Solving the engineering problems in SME's by using TRIZ methodology

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ТРИЗ + TRIZ

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- Introduce TRIZ-consulting project conducted by **K**orea-**R**ussia **I**ndustrial **T**echnology **C**ooperation **C**enter at Korea Polytechnic University(Further – KRITCC's TRIZ project)
- ARIP-2009
- Case presentation: "How to clean the clogged pores of Air-vent?" (Woo Kwang Tech. Co.,Ltd.)
- Conclusions

Objectives

- To introduce the project on implementation of TRIZ methodology to solve the production and engineering problems in SME's in Korea (KRITCC's TRIZ project)

- To show that the TRIZ is powerful and useful for developing creative process in SME's and to demonstrate the prospects of TRIZ application to companies of small and medium business

KRTICC's TRIZ project

❖ Backgraund

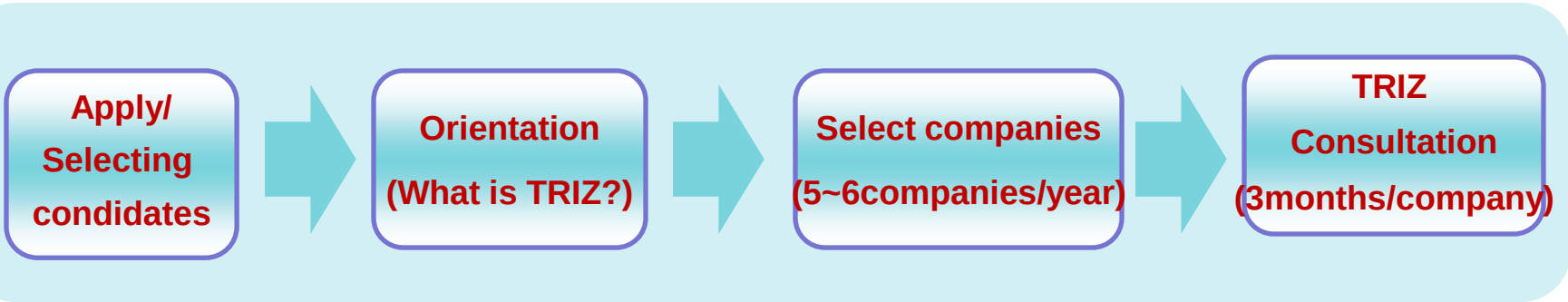
- In Korea TRIZ mostly has been applied to large companies such as Samsung, Hyundai and POSCO. As their significant successes or activities in applying TRIZ has been known to Korean industrial society, so the need from SME's for applying TRIZ as innovation tool has increased more and more. However, TRIZ is not widely implemented to SME's yet, not only due to their lack of manpower and financial resource, but due to weak assurance of success in TRIZ application to their organizations.

- Korea-Russia Industrial Technology Cooperation Center at KPU founded in 2004 by Ministry of Knowledge Economy as a Mecca of industrial technology cooperation between Korea and Russia. In 2009 we organized TRIZ-consulting project on solving production and engineering problems in SME's with Russian TRIZ experts-consultants in purpose of supporting for establishing an innovation environment in SME's

KRTICC's TRIZ project

❖ Project resume

- TRIZ-consulting project was started by KRITCC in 2009 under the Korea-Eurasia industrial technology cooperation program by Ministery of Knowledge Economy(from 2010 this project has been conducted in cooperation with the Incheon Business Agiency)
  - organize Russian TRIZ experts-problem solver team and collaborate with company's engineer team
  - provide principal concepts to solve production and engineering problem during 3 months consultation



KRTICC's TRIZ project

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ТРИЗ + TRIZ

❖ KRITCC's TRIZ team

Prof. Song /
Project Leader

Dr. Kang/
Project Manager

Mr. M. Gafitulin
(TRIZ Master)

Mr. I. Ivanov
(TRIZ expert in 17 years experince)

Mr. A. Bystritskiy
(TRIZ expert in 20 years experince)

KRTICC's TRIZ project

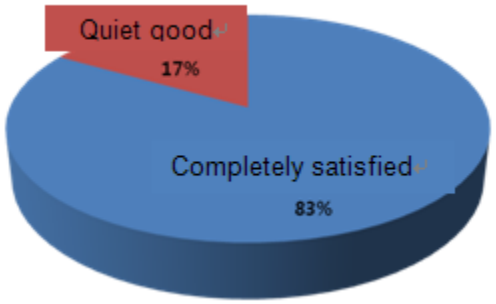
❖ Project results (2009~2010)

- Worked with 15 companies in various industry areas(electronics, mechanical engineering, chemical engineering, materials, metallurgy etc.)
- Provided 146 breakthroug ideas (in average 10 ideas/company)
  - 7~8 probe test failures → test passed without failure (Willtechnology.Co.Ltd)
    *the failure cost of probe test in 2008 was 350 million won
    *applied for a patent
  - Reduction of production cost 30,000 won/ea. → 1,000 won/ea.(Woo Kwang Tech.)
  - Improvement of heat dissipation structure of heat sink using convection circulation system (Noxtech Co.,Ltd)
    * 30~40% reduction cost for raw materials purchase
    * Applied for a patent
- Applied for 6 patents (and plan to apply for 5 patents)

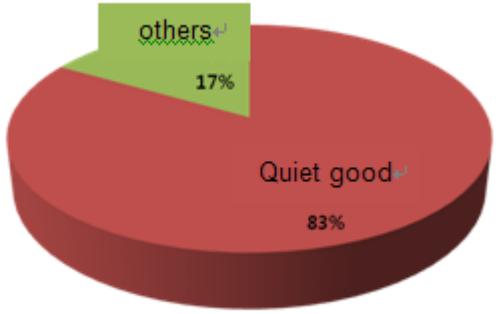
KRTICC's TRIZ project

- The result of survey on Project in 2010 (response from 6 companies)

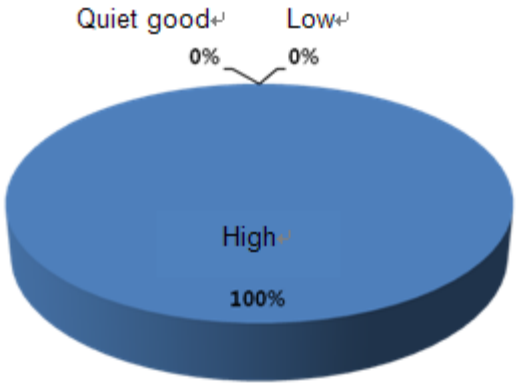
Did you satisfy TRIZ consultation?



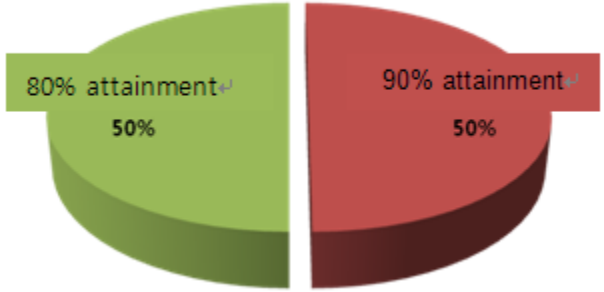
Did you satisfy TRIZ consulting duration?



How think about professionalism of TRIZ consultatns?



About goal attament by TRIZ consulting



ARIP-2009

❖ Basic steps for sovling engineering problems

Analysing resourses & Defining problem in terms of IFR

find contradiction

Resolving contradictions

✓Methods for resolving contradicton - separation in time, space, changing relations

✓40 Principles

✓Standards

Analysing the problem systematically & Finding the root cause of the problem.

Using physical-chemical effects

Problem

SOLUTION!

INVENTIONS !

The root cause of the problem

Evolution Law of technical system

ARIP-2009

❖ Algorithm to solve engeering problems – 2009 (ARIP-2009) by G.Ivanov group

➢ ARIP-2009 is used as a basic method for systematic analysis and solving production and engineering problems

Main ideas of ARIP

•Not to solve the problem, but to create conditions under which it dosen't occur

•The problem must be analysed in place where it appears at first and eliminated using resources that can be found in there.

•What caused the problem eliminates that problem

•Correctly formulated problem itself shows its solution

ARIP-2009

Part 1. Descript and formulate the problem

Part 2. Confirm the need to solve the problem

Part 3. Clarify the formulated problem

Part 4. Analyse the Su-Field resourses

Part 5. Formulate IFR

Part 6. Formulate the physical contradiction

Part 7. Resolve the physical contradiction

Part 8. Analyse the found solution

Case presentation

How to clean the clogged pores of Air-vents?

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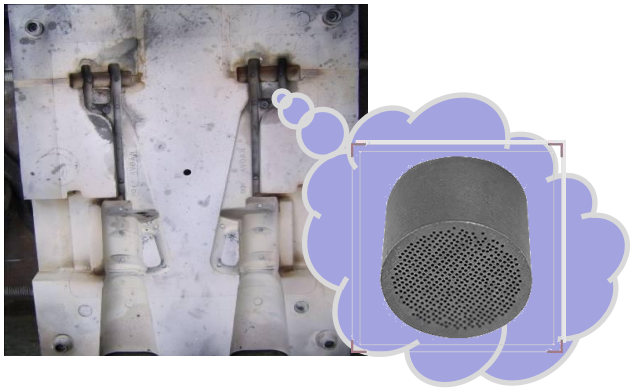
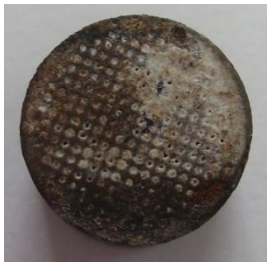
KOREA POLYTECHNIC UNIVERSITY

ТРИЗ + TRIZ

(주) 우광테크
Woo Kwang Tech

Problem situation





This company(a foundry) uses the steel mould for casting aluminum products. In this technical process filter(air-vent) is placed into the steel mould.

The problem is that in a few months all pores of this filter are clogged by DYCOTE, emulsion for refractory coating, and those filters became useless. Air-vent is necessary to prevent steel mould from defectiveness

These filters(air-vent) are imported from Japan, the cost is 30,000won/ea. So the company has been looking for soultion of this problem for 10 years using various methods(mechanical, chemical ext.) to clean the clogged pores of the filter.

Case presentation

How to clean the clogged pores of Air-vents?

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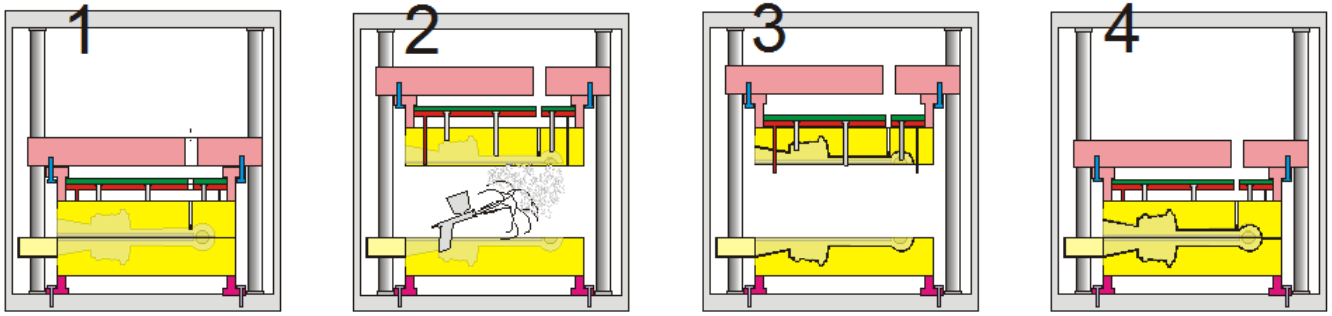
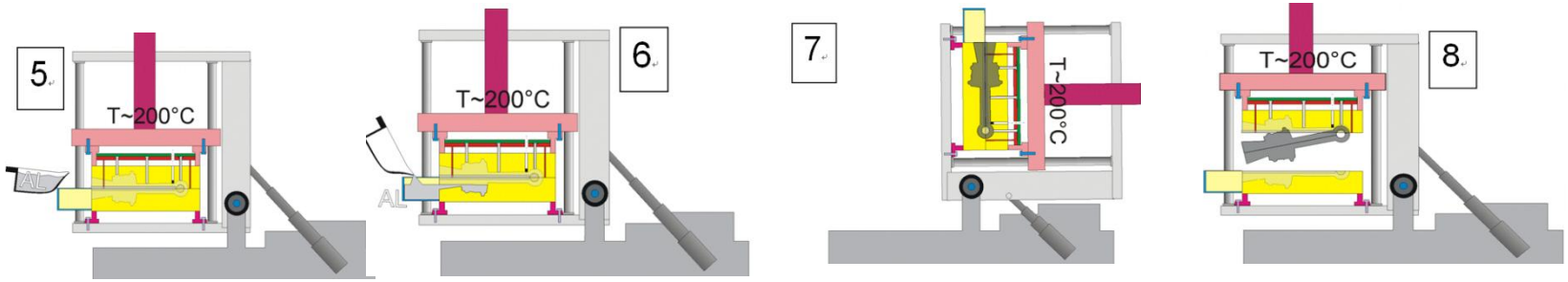
Descript & formulate the problem

- Problem Analysis
  - Analysis of technical process of DYCOTE coating



  - Analysis of technical process of injection



Case presentation

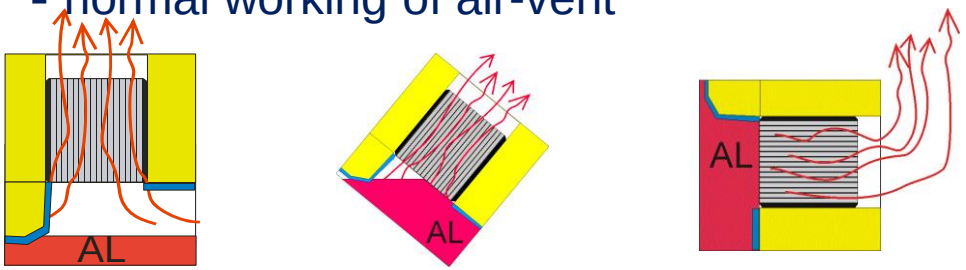
How to clean the clogged pores of Air-vents?

Descript & formulate the problem

- Fuction definition
  - What is function of the filter-air-vent?
  - What is fuction of Dycote?

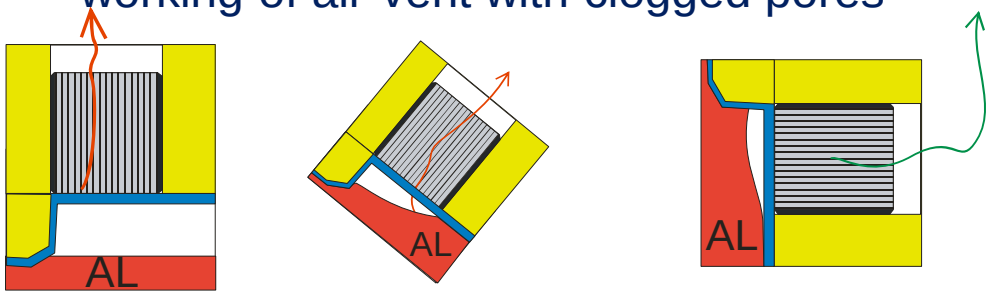
☞ Air-vent and Dycote are necessary elements in technical process

- Analysis of “operating zone” and find an undesirable element
  - normal working of air-vent



• Formation of air lock leads to interfere with heat dissipation and violate a condition for metal crystallization

  - working of air-vent with clogged pores

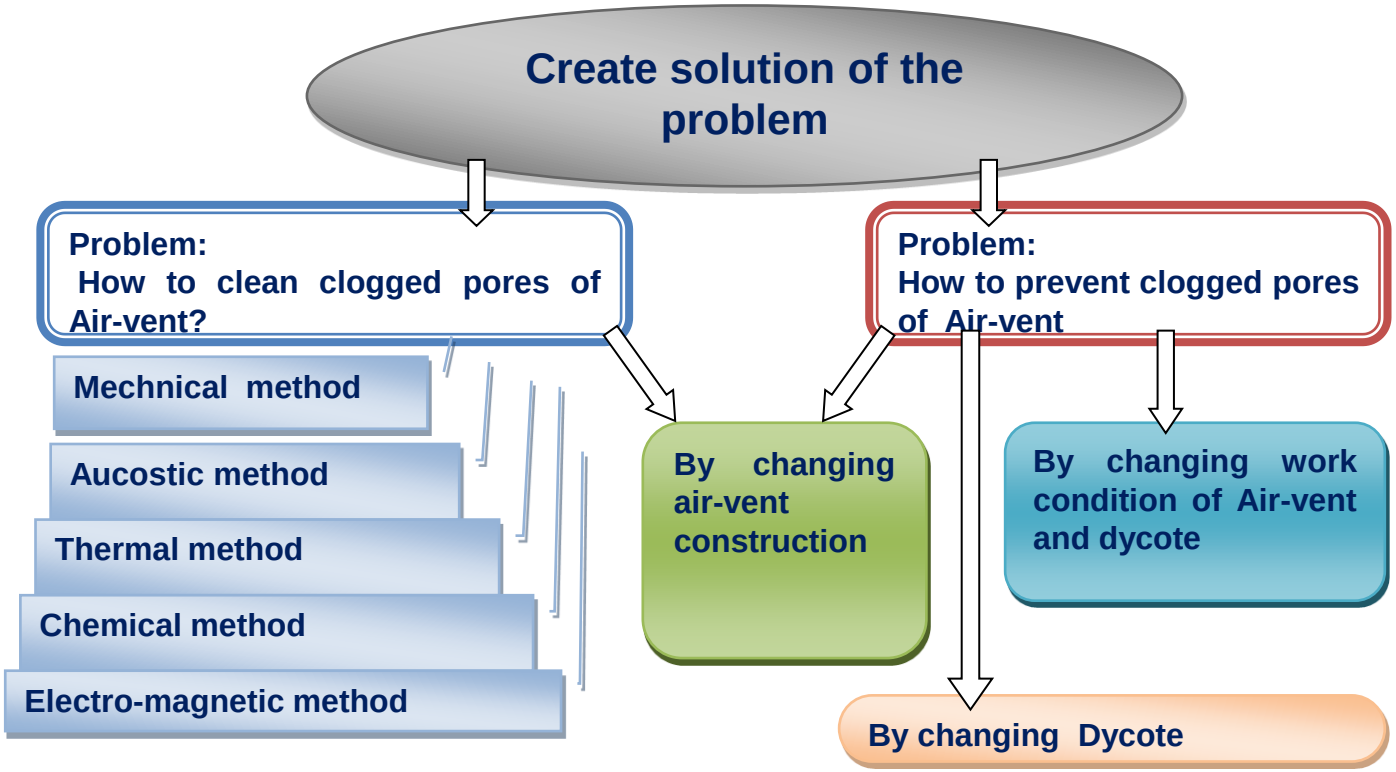


• Air lock is formed by deposited dycote layers because sprayed dycote to pores dosen’t melt and become solidified.

Case presentation

How to clean the clogged pores of Air-vents?

Clarify(reformulate) the formulated problem



☞ the company changed the probleme:

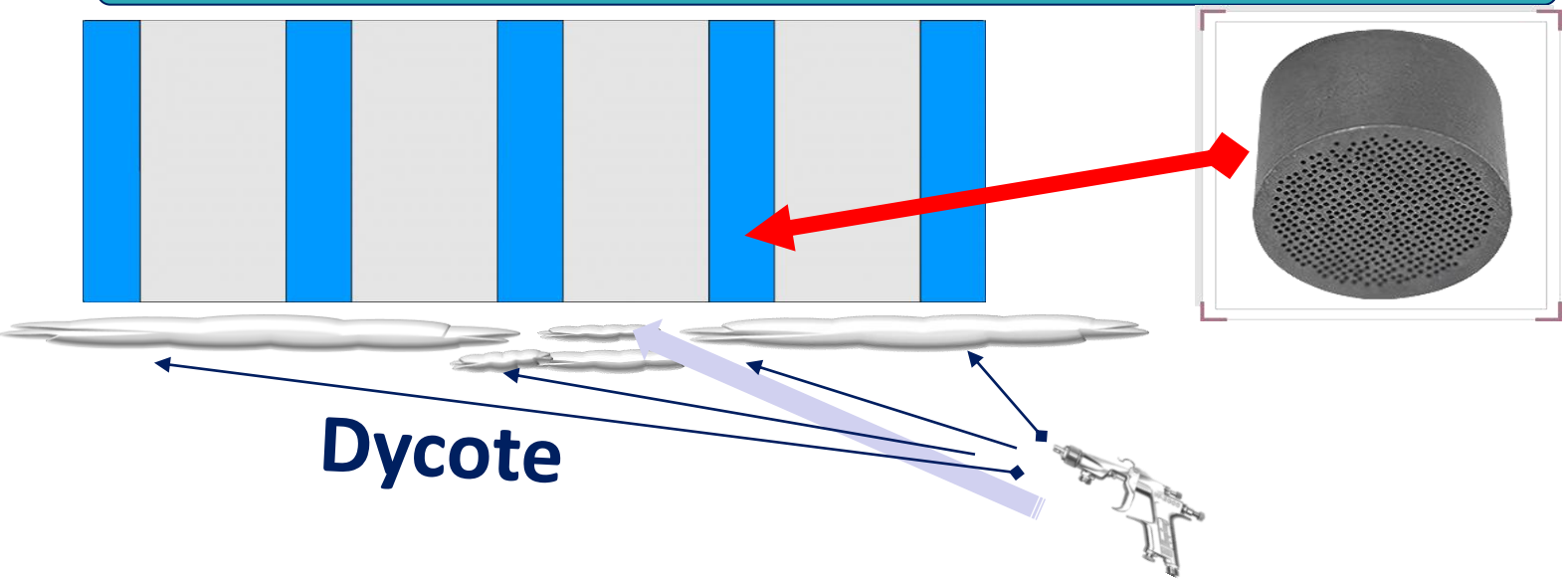
How to clean clogged pores of Air vent (to remove an effect) →

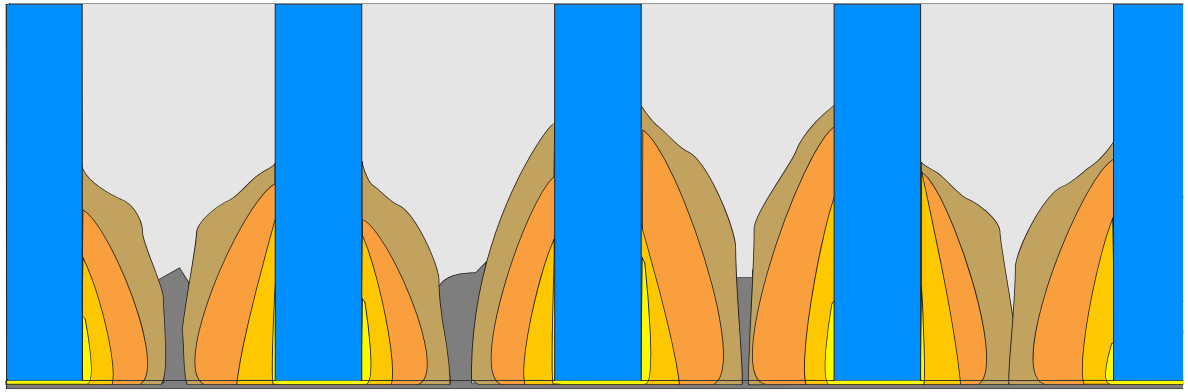
How to prevent clogged pores of Air vent (to remove a root caues)

Case presentation

How to clean the clogged pores of Air-vents?

Analyse physical process – Why the pores are clogged?





- formulate physical contradiction
- resolve physical contradiction by separation of contradiction in space

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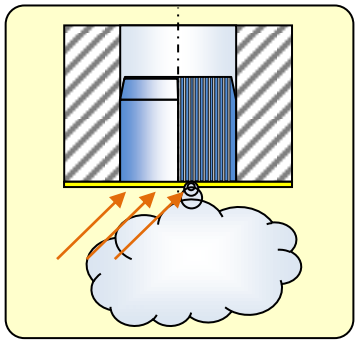
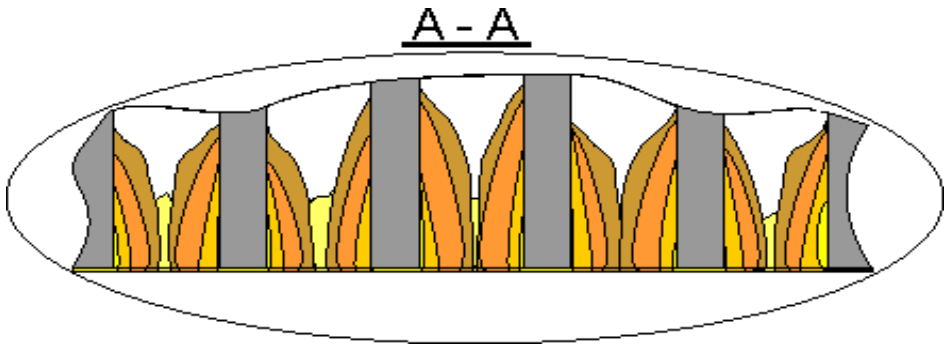
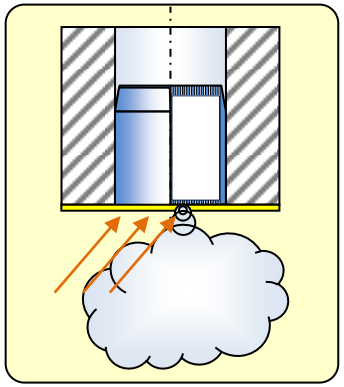
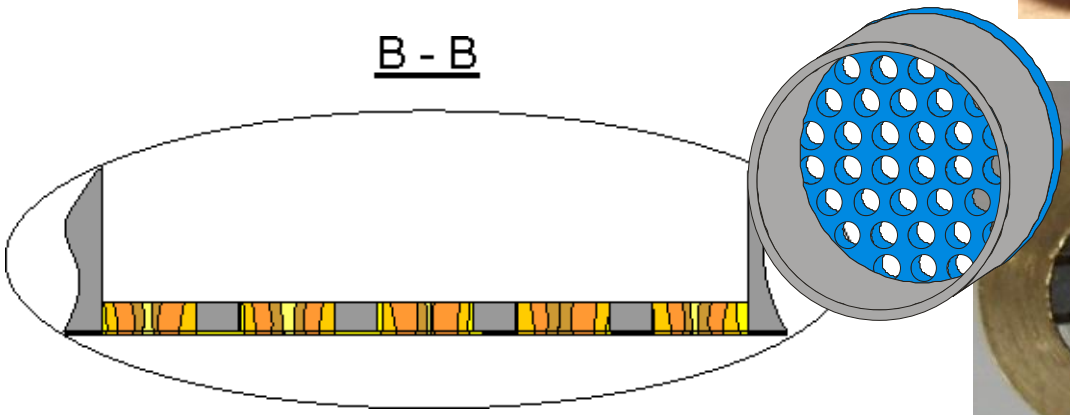
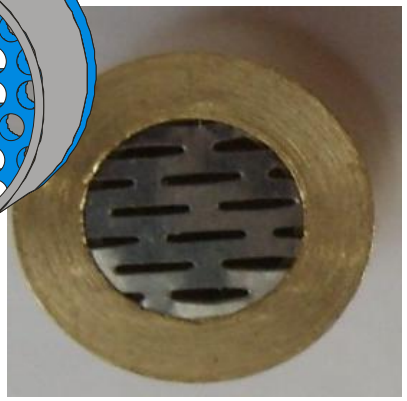
Analyse found soultion











✓ The company itself produces new Air vent :

- reduce the prodcution cost (30,000won/ea → 1,000 won/ea.)
- the pores are NOT clogged at all.

Case presentation

How to clean the clogged pores of Air-vents?

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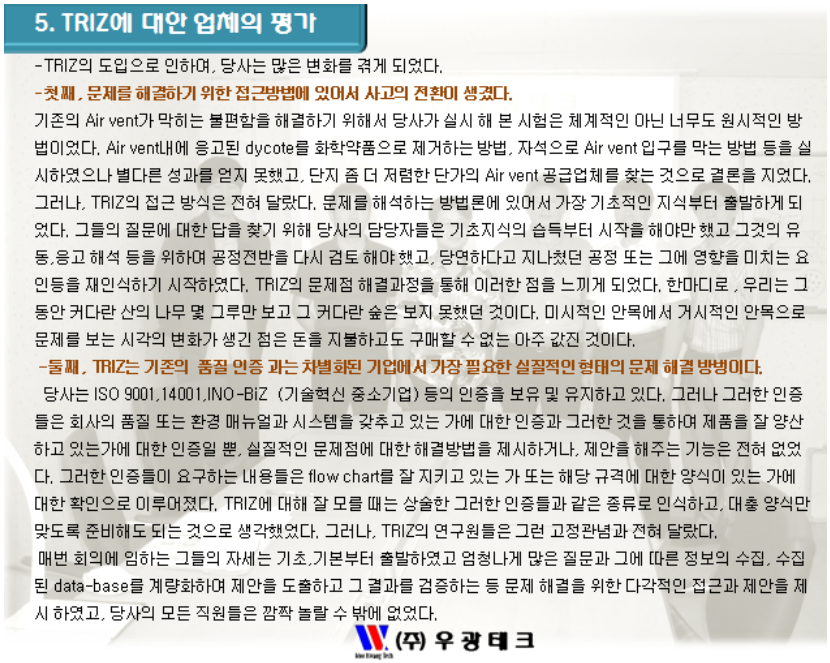
Company’ s comment

- TRIZ makes egineers of company think systematically
- TRIZ is the practical method for solving problems that is almost necessary for SME
- TRIZ must be used widly in SME



5. TRIZ에 대한 업체의 평가

-TRIZ의 도입으로 인하여, 당사는 많은 변화를 겪게 되었다.

-첫째, 문제를 해결하기 위한 접근방법에 있어서 사고의 전환이 생겼다.

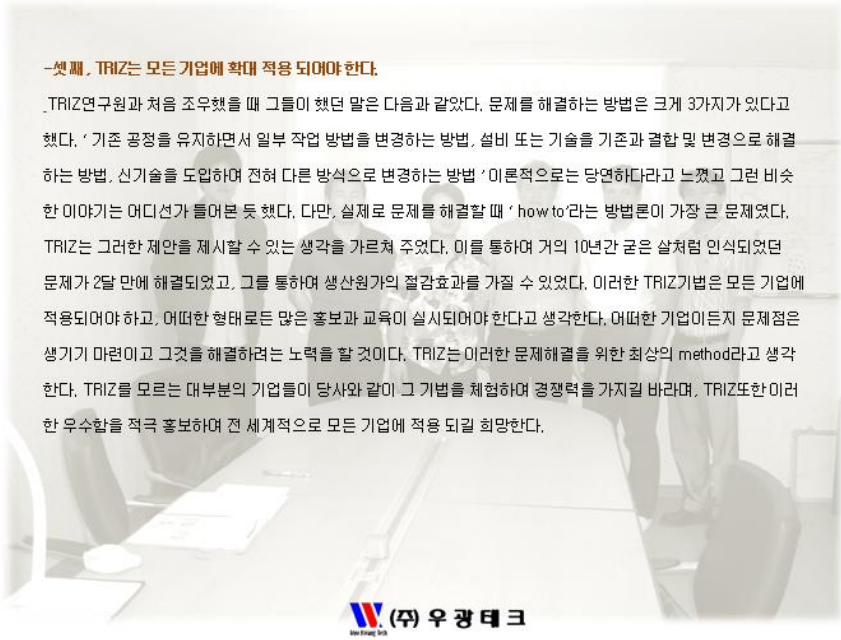
기존의 Air vent가 막히는 불편함을 해결하기 위해서 당사가 실시 해 본 시험은 체계적인 아닌 너무도 원시적인 방법이었다. Air vent내에 응고된 dycote를 화학약품으로 제거하는 방법, 자석으로 Air vent 입구를 막는 방법 등을 실시하였으나 별다른 성과를 얻지 못했고, 단지 좀 더 저렴한 단가의 Air vent 공급업체를 찾는 것으로 결론을 지었다. 그러나, TRIZ의 접근 방식은 전혀 달랐다. 문제를 해석하는 방법론에 있어서 가장 기초적인 지식부터 출발하게 되었다. 그들의 질문에 대한 답을 찾기 위해 당사의 담당자들은 기초지식의 습득부터 시작을 해야만 했고 그것의 유동,응고 해석 등을 위하여 공정전반을 다시 검토 해야했고, 당연하다고 지나쳤던 공정 또는 그에 영향을 미치는 요인등을 재인식하기 시작하였다. TRIZ의 문제점 해결과정을 통해 이러한 점을 느끼게 되었다. 한마디로 , 우리는 그동안 커다란 산의 나무 몇 그루만 보고 그 커다란 숲은 보지 못했던 것이다. 미시적인 안목에서 거시적인 안목으로 문제를 보는 시각의 변화가 생긴 점은 돈을 지불하고도 구매할 수 없는 아주 값진 것이다.

-둘째, TRIZ는 기존의 품질 인증 과는 차별화된 기업에서 가장 필요한 실질적인 형태의 문제 해결 방법이다.

당사는 ISO 9001,14001,INO-BiZ (기술혁신 중소기업) 등의 인증을 보유 및 유지하고 있다. 그러나 그러한 인증들은 회사의 품질 또는 환경 매뉴얼과 시스템을 갖추고 있는 가에 대한 인증과 그러한 것을 통하여 제품을 잘 양산하고 있는가에 대한 인증일 뿐, 실질적인 문제점에 대한 해결방법을 제시하거나, 제안을 해주는 기능은 전혀 없었다. 그러한 인증들이 요구하는 내용들은 flow chart를 잘 지키고 있는 가 또는 해당 규격에 대한 양식이 있는 가에 대한 확인으로 이루어졌다. TRIZ에 대해 잘 모를 때는 상술한 그러한 인증들과 같은 종류로 인식하고, 대충 양식만 맞도록 준비해도 되는 것으로 생각했었다. 그러나, TRIZ의 연구원들은 그런 고정관념과 전혀 달랐다.

매번 회의에 임하는 그들의 자세는 기초,기본부터 출발하였고 엄청나게 많은 질문과 그에 따른 정보의 수집, 수집된 data-base를 계량화하여 제안을 도출하고 그 결과를 검증하는 등 문제 해결을 위한 다각적인 접근과 제안을 제시 하였고, 당사의 모든 직원들은 깜짝 놀랄 수 밖에 없었다.

(주) 우광테크



-셋째, TRIZ는 모든 기업에 확대 적용 되어야 한다.

TRIZ연구원과 처음 조우했을 때 그들이 했던 말은 다음과 같았다. 문제를 해결하는 방법은 크게 3가지가 있다고 했다. ' 기존 공정을 유지하면서 일부 작업 방법을 변경하는 방법, 설비 또는 기술을 기존과 결합 및 변경으로 해결하는 방법, 신기술을 도입하여 전혀 다른 방식으로 변경하는 방법 ' 이론적으로는 당연하다라고 느꼈고 그런 비슷한 이야기는 어디선가 들어본 듯 했다. 다만, 실제로 문제를 해결할 때 ' how to'라는 방법론이 가장 큰 문제였다. TRIZ는 그러한 제안을 제시할 수 있는 생각을 가르쳐 주었다. 이를 통하여 거의 10년간 굳은 살처럼 인식되었던 문제가 2달 만에 해결되었고, 그를 통하여 생산원가의 절감효과를 가질 수 있었다. 이러한 TRIZ기법은 모든 기업에 적용되어야 하고, 어떠한 형태로든 많은 홍보과 교육이 실시되어야 한다고 생각한다. 어떠한 기업이든지 문제점은 생기기 마련이고 그것을 해결하려는 노력을 할 것이다. TRIZ는 이러한 문제해결을 위한 최상의 method라고 생각한다. TRIZ를 모르는 대부분의 기업들이 당사와 같이 그 기법을 체험하여 경쟁력을 가지길 바라며, TRIZ또한 이러한 우수함을 적극 홍보하여 전 세계적으로 모든 기업에 적용 되길 희망한다.

(주) 우광테크

Conclusions

- Our experience in applying TRIZ methodology to SME's shows that TRIZ is an effective and powerful for SME's to solve the engineering problems and most of all to develop creative thinking.
  - the problems which have not solved for many years(10 years, 7years, 4years) were solved in 3 months
  - Provided to every company a few solutions which are easily applied by company by using resources that can be found inside technical system
  - 8 companies applied(or plan to apply) for patents
- For solving the problems it is very important and a key point to analyse the problem systematically using 9-windows thinking, however systematic anaysis of the problems is mostly weak point for companies
  - After only correctly analysing and defining the problem we have got the solutions, and sometimes the solution became more optimized using the IFR and su-field resources

Conclusions

- ARIP as the improvement version of ARIZ for analyzing and defining the engineering problems is used effective to find out the root cause and analyze systematically. This is a basic to generate creative ideas.

Thank You !

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