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Cambashi Limited

AutoCAD P&ID Productivity Study

for Autodesk

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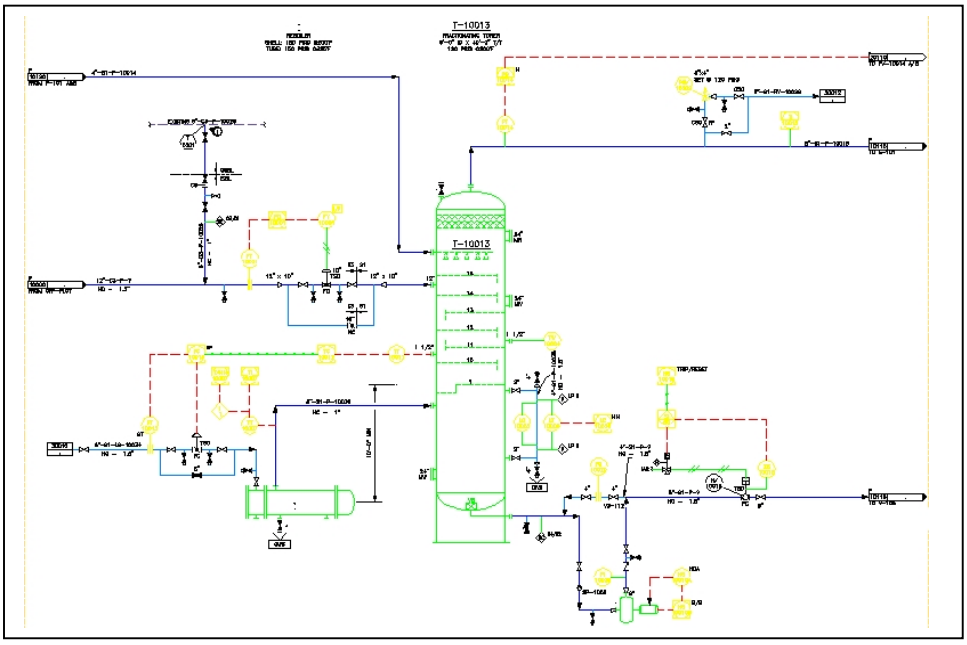
1 Autodesk takes a big step in plant engineering

AutoCAD P&ID has been designed to offer significant advantages in P&ID authoring productivity over standard AutoCAD *and* a straightforward transition. This project tests these claims so as to provide a company's CAD and process engineering community with real, relevant information on which to base the upgrade decision.

The results are compelling – the 'headline' productivity gain was found to be in the region of 40% - and this outcome was based on a rigorous and wide-ranging test of P&ID capability. This paper describes the methodology used to conduct the test and sets out the results in detail, including some of the qualitative feedback from users about their experiences with the new system.



Task	Description
1	Add new lines and inline assets
2	Modify existing lines and inline assets
3	Add a new control station
4	Modify P&ID layout and add new instrumentation and equipment
5	Modify P&ID layout and add new control station
6	Export line list, modify and re-import to reflect selected changes in the P&ID
7	Perform a series of changes to data associated with selected P&ID elements

Fig 1: Summary of the Productivity Test
(For a detailed description and more detailed drawings, see Appendix)

2 Quantifying the benefit of AutoCAD P&ID

Ever since CAD entered the process engineering arena, the optimum approach to the production of the all-important P&ID diagrams has been a subject of vigorous debate. At one extreme are those who believe that the creation and maintenance of the P&ID should be data-driven, at the other are those who place the emphasis on the graphical tools.

Of all the software providers in the plant engineering market, Autodesk should be best placed to resolve the graphics-emphasis versus database-emphasis conflict. There is a huge community of experienced users of standard AutoCAD (hereafter just AutoCAD) and a significant proportion has adapted the standard system for P&ID work, building graphical libraries and complementary data management tools to increase the system's effectiveness.

The overall benefits of an intelligent P&ID system can be far reaching. Through integration with complementary applications, it can be the foundation for maintaining accurate records throughout the entire plant lifecycle. However, being a function of indeterminate factors such as the number and scope of changes, the effectiveness of integration with other applications and the cost consequences of inaccurate data, these 'total lifecycle' benefits are very difficult to measure. Further, typical project structures do not effectively assign responsibility for these big picture benefits, and the introduction of data centric tools often requires major changes in working practices, making it difficult to associate productivity improvements with specific factors.

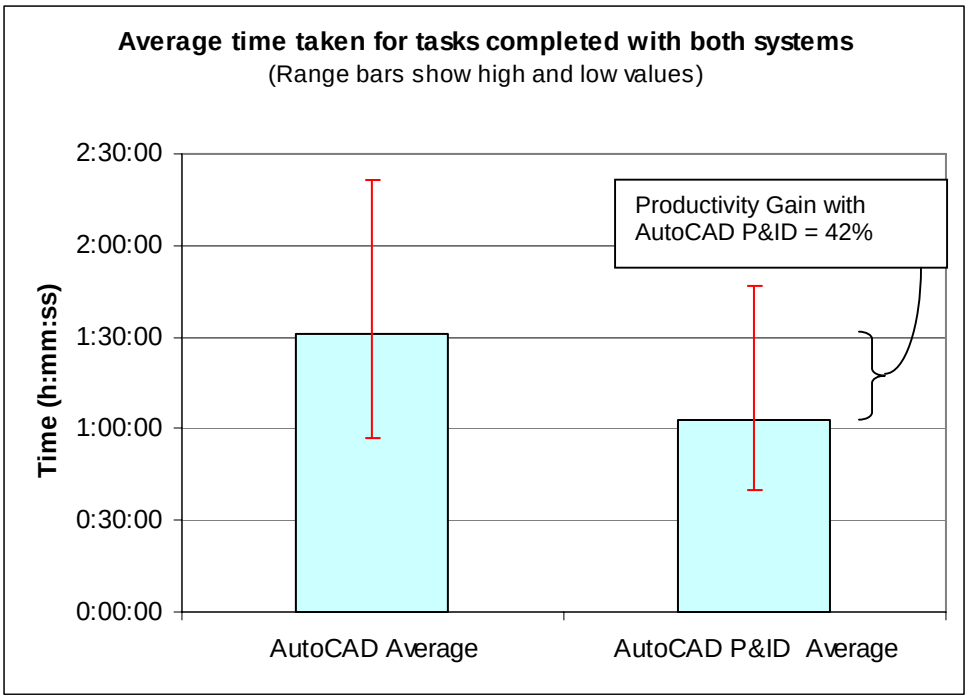
As a result, for many AutoCAD customers, the decision to upgrade will be based largely on fundamental, measurable productivity benefits – 'task' productivity. This project set out to determine the benefit that AutoCAD P&ID offers in comparison to AutoCAD in terms of task productivity. Even with this scope, measuring productivity is not simple – the test must cover a realistic set of P&ID tasks and a significant number of variables must be taken into account, including the user's level of experience with AutoCAD, his/her expertise in P&ID work and the extent to which the user has prepared for the test.

The test also sought to assess the ease of transition. Many users are exploiting AutoCAD for P&ID design already. Autodesk claims that AutoCAD P&ID will be familiar to designers and engineers, with the result that design teams can begin using it with little training. The following sections describe the methodology used to measure the productivity advantages of AutoCAD P&ID over AutoCAD, the outcomes of the tests and the conclusions to be drawn from the results.

Cambashi welcomes feedback to support its ongoing work in this field.

3 What did the results show?

The results show that, for a 'typical' combination of P&ID work, AutoCAD P&ID offers dramatic productivity improvements over AutoCAD. For the range of tasks completed with both systems, the average productivity gain across all users was 42%. The test also supported strongly the claim that the transition from AutoCAD to AutoCAD P&ID is straightforward.



3.1 Scope of test

Certainly the level of overall productivity improvement is striking. For this to be a factor in considering the adoption of AutoCAD P&ID, it is important to understand how such a result was reached. What did the 'typical' combination of P&ID work include? In which specific areas was AutoCAD P&ID significantly better than AutoCAD? Was the test biased towards P&ID functions that are beyond the capability of AutoCAD? What was the impact of different levels of user experience or the extent to which users had 'tailored' AutoCAD for their P&ID work?

Measuring the productivity of a general tool with one specifically designed for a given application is difficult - we can expect the latter to offer extended application-specific capabilities. Nevertheless, to provide a true measure of the benefits of AutoCAD P&ID, the test needed to cover a comprehensive range of P&ID tasks. It was designed to ensure that the comparison between the two systems was meaningful – too much emphasis on areas that were beyond AutoCAD would be unrepresentative and not tell us much about the ease of transition; restricting the scope to the areas covered by AutoCAD would not have taken

account of the full capabilities of AutoCAD P&ID (see below for a full explanation of the test design and methodology).

The results of the test are therefore best understood by categorizing the P&ID activities as follows:

a) **Task Group 1 - Graphical tasks** – graphical modifications to the test P&ID with little or no impact on the associated data. As might be anticipated, AutoCAD performed well in these tasks, with the systems broadly equivalent in terms of user productivity.

b) **Task Group 2 - Tasks combining graphics and data** – here, the association between graphics and the related attribute data dominated – that is, work typical of the majority of P&ID activities. AutoCAD P&ID's application-specific capability then produced average productivity improvements of over 50%.

c) **Task Group 3 - Data manipulation** – tasks involving modifying the data held against graphical elements, exporting and importing subsets of the P&ID data and verifying that any changes have been reflected in the drawing. Although some users have built complementary functionality external to AutoCAD to support this kind of work, the tasks proved difficult for AutoCAD users to execute within a reasonable time.

As noted above, the measured productivity improvement of 42% results from comparing the times taken to complete task groups 1 and 2. We discuss the outcome in each category in more detail in Section 3.3 below.

3.2 Ease of transition

The results from the graphical tasks demonstrate that experienced AutoCAD users will experience little difficulty in upgrading. A number of AutoCAD P&ID users found that they could use many of their AutoCAD shortcuts, which is not the case with other AutoCAD-based P&ID products. Certainly, training plays a part – for both systems, the fastest users were the most expert, demonstrating the benefit of proper training – but some AutoCAD P&ID users had enjoyed only two hours of training on the system, yet completed the tasks efficiently. The ability to become productive quickly is an important issue in an industry where contract relationships and project structures make responsibility for training a grey area.

> ***Participant quote**: 'I've created my own menus with ordinary AutoCAD to speed things up, but AutoCAD P&ID is so much more powerful.'*

As expected, the range of times recorded for the test using AutoCAD was higher than that for AutoCAD P&ID – the AutoCAD users had tailored their systems for P&ID work to different degrees, whereas AutoCAD P&ID, having comprehensive P&ID functionality as standard, provided a common level of capability.

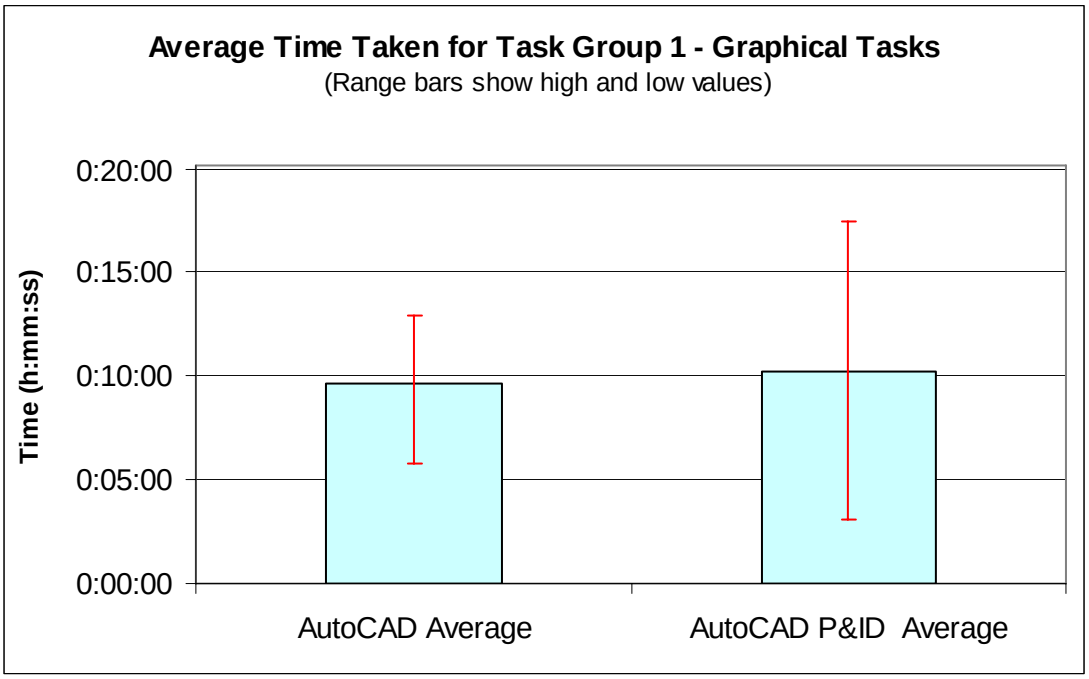
3.3 Review of test results

3.3.1 Graphical tasks

The results of the test show that the systems were very close in terms of raw graphics productivity.

Although far from being the whole story for P&ID work, efficient manipulation of graphics is a vital aspect and AutoCAD's traditional strength in this respect is the basis for its use in this area. The high level of symbol content and widely accepted layout rules has meant that users have been able to set up their AutoCAD systems to be very effective P&ID drawing tools. Inevitably, the intelligent attribute and connectivity hierarchy, which underpins AutoCAD P&ID, results in somewhat reduced flexibility and slightly higher overheads on the use of some AutoCAD techniques, such as 'cut and paste'. Nevertheless, AutoCAD P&ID compensates with some advanced graphics functions of its own.

The equivalence in drawing productivity is important to the transition issue. Although just part of the overall P&ID application, the basic drafting aspects of the test show that any drop in drawing productivity in the transition to AutoCAD P&ID is minimal.



Participant quote: *'The other real productivity benefit of placing symbols is that in AutoCAD P&ID the line is broken when the symbol is placed and you don't have to tidy up afterwards like you do with classic AutoCAD. And even when the line is broken for a valve it is still 'logically' a continuous line so picking it anywhere highlights the whole line so that you can do real global changes.'*

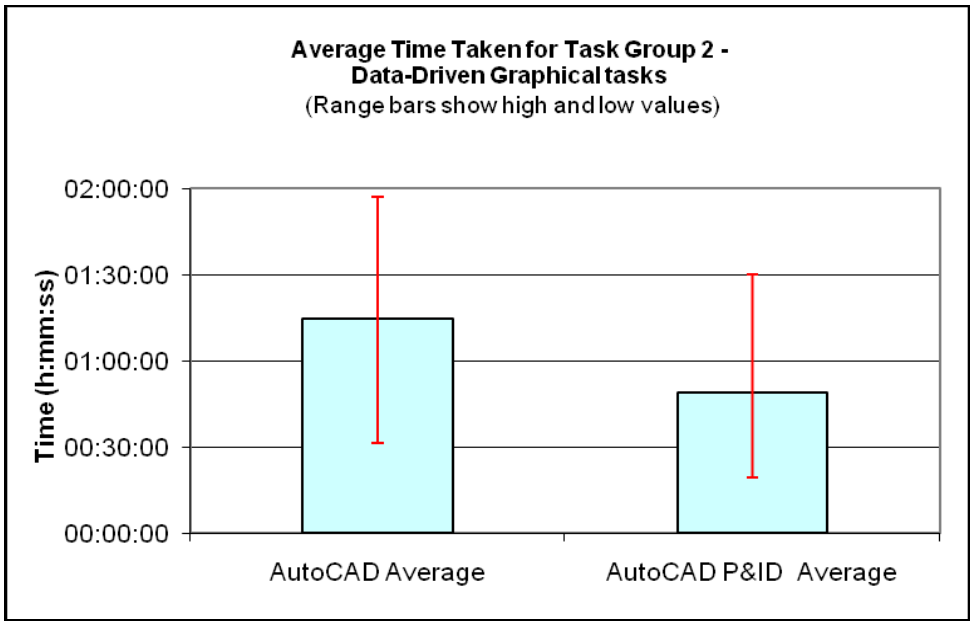
> ***Participant quote:*** *'There are so many options for changing geometry with AutoCAD P&ID it's the best thing I've ever seen. The ability to ring the changes with valves and actuators from pop-up graphical dialogues is immensely powerful and productive. And being able to orientate symbol placement by hovering the mouse is amazing.'*

3.3.2 Data-driven graphical tasks

Across this range of tasks, the average improvement was over 50%.

This, of course, is the real 'meat' of the P&ID activity and gives rise to major benefits in terms of data-driven creation/ update of the graphics and ensured accuracy of correlation between drawing and attribute database. AutoCAD P&ID was expected to show dramatic productivity benefits in these tasks (quite apart from the issue of ensuring data accuracy, which, for the purposes of the test, was assumed) and it did exactly that. The task involving changing the diameter of a complete line - including all of the inline assets and nozzles - was completed, on average, in half the time using AutoCAD P&ID, a 100% productivity improvement.

> ***Participant quote****: 'If you look at the graphical productivity there is a gain in engineering time depending on how experienced the user is. If you take the Data Manager into consideration as well you have to be looking at a 40 to 50% gain in engineering time.'*



3.3.3 Data intensive tasks

It was important that the test included data manipulation tasks, this being a key aspect of P&ID work. It was anticipated that at least some of the AutoCAD users would be able to attempt these tasks. Although AutoCAD does not provide the required functionality, users have often built a combination of manual work-arounds and external software to fill the

gaps. ***In practice, however, the AutoCAD users were unable to complete the tasks in a reasonable time.***

Although these tasks did not produce times for completion using AutoCAD, they did, as expected, demonstrate the data management power of AutoCAD P&ID. This was underlined by the times recorded – the 42% productivity improvement with AutoCAD P&ID compared with AutoCAD for task groups 1 and 2 has already been discussed. Further, the average time taken to complete task groups 1, 2 *and* 3 with AutoCAD P&ID proved 24% faster than the average time taken to complete *just* task groups 1 and 2 with AutoCAD.

***Participant quote**: 'The ability to re-import an Excel spreadsheet and accept or reject changes allows you to do much more remote modification of a P&ID and it still leaves control in the hands of the original P&ID engineer. This is great for process engineers where they have a hard copy of the drawing and an Excel spreadsheet they can make the changes and reapply them later when back in the office.'*

***Participant quote**: 'One of the best things about P&ID is that the Data Manager is linked to a drawing -- there is no way that the two can get out of step. If you click on an asset in the drawing it is highlighted in the Data Manager and anything you change in the Data Manager is immediately reflected in the drawing. With vanilla AutoCAD if someone's made a mistake there is no way to check except graphically.'*

3.4 Additional benefits

This exercise was not intended to provide a complete product review, but it is important to note that the benefits of AutoCAD P&ID extend beyond the task-oriented productivity improvements reported here.

The design of the system recognizes that the benefit of a P&ID system is enhanced still further with full integration with complementary systems - a large proportion of plant engineering effort involves revision work throughout the plant lifecycle, with frequent and significant modifications to the plant P&IDs. Although out of scope of the test being undertaken, a number of the users identified the additional aspect of wider integration as a further benefit of adopting AutoCAD P&ID.

A final point to note is that the assumption of data accuracy throughout the tasks involved in the test is likely to lead to an underestimate of the real productivity benefit of AutoCAD P&ID, since correlation between data and graphics is inbuilt into the system.

***Participant quote**: 'The great thing about the intelligent P&ID system is the integrity of the underlying data. We can now have meaningful 'as designed', 'as built' and 'as maintained' versions in the certain knowledge that they are 100% accurate. Being able to access all the data through the Data Manager means that we can slice and dice the data in any way we need to, and deliver to clients and suppliers alike the exact data output they need for the next stage in their process.'*

4 The test methodology

The test would need to give an objective, accurate and repeatable picture of the performance of AutoCAD P&ID against AutoCAD for a representative range of P&ID tasks – that is, including both graphical and data management aspects of P&ID work. While this would extend the scope of the test to include tasks that are at the very limit of AutoCAD's functionality, it was essential for a full test of AutoCAD P&ID.

The approach chosen was to construct a small design project together with a set of tasks that represented the work typically undertaken by P&ID drafters and process engineers. The tasks involved accessing a P&ID typical of those used for Autodesk's P&ID training programs (see Fig 1) and making specified additions and modifications, including effecting linkages to other areas of the process model. The whole exercise was designed to be completed in about one hour. To reflect 'real world' conditions, the users could approach the tasks in their own way based on their understanding of the software - this would provide a fairer comparison of overall P&ID productivity than simply focusing on the new features within AutoCAD P&ID.

> ***Participant quote**: 'I like the way the whole (P&ID) package works and you can accomplish a lot if you tweak the symbols. Spending 10 minutes customizing your symbols can save you hours in the long-term. Because of the underlying intelligence in P&ID you can do significant drawing modification in a heartbeat with the Data Manager.'*

Initial trials were undertaken to identify any issues and refine the exercise. The set of tasks was then finalized for time trials with industrial users of AutoCAD and AutoCAD P&ID. These are summarized in Fig. 1 and set out in detail in Appendix 1.

The test was undertaken by a group of AutoCAD users and by a group of AutoCAD P&ID users, with each task being timed. In addition to the quantitative data, qualitative feedback from the users on their impressions and experiences of using the software was collected. The groups chosen represented an international cross-section of the user community.

It was important to cater for the different levels of user training, familiarity with AutoCAD, level of preparation and experience with P&ID work. The approach adopted was to use task 1 as a benchmark, since this graphical task was essentially the same using AutoCAD and AutoCAD P&ID. The average time taken to complete task 1 was 5 minutes. For each user, the factor by which the time for task 1 needed to be multiplied to bring it to 5 minutes was calculated. Applying this factor to each of that user's times for the subsequent tasks effectively 'normalizes' the results to eliminate, as far as possible, the impact of the above variables.

An important measure of the quality of the test and the validity of the conclusions drawn from the results was the spread in the times recorded for each task. The lower the spread of times for each task, the higher the level of confidence in the average as a valid representation of the performance of a broader spectrum of users. Accordingly, the standard deviation – the measure of the spread of results - was calculated. Using AutoCAD it was lower than expected at below 30%. For AutoCAD P&ID, it was even lower at 25%. This demonstrates a high degree of consistency in the results.

5 Conclusions

The project set out to provide answers to a number of the questions that a company considering the adoption of AutoCAD P&ID is likely to ask:

- What are the measurable benefits of AutoCAD P&ID over AutoCAD for this specialized and demanding application area?
- Can the system really be picked up quickly by AutoCAD users?
- Has Autodesk achieved the goal of a 'serious' P&ID system that offers the necessary connectivity between graphics and data?

A thorough, realistic test of P&ID capability was developed and undertaken by users with a range of AutoCAD experience. The test results present a compelling case for AutoCAD P&ID. Despite the inherent overhead of graphics-data connectivity, the system proved to be comparable to AutoCAD in terms of graphics productivity. For operations involving significant changes to the data, AutoCAD P&ID delivered dramatic improvements. Finally, the elements of the test involving data modifications driving changes to the graphics showed that it deserves the designation of a 'real' P&ID system.

The test also proved that, for AutoCAD users, the transition to AutoCAD P&ID can be made quickly and easily. The AutoCAD P&ID productivity improvement of 42% was achieved even with a number of inexperienced users of the system in the participating group. Further, the low spread of times across all users of AutoCAD P&ID shows that the less experienced users were still able to complete the tasks quickly and successfully, with some even beating the time taken by experienced AutoCAD users.

One other important benefit was apparent from the test. AutoCAD P&ID has been developed in recognition of the role of a P&ID system in the overall plant engineering information management strategy and across the entire plant lifecycle. Even with the investment in AutoCAD P&ID being made on the basis of the local productivity benefits, the user organization can look forward to even greater benefits as it becomes part of the plant engineering infrastructure.

> ***Participant quote:*** *'Having flexible access to the data means that we can build interfaces to other systems very quickly so that other applications actually benefit from the rigorous data of AutoCAD P&ID. Because of the associativity between the Data Manager and the model, as components get superseded they can be replaced in the Data Manager from where they can update all relevant models, drawings, parts and assemblies.'*

Finally, why not take a look at the AutoCAD P&ID screencast by clicking here?
View Screencast.

Or, perhaps you'd like to try the test for yourself? A free trial download of the system, including the test P&ID can be found here Free Trial Download. Appendix 1 describes in detail the tasks to be carried out. We would be delighted to hear the results!

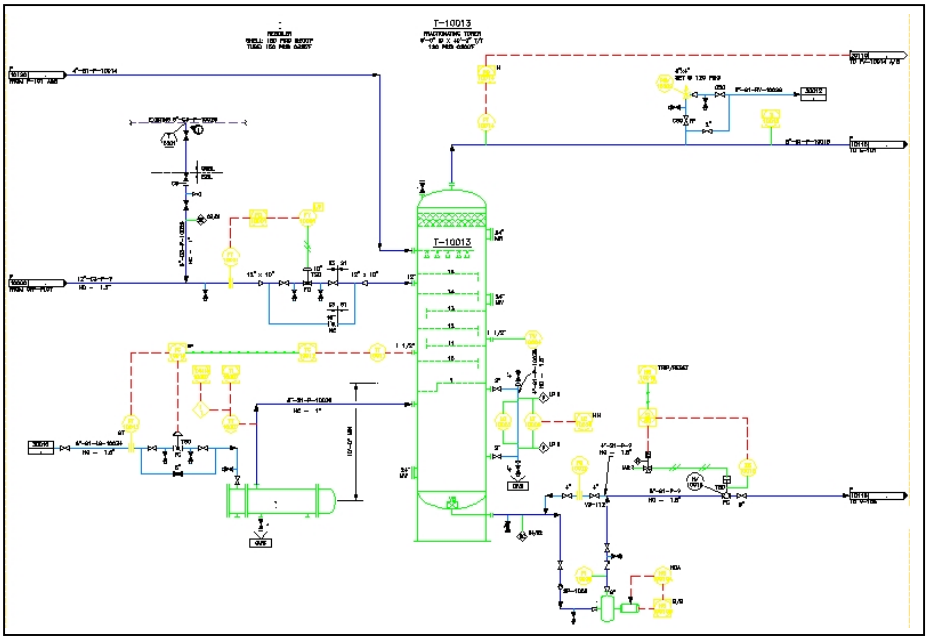
Appendix

Overview of the test methodology

The test comprised a set of activities to be completed under a timed test environment. All users were provided with the materials needed to complete the test, including the complete P&ID and an extract for each of the tasks to be executed.

It was anticipated that users carrying out P&ID work with AutoCAD would have built a symbol library and that some level of report generation capability for P&ID information contained within the drawing (line list, tag list etc.) would have been added to the AutoCAD environment. Allowing users to exploit these facilities for the test would be important for a genuine assessment of the performance improvement achieved using AutoCAD P&ID rather than AutoCAD.

Test P&ID



To enlarge and traverse the start drawing, click here and use the slider controls on the Acrobat window. To enlarge and traverse the final drawing, click here . Use Alt + 'back arrow' to return to this view.

Test sequence

1-1 Add new lines and inline assets

Draw new lines between the Fractionation Tower (T-100) and Reboiler (E-100):

(a) Connect Fractionation Tower (T-100) to Reboiler (E-100) using 'Primary' Line segments;

(b) Ensure line is connected to Fractionation Tower with 'flanged nozzle' at height indicated i.e. in line with existing dimension indicator at '10' 0" min';

(c) Show intersection with existing horizontal line with a ‘loop’ (semi-circle) symbol;

(d) Add drain valve with plug and open drain symbol as indicated;

(e) Add the line number annotation and assign attributes.

1-2 Add new lines and inline assets

Draw the new lines between Reboiler (E-100) and off-page utility connector (30011-01-301):

(a) Repeat a similar exercise on the line from Reboiler to off-page connector using ‘secondary’ line segments;

(b) Add off-page utility connector at edge of P&ID diagram;

(c) Add inline gate valves and drain valve with plug;

(d) Break line with steam trap and annotate as special piping item – ‘SP-1001’;

(e) Add the line number annotation and assign attributes.

2 Modify existing lines and inline assets

Update the following existing valve and instrument items to reflect a change in line size and in line valves used:

(a) Generate a valve list into Excel before undertaking the updates to the P&ID indicated on this worksheet. Save this external spreadsheet;

(b) Modify the annotation on the line ‘12”-C3-P-10001’ to ‘‘14”-C3-P-10001’;

(c) Change or ensure that all inline items reflect the size change;

(d) Change the two existing inline gate valves to ball valves. Change the valve type from ‘VG’ to ‘VB’;

(e) Update the end connection on these two ball valves from ‘flanged’ to ‘welded’ as shown;

(f) Update the control valve with a ‘butterfly’ valve body and ‘back pressure regulated’ actuator;

(g) Update valve on control station by-pass to plug valve and make status ‘locked closed’;

(h) Generate a new valve list and compare the two spreadsheets to ensure that valve sizes and types have updated.

3 Add new control station

Generate a new control station on line ‘8”-S1-P-10016’:

(a) Place a control valve on line ‘8”-S1-P-10016’;

(b) Insert instrumentation as shown on the diagram and connect with signal (dotted) line;

(c) Create by-pass line using ‘secondary’ line segment;

(d) Add inline equipment as displayed e.g. valves, reducers and add drain valves with plugs;

(e) Annotate all items on the control station as shown.

4-1 Create space and add instrumentation

Create space on the drawing and add instrumentation:

(a) Generate a valve and instrument list into Excel before undertaking the updates to the P&ID indicated on this worksheet. Save these external spreadsheets;

(b) Move the manual and control valve along the line to the right to create space;

(c) Move the off-page connector vertically upwards to create a vertical line segment starting at point shown;

(d) Add the control valve and associated piping items e.g. reducers, drains, valves as shown on the worksheet;

(e) Place inline vortex device and add instrumentation as shown;

(f) Move the valve VG-112 (note 5) to the right and from the 4" to 8" line. Ensure that the valve size is updated to 8";

(g) Generate a new valve and instrument list into Excel. Open original and updated valve and instrument lists and check that the new instruments have been added and that valve VG-112 now reflects its increased size.

4-2 Create space and add instrumentation

Install a second pump set:

(a) Insert a second pump set with all associated lines, instrumentation, inline equipment, nozzles, drain valves etc.;

(b) Annotate equipment and lines as shown on the diagram. Ensure that instrument numbers are 'readable' i.e. the attributes/text does not cross with the instrument circle symbol;

(c) Place equipment annotation tag (P-100B) and update the existing equipment information details (bottom of the drawing).

5 Create space and add control station

Create sufficient space on the drawing and add control station:

(a) Create additional space at the top of the drawing by adding a vertical leg in the line;

(b) Add the control station and add all associated piping and instrumentation items;

(c) Ensure all items are assigned the size indicated

(d) Add globe valve in vertical leg.

6 Create a line list report and modify information for P&ID update

Using existing reporting functionality, generate a line list from the P&ID, update the resulting Excel spreadsheet and re-import the changes. (Note: It was recognised that the extent to which following steps can be executed using AutoCAD would vary with user, but the tasks were included as representing important P&ID capability):

(a) Generate a line list report (or similar) into an external Excel spreadsheet;

(b) Start Excel and open the generated line list;

(c) Change or add data to 6 cells in Excel and save the file;

(d) Re-import the modified report;

(e) Review the changes and accept 4 of the changes/new data elements and reject the remaining 2;

(f) Review the P&ID and confirm that the accepted changes have been updated.

7-1 Managing data changes

Using the Data Manager or similar functionality, manipulate, by addition or modification, the data associated with the intelligent elements within your P&ID. (Note: As with task 6, it was recognized that the extent to which the following steps can be executed using AutoCAD would vary with user, but the tasks were included as representing important P&ID capability):

(a) Use the Data Manager to display the current data held on Pumps (Drawing Data > Equipment Items > Equipment > Pumps);

(b) Add the following information as displayed below:

P-100A	Add ‘Manufacturer’ – Grundfos
	Add ‘Model’ – CR-2-20-A-A-A-AUUE
	Add ‘Weight’ – 24 Kg
P-100B	Add ‘Supplier’ – Nuovo Pignone
	Add ‘Model’ – CR-2-20-A-A-A-AUUE
	Add ‘Material of Construction’ – Cast Iron

7-2 Managing data changes

(a) Navigate to the ‘off-page’ connectors (Drawing Data > Non-Engineering Items > Connectors > Off Page Connector) and add the following information:

Connector 10120	Add ‘Origin or Destination’ – From P-200A&B
Connector 10116	Add ‘Origin or Destination’ – To V-200.

It was anticipated that AutoCAD users, not having access to the AutoCAD P&ID Data Manager, could execute the task by updating the information into attributes held against the symbols.

REBOILER
SHELL: 150 PSIG @200°F
TUBE: 150 PSIG @325°F

T-10013
FRACTIONATING TOWER
6'-0" ID X 40'-0" T/T
120 PSIG @200°F

P
10120
FROM P-101 A&B

4"-S1-P-10014

EXISTING 8"-C3-P-10025

T 0001

OSBL
ISBL

03/01

6"-C3-P-10026
HC – 1"

P
10000
FROM OFF-PLOT

12"-C3-P-?
HC – 1.5"

FC 10001
FT 10001
FY 10001
I/P

12" x 10"
10" TSO FC
C3 S1
12" x 10"
12"

C3 S1
10" NC

T-10013
16
14
13
12
11
10
1

24" MW
24" MW

1 1/2"
TW 10004

4"-S1-P-10035
HC – 1.5"

2" 4"
LP N
2" 4"
LP N

LG 10003
LT 10006
LC 10006
HH

24" MW

VB

SC 04/02

OWS

FC 10013 SP
TC 10012
TT 10012
1 1/2"

TAHH 10007
TI 10007
TT 10007

8"-S1-P-10036
HC – 1"

10'-0" MIN

FT 10013
ST

30010
6"-S1-LS-10034
HC – 1.5"

TSO FC
6"

OWS

PC 10014
H
PT 10014

20110
TO PV-10014 A/B

PSV 10002
3"x4"
SET @ 120 PSIG
CSO
6"-S1-RV-10028
30012

CSO FP
2"

TI 10013

8"-S1-P-10016

P
10115
TO E-101

HS 10018
TRIP/RESET
SI 50

4"-S1-P-?
HC – 1.5"
IAS

FQ 10020
ZS 10018
HV 10018
TSO FC
8"

4" 4"
VG-112

8"-S1-P-?
HC – 1.5"

P
10116
TO V-105

PI 10008
SP-1002
6"

HOA
HS 10010A
HS 10010B
S/S

P-?

P-?
T-100 BOTTOMS PUMP
850 GPM @70 FT TDH

General Notes

1. CONNECT TO TOP OF LINE.

No.	Revision/Issue	Date

Drawing Name
PIP-01-101 – Test P&ID – Starter – 003
####

Project Name and Address
PIPSampleProject
Sample PIP Project
111 McInnis Pkwy.
San Rafael California

Area	Stamp
####	
Drawing Number: PIP-01-101	
Author: ####	

C:\derry\SampleProjects\PIP-01-101 – Test P&ID – Starter – 003.dwg

E-100
REBOILER
SHELL: 150 PSIG @200°F
TUBE: 150 PSIG @325°F

T-10013
FRACTIONATING TOWER
6'-0" ID X 40'-0" T/T
120 PSIG @200°F

P 10120 FROM P-101 A&B
4"-S1-P-10014
EXISTING 8"-C3-P-10025
FC 2001
FY 2001
I/P
FT 2001
4" x 3"
3" TSO
T 0001
OSBL
ISBL
6"-C3-P-10026
HC - 1"
SC 03/01
FC 1001
FY 1001
FT 1001
P 10000 FROM OFF-PLOT
14"-C3-P-10011
HC - 1.5"
14" x 10"
10" TSO
C3 S1
FC
12"
T-10013
16
14
13
12
11
10
1
24" MW
1 1/2"
TW 10004
FC 10013
SP
TC 10012
TT 10012
TAHH 10007
TI 10007
FT 10013
ST
TT 10007
30010
6"-S1-LS-10034
HC - 1.5"
TSO
FC
6"
8"-S1-P-10036
HC - 1"
10'-0" MIN
OWS
30011
3"-S1-SC-20002
ST - 1.5"
SP-1001
T
6"-S1-P-10006
HC - 1"
OWS
2"
4"
4"-S1-P-10035
HC - 1.5"
P
LP N
LG 10003
LT 10006
LC 10006
HH
OWS
VB
SC 04/02
PC 10014
H
PT 10014
CV 10028
12" 12"x8"
12"x8" 12"
20110 TO PV-10014 A/B
PSV 10002
3"x4"
SET @ 120 PSIG
CSO
6"-S1-RV-10028
30012
CSO FP
2"
TI 10013
8"-S1-P-10016
P 10115 TO E-101
HS 10018
TRIP/RESET
SI 50
IAS
2
HV 10018
TSO
FC
8"
ZS 10018
P 10116 TO V-105
LI 10028
LT 10028
LC 10028
FAL 10015
FI 10015
FT 10015
FQ 10020
4"-S1-P-10015
HC - 1.5"
4"
VG-112
8"-S1-P-?
HC - 1.5"
PI 10008
PI 10009
HOA
HS 10010A
HS 10011A
SP-1002
6"
S/S
HS 10010B
HS 10011B
P-100A
P-100B

P-100A
T-100 BOTTOMS PUMP
850 GPM @70 FT TDH

P-100B
T-100 BOTTOMS PUMP
850 GPM @70 FT TDH

General Notes

1. CONNECT TO TOP OF LINE.

No.	Revision/Issue	Date

Drawing Name
PIP-01-101 - Test P&ID - Starter - 003
####

Project Name and Address
PIPSampleProject
Sample PIP Project
111 McInnis Pkwy.
San Rafael California

Area	Stamp
####	
Drawing Number: PIP-01-101	
Author: ####	

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