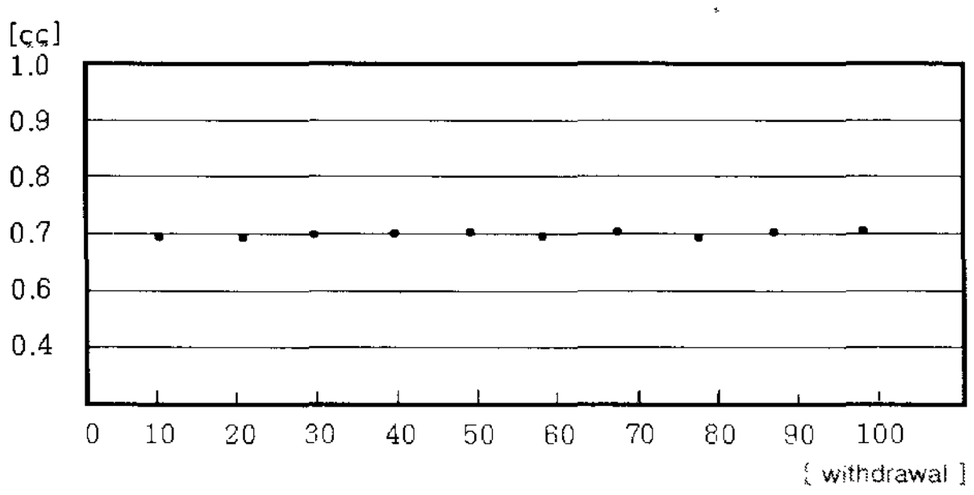


그림 14. 평균값이 0.7[cc]일 때 토출 량
Fig. 14. Dispensing amount when average value 0.7[cc].

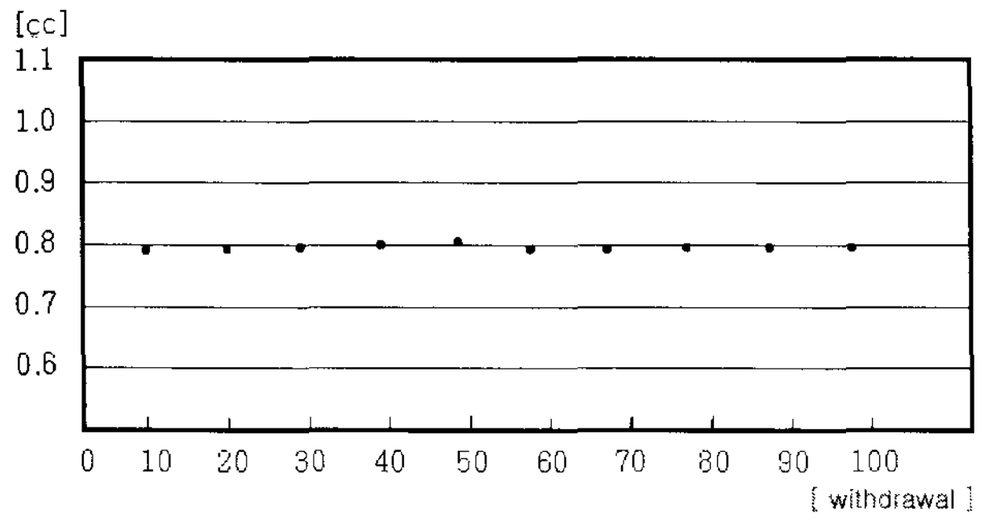


그림 15. 평균값이 0.8[cc]일 때 토출 량
Fig. 15. Dispensing amount when average value 0.8[cc].

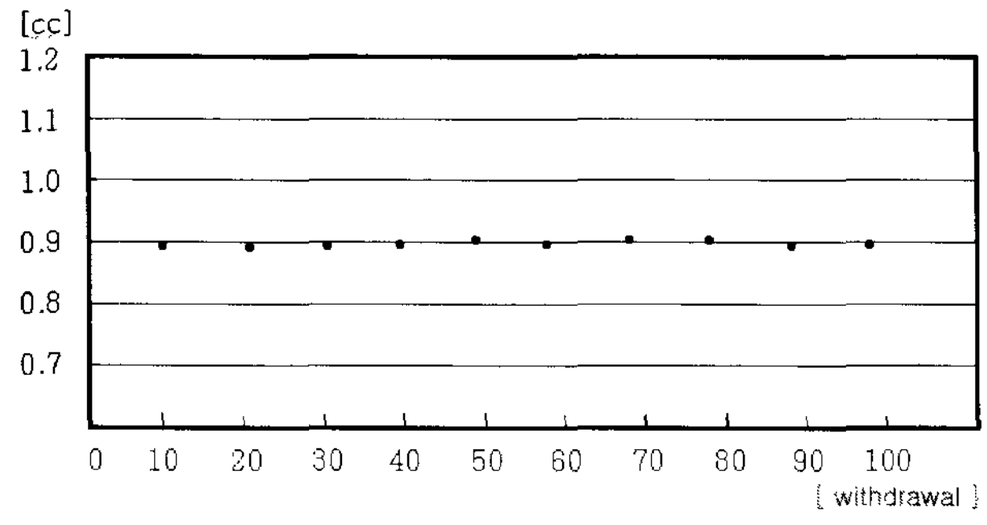


그림 16. 평균값이 0.9[cc]일 때 토출 량
Fig. 16. Dispensing amount when average value 0.9[cc].

10[withdrawal] dispensing average value 0.7[cc], 20[withdrawal] average values appeared by 0.699[cc]. This time, setting pressure is 4.0 [kgf/cm^2], use temperature is 20 [℃].

Liquid used silicone in figure 15, after dispensing time sets by 0.1[s]close withdrawal after 10[withdrawal] dispensing average value 0.8[cc], 20[withdrawal] average values appeared by 0.799[cc]. This time, setting pressure is 4.0 [kgf/cm^2], use temperature is 20 [℃].

Liquid used silicone in figure 16, after dispensing

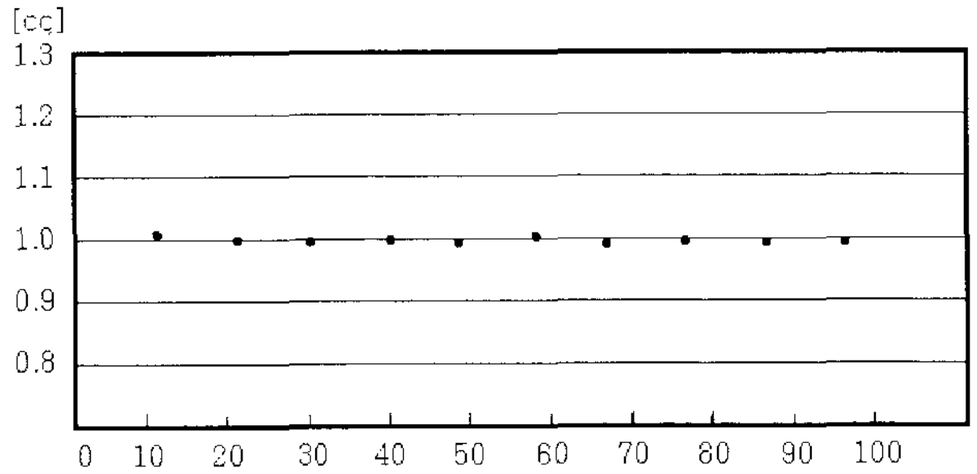


그림 17. 평균값이 1.0[cc]일 때 토출 량
Fig. 17. Dispensing amount when average value 1.0[cc].

표 1. EMC gun valve의 잔량제거 흡입에 대한 결과
Table 1. Result about residual quantity exclusion inhalation of EMC gun valve.

Development project	Domestic level before development	Results[%]
Pouring in amount : 0.1[cc]	Simplicity close way : ±3.0[%]	100 ±1.0[%]
Suction length[mm]	−0.5	100−1.0
Cycle time[s]	0.3	100+0.1
Liquid close speed[s]	0.3	100+0.1
Durability−filler Ingredient[withdrawal]	100.000	132.371
Pouring in amount : 0.1[cc]	Simplicity close way : ±3.0[%]	100 ±1.0[%]
Total tolerance[%]	Simplicity close way : ±3.0[%]	100 ±1.0[%]

time sets by 0.1[s]close withdrawal after 10[withdrawal] dispensing average value 0.9[cc], 20[withdrawal] average values appeared by 0.899[cc]. This time, setting pressure is 4.0 [kgf/cm^2], use temperature is 20 [℃].

Liquid used silicone in figure 17, after dispensing time sets by 0.1[s]close withdrawal after 10[withdrawal] dispensing average value 1.0[cc], 20[withdrawal] average values appeared by 0.999[cc]. This time, setting pressure is 4.0 [kgf/cm^2], use temperature is 20 [℃].

Ⅳ. Conclusion

Solved of needle tip residual quantity and cause of thread extend phenomenon so that inhalation for

nozzle tip residual quantity exclusion may occur after standardization of measuring capacity and dispenser completion.

In this paper, after sets displayed of EMC gun dispenser time by 0.1 [s], interception withdrawal by 10 [times] experiment result in table 1 and measuring beforehand amount that washing is easy, want designing to connect directly EMC gun and washer tank minuteness fixed quantity that essential equipment in semi-conductor packaging process because developed EMC so that molding with high speed consider.

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