



---

**Industrial Engineering is concerned with the analysis, design, improvement, installation and management of integrated systems of human resources, data, finances, materials, equipment, and energy as safely as possible with minimum impact on the environment, delivered within a holistic methodology.**

## **NEWSLETTER 8**

[From the President](#)

[Divisions](#)

[IIEA Member Expose](#)

[Quick Lock Pin Assembly Improvements](#)

[Did You Know](#)

[Consensus Decision Making-Utilising Industrial Engineering Techniques](#)

### **FROM THE PRESIDENT**

- We are entering with a very busy schedule of events. March kicks off with 3 events(2 on site and 1 webinar). Webinars will be open to all IIEA members.
- Events are planned to be in collaboration with the College of Leadership and Management(CLM) a part of EA.
- A big achievement has occurred with the resurrection of the SA division. Graham Eagles has been appointed SA Division president.
- The 2021 AGM at this time is scheduled for Saturday 11<sup>th</sup> September. At this stage whether it's a F2F(face to face)/Hybrid meeting or Webinar, will be determined. The undertaking of F2F events in Melbourne is still being determined by the Covid19 situation.
- New members are being welcomed on a regular basis. We hope to get these members participating in our events and activities.
- The IIEA is actively working with Curtin University and University of Melbourne in developing their IE degree courses

### **DIVISIONS**

**Queensland**-Michael Morrow(MIIEA), Program Director

QLD division has planned several events for 2021.

On 26<sup>th</sup> March 1<sup>st</sup> event Webinar CS Energy (Brian Lawrence) Visual Inspection via Technology at CS Energy

In May another Webinar is planned entitled Advanced Robotics Manufacturing (ARM) Hub showcasing advanced manufacturing in Queensland

**NSW**-Prabhu Ramdos(MIIEA)-A Webinar is planned for July.

**Victoria**-Abdul Mazid(MIIEA)-An onsite visit to OMRON entitled Cobot and programmable controllers for industrial automation on 23<sup>rd</sup> March.

**SA**-Graham Eagles(MIIEA)-21<sup>st</sup> April a Webinar entitled Designing the Way We Work with Alister Lee from UniSA. Another Webinar for May entitled Theory of Constraints – 'Love Your Constraints'-Lewis Trigger UniSA.

The SA Division is also working closely with new and existing members.

**WA**-Bob Watson(FIIEA)/David Karr(CPEng, FIIEA)



Bob Watson, our Senior Federal Vice President, on the 22nd of January presented Bill Sashegyi with his certificate for election to Fellow member. Bill earned this honour for his role in the promotion and practice of Industrial Engineering within the mining industry and his role in service to manufacturing and government peak bodies in Western Australia. Bill's father Al Sashegyi was one of the founding members who established the WA Division of the IIE in WA. Al who was a specialist Work Study lecturer at the Perth Technical College, enthusiastically mentored the mainstay of our WA graduate practitioners at the inception. WA is also undertaking a rescheduled site visit to Roy Hill Operations Centre at Perth Airport. This event is being undertaken with CLM. The good news is that the event is fully booked with 30 registrants.

---

**IIEA Member Exposé**-Cameron Makenzie(MIIEA) WA



Division

I am currently the Federal Secretary for IIEA and work full time at Woodside Energy as a Logistics Strategy Adviser, but juggle many hats beneath that title.

I have always been passionate about mathematics, and procedures (Lego, etc.) and (sometimes naively) like to see the world as neat building blocks connected together by rules. I graduated high school in 2009 when WA was still well into the mining boom and industry was screaming "we want engineers!" – my dad was an electrical engineer, and I enjoyed STEM subjects, it would have made sense to go down that path. However, I thought that if everyone was studying engineering, that surely by the time I graduated there would be a surplus of Engineers seeking work so I decided to break the mould and began studying a Bachelor of Science majoring in Actuarial Science at Curtin University. Turns out it was a good move as my friends who studied engineering all struggled to find work when they graduated and I was immediately drawn to the statistics of Actuarial Science – being able to model seemingly random events in the world felt like a superpower! However the finance aspect along with fact that at the end of the day a model is merely an indication of what may happen rather than a source of truth (particularly when it comes to economics and finance) always frustrated me a bit.

After graduating with a BSc (Actuarial Science) and working for about a year I returned to Curtin University to study a Master of Science majoring in Industrial Engineering, which was a mathematics degree geared towards the optimisation of business process via various mathematical methods. I immediately loved the exact and procedure based nature of the discipline and excelled in my studies – being awarded a spot in the Woodside Summer Vacation Program in my penultimate year working in the Browse FLNG Logistics team where I performed cost modelling of the logistic services. I was then able to take real Woodside examples back to university to use for my Masters Projects and ultimately ended up graduating with a MSc (Industrial Engineering) with Distinction where I was then fast tracked me into the Woodside Graduate Program.

I joined Woodside in the Logistics Function due to the Operations Research focus of my degree and have been working there since 2017. Over this time I have used my skills to model end to end material supply chain costs, FIFO Camp Accommodation demand, optimal offshore container fleet sizing, and vessel movements for drilling campaigns finding significant savings over the previous ways of doing this. I have also been able to develop

my softer skills through multiple contract management roles, process improvement across many stakeholders, health and safety activities, and strategy creation work. I was also given the opportunity to live and work in Karratha for two years which was an amazing time and I would recommend the town to anyone.

Recently I have been given a new role as a Product Owner of a new cost saving initiative that we are planning to deliver using an Agile model. I am responsible for directing a small team to deliver a product that will provide significant value to Woodside in a short amount of time. I will do this by ensuring the team has the right support to succeed by managing stakeholders to ensure I have the right resources, understanding the customer needs to ensure the product delivers maximum value, and ensuring the team is aligned by providing them with a clear mission and vision. It is a new challenge for me, but I am sure the skills I have developed over the years – particularly the industrial engineering skills, will allow me to deliver a maximum value product using minimum resources in an efficient timeframe.



**QUICK LOCK PIN ASSEMBLY IMPROVEMENTS**

By Prabhu Subbiah Ramdoss(MIIEA)

**PART 1**

Contents

a) Introduction: .....	4
<b>CE3.1 Project .....</b>	<b>4</b>
b) Background: .....	4
<b>CE3.2 Nature of the overall engineering project .....</b>	<b>4</b>
<b>CE3.3 Objective of the project .....</b>	<b>5</b>
<b>CE3.4 Nature of my particular work zone .....</b>	<b>5</b>
<b>CE3.5 Statement of my duties .....</b>	<b>5</b>
c) Personal Workplace Activity: .....	5
<b>CE3.7 Technical details of the work .....</b>	<b>6</b>
CE3.7a Glue .....	6
CE3.7b Keyence Vision System .....	6
CE3.7c Nordson’s Liquidyn P-Dot Precision Glue Jetting System.....	7
CE3.7d Schunk Gripper .....	8
CE3.7e Modified Schunk Gripper .....	9
CE3.7f Torque drivers .....	10
CE3.7g New manual assembly table .....	11

## a) Introduction:

### CE3.1 Project

I am going to discuss about the improvements that I made at Quick Lock pin Assembly section. This project initiated due to the known and unknown technical problems. Operators were victimized for those problems resulted in drop of Quick Lock Pin assembly production rate. Assembly operators were trying hard to meet their production rates with the problems that caused due to change in design parameters. The cause for change in design parameters has come because of a customer complaint.

Any failure in functioning of these pins may cause a major disaster. This project has been aimed to fix the problems in the assembly section to increase productivity by inventing new devices to produce consistent products, reduce operator fatigue and (after exploring the facts) address major safety issue.

## b) Background:

### CE3.2 Nature of the overall engineering project

The Assembly improvement project started after a major customer complaint, that the Quick Lock pins handles are coming apart. I could able to identify the cause for failure; it is due to improper application of a transparent Cyanoacrylate Quick Fix metal glue. The operators were not able to recognize the amount of glue is applied, when assembling the pin. Being glue's transparent nature, sometimes the assembly operators may think that they applied the glue, but in certainty it was not applied. Glue has the property that, it will be a low viscos fluid while coming out of the container or pet bottle. Once it is out within 30 seconds, it will become a semisolid after getting contact with the atmospheric moisture.

In Auto assembly machine with Fanuc pick and place robot, a Semi Auto assembly machine in which all the activities were automated (except components loading) and four manual assembly tables in which all the assembly activities were done manually for Quick Lock pins. Once the glue is the failure has been shared with assembly operators, they were trying hard to apply the same number of drops, on each pin when they assemble. This is the start for problem escalation, that leads to production drop and more fatigue for the operators. They were not able to deliver the products per customer promise date. This demanded for a feedback loop system in auto assembly machines to ensure the amount of glue dispensed and proper training to the operators on the manual assembly table.

Secondly, random products from warehouse were handpicked and did reverse torque test. Even with the presence of glue, some of the pins failed. As a result, the torque being applied on the pins were increased from 25 in-lbs to 48 in-lbs (maximum the current electric driver can do with tolerance of +2 in-lbs at 500 RPM), without understanding the installed facilities can support them.

All the assembly machines were installed with ASG electric torque drivers, has maximum of 50 in-lbs torque capacity. When torqueing at 48 in-lbs, the clamping devices used to hold the pins were not able to grip it, resulted in giving spin marks over the pin. The clamping devices are Zagar hydraulic chucks actuated by hydraulic intensifiers in manual assembly table and Pneumatic SCHUNK PZB-125-2 grippers in Auto assembly machines.

When the design parameters got tighter, there was a challenge to fix all the above problems, to validate it and necessary to invent new drivers for all button and ring handles Quick Lock pins. Earlier, operators used manual collet wrench to torque manually and a stressful compression type - special rubber inserted cup drivers for button handles.

It was a time-consuming process in old manual assembly table. The table was so clumsily designed that needs a lot of modification by changing pneumatic and hydraulic lines, new heavy hydraulic boosters, Quick directional control switch, higher capacity electric torque driver, invent a new ball drop units for first four ball size to avoid ball picking by hand and the new glue dispensing system to increase the productivity.

There were a lot of improvements are required to solve the above known technical problems, mysteries behind the unknown problems, reduce operator fatigue and increase productivity. The above needs call for the necessity of this improvement project.

### CE3.3 Objective of the project

Objective of the project is to improve the assembly line of Quick Lock pins by identifying solutions to the known and unknown technical problems, developing a glue feedback system in the auto assembly machines & standard assembly procedure, developing new driver tools, increasing productivity in manual assembly table and validating the new design parameters.

### CE3.4 Nature of my particular work zone

- Identify the key problems in Quick Lock Pin assembly section.
- Categorize them as known and unknown technical problems.
- Find solutions to the known technical problems and research the solutions for the unknown technical problems.
- Develop a feedback system for Glue dispensing to acknowledge the amount of glue is applied when assembly is carried out in Auto & Semi Auto assembly machines.
- Reduce the fatigue of the operators to work smartly than harder
- Improve and validate the product quality to meet new design parameters.
- Invent new torque drivers for all button handles and ring handle Quick Lock Pins.
- Improve productivity in manual assembly machine.

### CE3.5 Statement of my duties

- I have prepared the Six Sigma Project charter a single page report, which is a summary about the project scope, problem statements, benefits to the customer, Business, Objectives, Team members, Schedule, Risks.
- I have identified the fluorescent type Cyanoacrylate Glue Vibratite - 330F manufactured by ND industries. This Super Glue can glow under black light.
- I worked with Keyence vision system and the Auto assembly machines manufacturer to install a glue feedback system. This system has a video camera to monitor the glue being applied on each pin when it is getting assembled.
- I have driven the need for a consistent glue dispensing system, that lead to work with Nordson Corporation to study the feasibility of changing the current 752V series diaphragm valve system with Nordson Liquidyn P-Dot jetting valve to apply the same consistent beads of Vibratite 330F CA around the pin.
- I have changed all the hydraulic boosters on manual assembly machines for holding the pin with sufficient gripping force while applying new higher torque values per defined in new design parameters.
- I have replaced the SCHUNK PZB-plus-125-2 Gripper with a spring assist high gripping force SCHUNK PZB-plus-200-2-AS Gripper on Full Auto assembly machine with the new orientation base adopter, Jaws and fingers.
- Due to space constraints in Semi Auto Assembly machine, I have innovatively redesigned the same SCHUNK PZB-plus-125-2 Gripper by adding the high-tension springs to add more gripping force.
- I have improved productivity by introducing quick direction control valve, new balls drop units and glue dispensing systems on manual assembly stations.
- I have Invented the new Pin torque driver (by replacing a rubber inserted cup type) and spring-loaded lever torque drivers for button handles and ring handles. These drivers are used for applying torque over the pins consistently.

### c) Personal Workplace Activity:

## CE3.7 Technical details of the work

### CE3.7a Glue

Transparent Cyanoacrylate glue got changed to florescent Cyanoacrylate glue. Under black UV light the florescent glue will glow in pale yellow color, this feature is used as an identifier for glue presence in the application.

#### Vibra-Tite 330F Metal & Rubber Bonding Cyanoacrylate

A single component, low to medium viscosity ethyl cyanoacrylate  
Slow setting formulation designed for rubber to metal bonding with  
dye added.

#### Glue Specification

Available Sizes	1 lb, 1 oz, 1.5 mL
Shelf Life	1 Year from date of manufacture
Country of Origin	Japan
UNSPSC	31200000
Harmonized Tariff Schedule	3506.91
Key Substrates	Metal, Rubber
Fixture Time	30 sec
Full Cure Time	24 hrs
Max Gap Fill	0.006
Specific Gravity	1.09
Specifications Met	A-A3097 Type II - Class 1
Temp Range High	200°F
Viscosity (cP)	123 – 127
Color	Clear
Base Material	Ethyl
Shear Strength (psi)	2600
Secondary Grouping	Metal Bonder
Flashpoint	185°F
Compares to	Cyberbond Z-396

*Picture - 1 Super Glue*



adhesive.  
Fluorescent

### CE3.7b Keyence Vision System

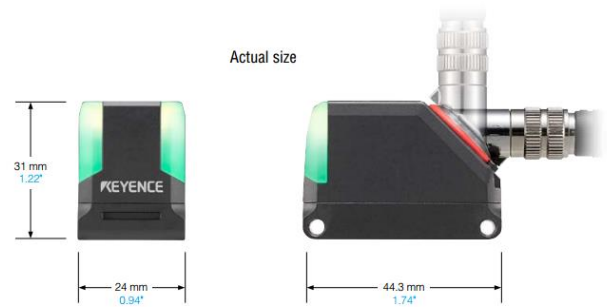
Introduction of IV Navigator Vision Sensor in Full Auto & Semi Auto Assembly machine and implementation of a new feedback Keyence Vision System to acknowledge the presence of glue during assembly.





#### ULTRA-COMPACT MODEL NEW

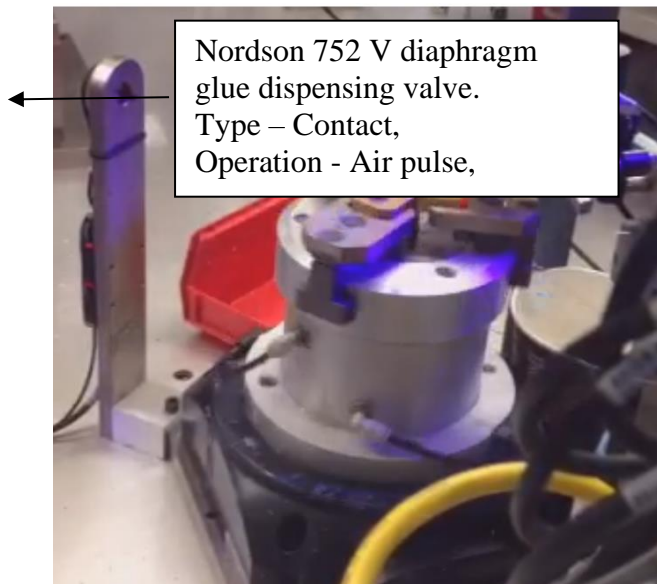
INSTALL ANYWHERE WITH MINIMAL SPACE RESTRICTIONS



*Picture - 2 Keyence vision system*

CE3.7c Nordson's Liquidyn P-Dot Precision Glue Jetting System

Proposed to replace Nordson 752V series diaphragm valve glue dispenser to Nordson's Liquidyn P Dot Glue jetting system.



*Picture - 3 Full Auto Assembly Machine Glue station*



Nordson's Liquidyn P-dot CT Precision Jetting Micro glue dispenser  
Type – Non contact,  
Operation – Electric pulse

Controller – can set the dispensing frequency in Hz, length, width of the glue to be applied

Samples are tested at Nordson's Technical center. The results are shown below,

## Test System Configuration



1 / 2 "Collar



1 / 4 "Collar



3 / 16" Collar

Figure 1.3: Sample of a difference sizes of Collar Dispensing line beads.



Nozzle 250µm



Nozzle 150 µm

Figure 1.4: Sample of Jetting of difference sizes of Liquidyn Nozzles.

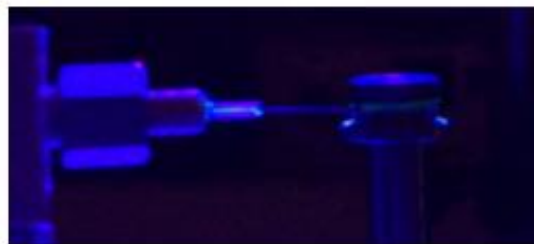


Figure 1.5: Sample of Jetting of a Liquidyn Nozzle using NDKT60250.

### [Link to More Demo Pictures/Video:](#)

Since video files is too large. Video will be supply upon request

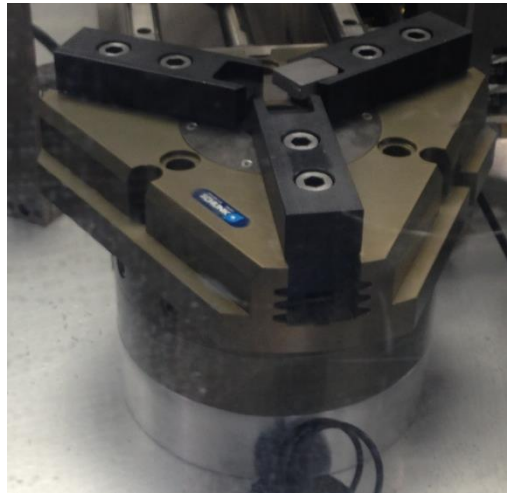
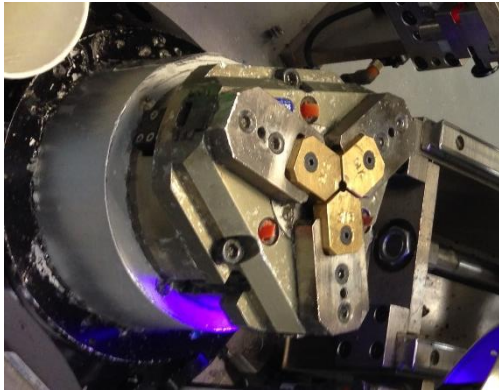
[www.nordsonintl.com](http://www.nordsonintl.com) [info@nordsonintl.com](mailto:info@nordsonintl.com) USA & Canada 800-556-3484 Europe +44 (0) 1582 666334 Asia +86 (21) 3866 9006  
Sales and service of EFD dispensing systems are available worldwide.



Figure 1.2: Sample of Assembly handle parts displayed to be dispense line beads.

CE3.7d Schunk  
Gripper  
Schunk PZB-plus  
125-2 Gripper with  
5050 N to close  
got replaced with  
spring assist PZB-  
plus 200-2-AS  
with 13950 N to  
close. The  
Technical details  
of the models are  
shown below.

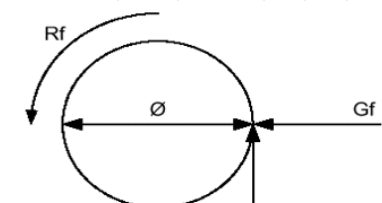




Picture - 5 Old PZB – plus -125-2 Gripper      New PZB – plus -200-2-AS Gripper

Higher gripping force is required for higher torque values as stated in new design parameters

Table - 1 Schunk Gripper Technical Data

Technical data		PZB-plus 200-2-AS	PZB-plus 125-2
Rotational Force Calculation			
 <p> <math>Ff = Rf / (\Ø / 2 / 1000)</math>  <math>Gf = Ff / \mu</math> </p>	[mm]	304953	0305181
	[N]	14	5
	[N]	13950/-	5050
	[N]	3950	5700
	[kg]	15.8	2.5
	[kg]	55	20
	[cm <sup>3</sup> ]	1550	65
	[bar]	4/6.5	2/8
	[bar]	6	6
	[s]	0.6/1	0.2/0.2
Air consumption per double stroke	[mm]	200	120
Min./max. operating pressure	[kg]	6.5	1.1
Nominal operating pressure		40	40
Closing/opening time	[°C]	5/90	-10/90
Max. permitted finger length	[mm]	0.05	0.01
Max. permitted weight per finger	[mm]	44	25
IP class			
Min./max. ambient temperature			
Repeat accuracy			
Diameter of center bore			

Torque applied  $Rf$   
 $= 100 \text{ in-lbs} =$   
 $11.30 \text{ NM}$   
 Pin Diameter  $\Ø =$   
 $3/16 \text{ in} = 4.7625$   
 $\text{mm}$

Frictional Force  
 $Ff =$

$$11.30 / (4.7625 / (2 \times 1000)) = 4745 \text{ N}$$

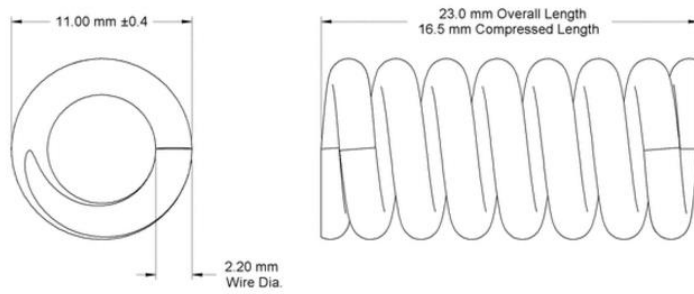
$$\text{Co-efficient of friction } \mu = 0.5$$

$$\text{Gripping force } Gf = Ff / \mu = 4745 / 0.5 = 9490 \text{ N}$$

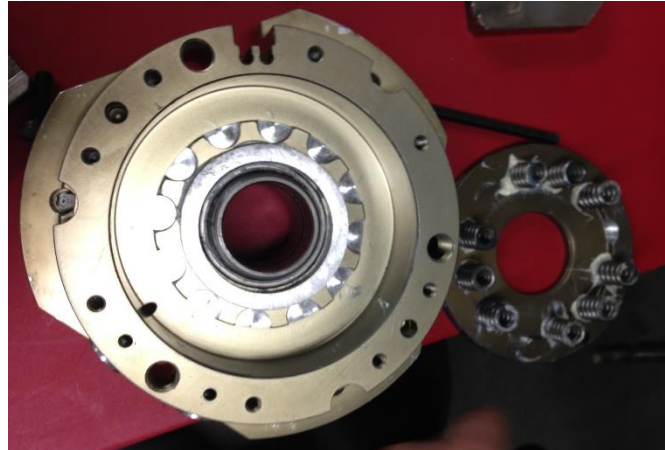
### Calculation - 1 Gripping force

#### CE3.7e Modified Schunk Gripper

- Manual assembly station gripper got innovatively custom built by adding 12 springs about 4045N to actual designed Schunk PZB-plus 125-2 Gripper to aid gripping force of 5050N,



## Spring Specification



Overall Length	23.0 mm
Spring OD	11.00 mm
Wire Diameter	2.20 mm
Compressed Length	16.5 mm
Load	75.8 lbs.
Rate	14.29 lbs./mm
Additional Specifications	Steel Music Wire
RoHS	Compliant

*Picture - 6 High Tension spring*

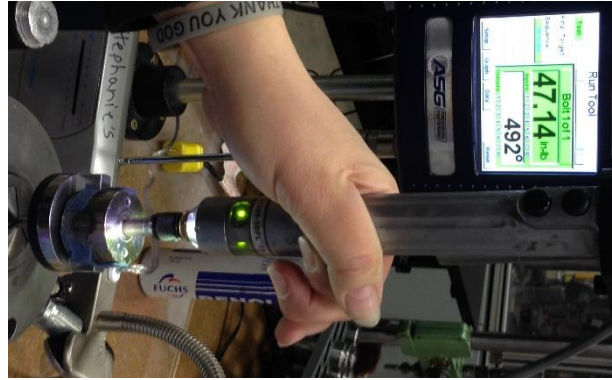
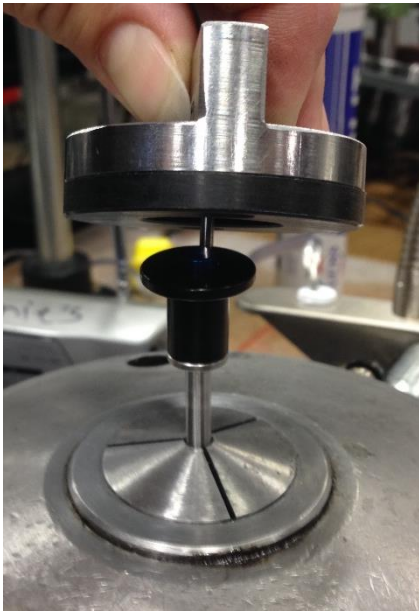
## CE3.7f Torque drivers

Invented New torque drivers – Pin driver for button handle and spring actuated lever driver for ring handles

*Picture - 7 Button Handle Pin driver*

Pin Driver for Button handles

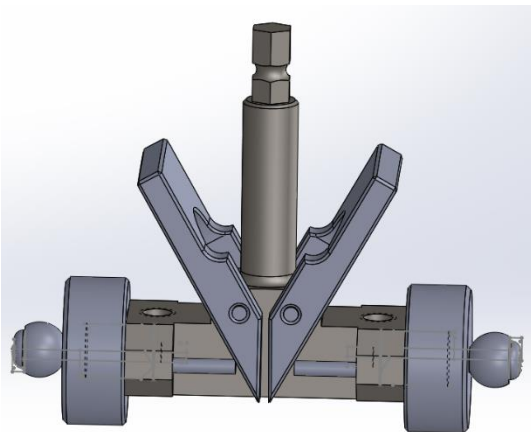
Pin Driver in action



*Picture - 8 Ring handle spring actuated lever driver*

Spring Actuated lever driver for Ring handles

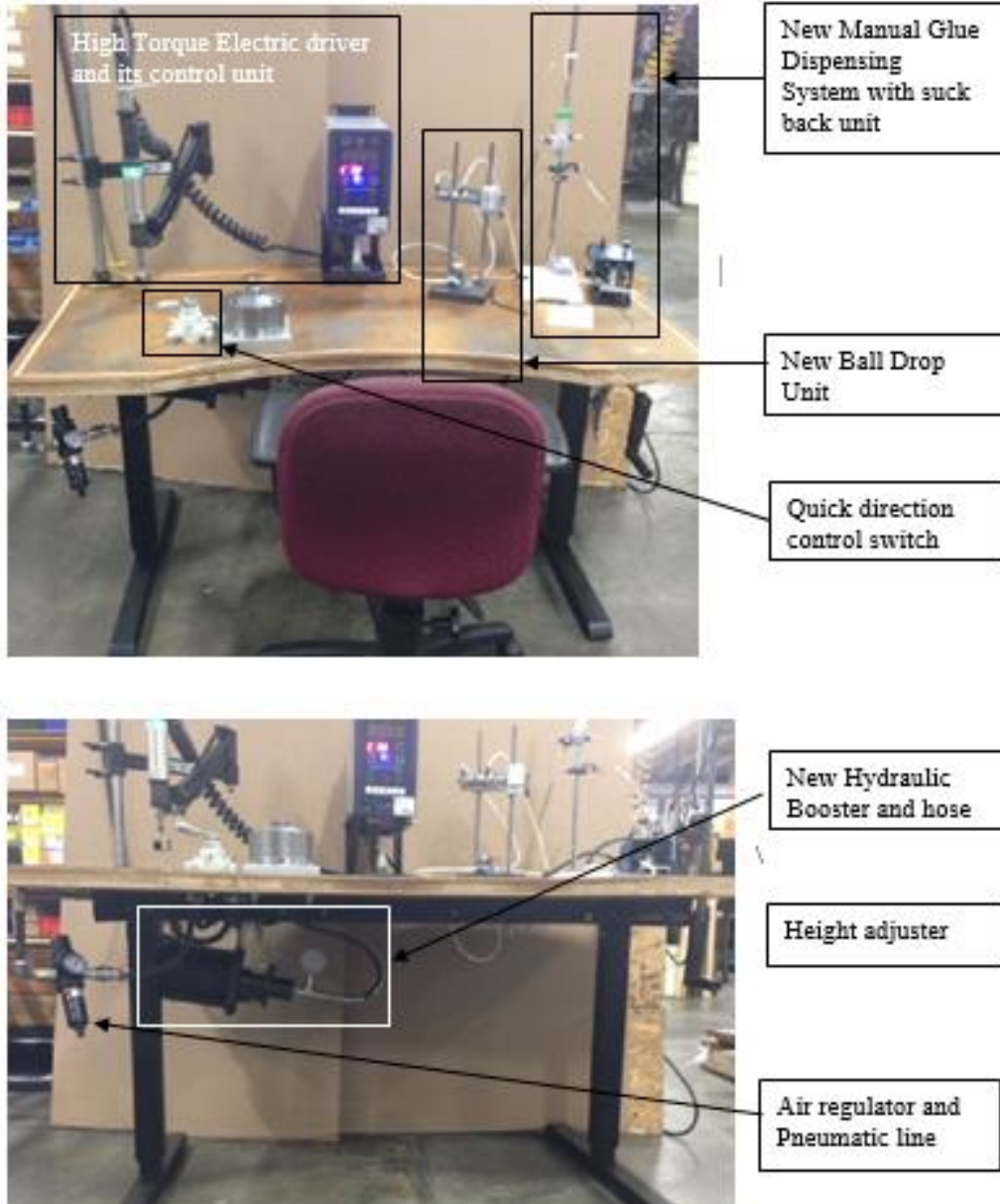
Spring Actuated lever driver in action



CE3.7g New manual assembly table

New assembly table with High capacity electric torque driver, ball drop unit and glue dispensing unit.

Picture - 9 New assembly table



PART 2 To be published in Newsletter 9.

Did you know..... 

**MS Word** 

Converting a .docx file to PDF is easy. Just Save as and select PDF file format. It also converts large word documents to very manageable smaller PDF files.

**Outlook 365 eMail** 

Creating artistically pleasing emails is uncomplicated. Create a Table(as in MS Word) by using Insert with required columns and rows. Adding images, selecting backgrounds becomes a breeze.

If you have a software tip, please forward to the editor

# CONSENSUS DECISION MAKING-UTILISING INDUSTRIAL ENGINEERING TECHNIQUES



By David Karr(CP Eng, FIEA) 10-03-21

Industrial Engineering(IE) lends itself extremely well to optimum outcomes especially with respect to effective decision making.

Consensus Decision Making is a creative and dynamic way of reaching agreement between all members of a group. Instead of simply voting for an item and having the majority of the group getting their way, a group using consensus is committed to finding solutions that everyone actively supports, or at least can live with.(Reference [www.seedsforchange.org.uk](http://www.seedsforchange.org.uk) )

Traditionally decisions are usually made unilaterally(top down organisations), dictatorially (dictatorships or strong organisations or strong personalities) or by senior management or rubber stamped(weak democracies following strong leaders)

Utilising IE tools such as

- Game Theory
- Systems Engineering
- Operations Research Techniques,
- Optimal Data Analysis
- Numerical Methods/Linear Programming
- Scheduling and inventory control/Materials handling
- Business Process Re-Engineering
- Systems and Process Engineering
- Cost Benefit and Value Analysis
- Etc

and not forgetting effective communication techniques, IEs are able to successfully achieve effective outcomes benefiting organisations and even individuals in their daily lives.

Some examples include

- Business strategies post Covid 19(innovative, agile implementing effective change management)
- Equipment purchases for new product lines
- Making a household purchase or deciding on a family holiday
- Legislative outcomes
- etc

Thus effective decision making, leads to better outcomes that are more democratic, allowing for as many of the impacted community to have valued input into the vested outcome. This process benefits more of society and is inclusive.

Practical examples include

Norway which has a system of consensus decision making whereby the 2 main political organisations agree on many aspects of Norway's society. There is collaboration in



parliament and with Norwegians directly. Thus there is a true governance in the government process of Norway.

Some cantons in Switzerland(Appenzell Innerrhoden and Glarus) practice direct democracy. Thus legislation is approved by the citizens directly. Admittedly the populations of these cantons is very small ranging from 16,000 to 55,000.

In Germany, the legislated makeup of large German company boards above 500 employees, ranges from a third to nearly of board members to be elected by employees. This is called codetermination. Thus company decisions are more inclusive.

ARUP a UK company founded by Dane Ove Arup. "Arup is owned by trusts the beneficiaries of which are Arup's past and present employees, who receive a share of the firm's operating profit each year"(refer [https://en.wikipedia.org/wiki/Arup\\_Group](https://en.wikipedia.org/wiki/Arup_Group) )

Thus there are different methods of introducing consensus decision making and good governance into organisations and politics.

It should be remembered that generally organisations(and elected bodies) have four interested or beneficial parties. These include:-

- Company clients/electorate
- Employees/electorate
- Shareholders/people
- Society at large

The trick is determine which of these vested interested parties have priority. This determines in large part, how the decision making process is undertaken.

For example in Australia at a federal level, a decision effective energy policy has not been undertaken at the moment. The reason for the indecision, is due to the various vested interests such as coal miners, oil and gas companies, renewable energy proponents, generators, large and small users and of course the public at large. Thus indecision and uncertainty controls the situation which is definitely not in Australia's best interests.

Consensus decision making, utilising an IE technique called Game Theory, would deliver the optimum outcome. The challenge is that these "highly vested interest groups" hold sway. The politics is driven by how many votes can be gained or not lost by holding onto the status quo.

Meaningful change, which is the only organisation constant, usually only occurs when there is a catastrophe of major proportions such as economic(GFC1),natural(fires) or health(pandemic) etc.

The politocracy(attempted government by politicians) including the bureaucracy, have vested interests in maintaining the status quo with minimal or slow change.

Thus meaningful change in energy and climate change policy, value adding industrial development, a fair economic wealth distribution, meaningful indigenous policy and a competent education system for example, will only occur when there is a wider more inclusive consensus decision making course of action by the impacted people.

---