

**COMPLIANCE AND GAP ANALYSIS
PROCESS MANAGEMENT**

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MS Dissertation

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Computer Engineering Program

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JÜRİ VE ENSTİTÜ ONAYI

Niyamaddin Taghiyev'in **Compliance and Gap Analysis Process Management** başlıklı **Bilgisayar Mühendisliği** Anabilim Dalındaki, Yüksek Lisans Tezi 11.02.2016 tarihinde, aşağıdaki jüri tarafından Anadolu Üniversitesi Lisansüstü Eğitim-Öğretim ve Sınav Yönetmeliğinin ilgili maddeleri uyarınca değerlendirilerek kabul edilmiştir.

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ABSTRACT
MS Dissertation

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Graduate School of Sciences
Computer Engineering Program

Supervisor: Prof. Dr. Yaşar HOŞCAN
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In this thesis, developing Gap Analysis process creates opportunities to provide demonstration of compliance to the set of adopted standards the companies perform however currently, this process is used in the most of the industrial or energy companies by the various ways. It is involved many engineering specialists from various disciplines in this process and it is even more complicated when trying to manage a multi discipline standard gap analysis process. To complete review of such a document may take up to a month or more due to availability of people and document circulation between the departments. It is required a very well managed collaboration, planning and performance management in order to complete the process with high quality and ensures that the results are not lost among the bureaucratic chains of verifications and approvals. Experimental results show that we can solve a time consuming by straight through processing and difficulties to manage a process especially when the number of applicable standards or technical practices is over a hundred.

This methodology describes the implementation of the Gap Analysis process in a form of a computer database application to incorporate all the main aspects of Gap Analysis process and facilitate automated control over the process.

Keywords: Gap Analysis; Standards; Directive Statement; Engineering Compliance Management

ÖZET
Yüksek Lisans Tezi

UYUM VE BOŞLUK ANALİZİ
SÜREÇ YÖNETİMİ

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Bu tezde, Boşluk Analizi geliştirme süreci, şirketlerin gerçekleştirdiği kabul görmüş standartlar setine uyum sağlamak için fırsatlar yaratır. Ancak, şu anda bu süreç çeşitli şekillerde endüstriyel veya enerji şirketlerinin çoğunda kullanılır. Bu süreçte çeşitli alanlardan birçok mühendislik uzmanları yer almaktadır ve bu durumda çok disiplinli standart boşluk analizi süreç yönetimi zamanı daha da karmaşık olur. Böyle bir evrağın gözden geçirilmesinin tamamlanması, birimler arası evrak dolaşımı ve kişilerin her zaman müsait olamaması nedeniyle bir ay veya fazla sürebilir. Bu süreci yüksek kalite ile tamamlamak için mükemmel bir işbirliği, planlama ve performans yönetimi gerekmektedir ve bu doğrulama ve onaylamalarında bürokratik zincirler arasında kaybolmamasını sağlar. Deneysel sonuçlar, özellikle uygulanabilir standartlar veya teknik uygulamalar sayısı yüz üzerinde olduğunda bir süreci yönetmek için zaman kaybının, kesintisiz işlem ve zorluklar aracılığıyla önlenebileceğini göstermektedir.

Bu metodoloji, Boşluk Analizi sürecinin tüm ana yönlerini birleştirmek ve süreç üzerinde otomatik kontrolü kolaylaştırmak için bilgisayar veri tabanı uygulamasında Boşluk Analizi sürecinin uygulanmasını tanımlar.

Anahtar Kelimeler: Boşluk Analizi; Standartlar; Direktif Bildirimi; Mühendislik Uyumluluk Yönetimi

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ABBREVIATIONS

BOD	Basis of Design - a set of Company Adopted Documents Standards, Codes and Practices comprising a basis of design/operation of an asset/facility.
DS	Directive Statement - a paragraph, sentence or a phrase within a standard which mandates, or recommends certain rules to be applied to the company assets in various areas of their operation.
Gap	Non-compliance, non-conformance to a particular Directive Statement of a Standard.
ER	Exceptions Request
AR	Actions Register
GAI	Gap Analysis Item - aggregate of Details (e.g. compliance flags, comments, references, links et.) corresponding to one Key Word (or one Index Point) of a Directive Statement .
GAR	Gap Analysis Record - an aggregate set of information describing compliance of a given part of an asset/facility to one particular Standard
IP	Index point - a reference point to a Key Word within a Directive Statement in a Standard electronic document text.
MI	Matrix of Indexes - set of reference points to the Key Words of Directive Statements of a particular Standard.
KW	Key words - Words that define the meaning of Directive Statements such as Shall, Should, Will, May etc.
SQL server	Structured Query Language server

1. INTRODUCTION

Gap Analysis process is prepared for the performing whereas currently this process worldwide is used in most of industrial or energy companies as many various ways using Microsoft (MS) Word, MS Excel or similar software office applications. It should be solved possibility a time consuming and difficult to manage process especially when the number of applicable Standards or Technical Practices is over a hundred. To provide demonstration of compliance to the set of adopted Standards the companies perform Gap Analysis exercises involving relevant technical specialists from within their company or by hiring external resources.

There are some tools built into Gap Analysis process that increase process efficiency and offer great collaboration possibility that are not found in the traditional process with emails and MS Word and Excel documents. It should be solved possibility a time consuming and difficult to manage process especially when the number of applicable Standards or Technical Practices is over a hundred. To provide demonstration of compliance to the set of adopted Standards the companies perform Gap Analysis exercises involving relevant technical specialists from within their company or by hiring external resources. According to estimation, Gap Analysis process can save up in the working time associated for engineers.

Implementing the flexible concept of organisation structures when developing a computer software will make it possible for this to be to customizable for organizations of any scale and any industrial sector where the compliance to standards is crucial.

In the first chapter, Introduction has been included. It is intended to provide general information about the thesis.

In the second chapter of this study, Gap Analysis Process has been explained overview.

Engineering Compliance Management process methodology has been illustrated the basis of the proposed methodology in diagram that Compliance Management Process is separated some divisions, facilities, standards and requirement and a potential software application which can be developed based on this methodology are used in the third chapter of this thesis

In the fourth chapter of this thesis, results and benefits have been added. Eventually conclusion has been illustrated.

2. GAP ANALYSIS PROCESS OVERVIEW

2.1 Standards

Modern industries are more and more reliant on compliance to globally accepted regulations, codes, standards and practices in order to maintain their ability to operate in the current global market and ensure that their assets are properly built and maintained and any product of their operations is fit for purpose and complies to the appropriate regulations. For many industries there is a set of mandatory codes, standards, regulations and practices which they have to adopt and legally comply to. In addition industrial companies often develop their own internal technical practices which are based upon existing standards but using a company internal language and list only standard requirements which are applicable to their business. Therefore the industrial companies have to demonstrate their compliance to these regulatory documents either internally or to external auditors on a regular basis.

Within this document the terms Codes, Standards, Regulations, Practices (both internal and global) will be referred as Standards [1] for simplicity.

The company internal Processes, Procedures, Product or Facility Design/Operating Specifications [2] and any other documented piece of a company asset will be referred to as Company Internal Documents or Company Documents.

To provide demonstration of compliance to the set of adopted Standards the companies perform Gap Analysis exercises involving relevant technical specialists form within their company or by hiring external resources.

2.2 Gap Analysis Process

Gap Analysis Process is a process of detailed review of requirements within a particular Standard against the relevant Company Internal Documents to identify non-compliance elements (or Gaps), if any, and compile a set of evidence records which demonstrate compliance of the company internal document requirements (or internal processes) to the requirements of the Standard. The Gap Analysis Overview is used to describe the organisation, business process and technical architecture that is being appraised. Using a business-process driven analysis methodology, it follows the flow of

the information created and used to assistance a business. It identifies standard documents that need to be captured, operated and administrated as records (eg requisition forms) for the evry primary steps in the business process [3].

Standard defines the rules and regulations by which the individuals or assets inside of the scope must abide by. Process provides greater elaboration on the standard by describing how the individuals or assets comply with the standard [4].

Where a gap is identified between a requirement of a standard and current company internal document it is important to perform risk assessment to identify the impact of this gap on the company operation/project, cost, HSSE, reputation etc. and plan appropriate Corrective Action to eliminate it. In case if elimination of the gap is not possible for various reasons, it has to be properly documented as an Exception (or Deviation) involving relevant technical specialists from various levels of the organisation to ensure that it is safe to continue operating the company's asset with this non-compliance. Process of Exceptions management may lead to planning of Follow-Up Actions to address any risks incurred by this Exception (Deviation).

Within this document the Corrective and Follow-Up Actions will be referred to as Actions and the company documents which identify Exception(s) (or deviations) and document the formal risk assessment, review and approval process will be referred to as Exception Requests.

2.3 Gap Analysis Record

The final product of the Gap Analysis Process is a Gap Analysis Record document [5, 6]. This document is a summary of the gap analysis exercise on a particular Standard and usually contains the following information:

- Purpose and scope of the gap analysis exercise
- Summary of Gaps, Exceptions Requests, Actions.
- Feedback to the originator (author) of this Standard identifying any suggestions for improvement.
- Detailed gap analysis section where each directive statement (see below) of the standard is referred to a relevant company document to demonstrate compliance, or flagged as a Gap with reference to an Action or Exception Request.

- Names of technical specialists who have been involved in the Gap Analysis exercise

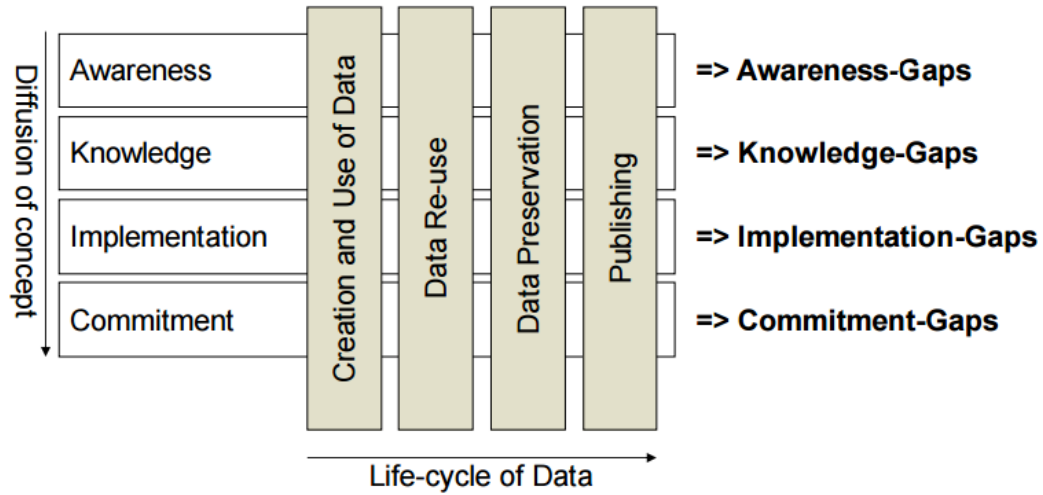


Figure 2.1 Gap Analysis Framework [7]

2.4 Directive Statement

Directive Statement - is a paragraph, sentence or a phrase within a standard which mandates, or recommends certain rules to be applied to the company assets in various areas of their operation. There is a common set of words which are used in the directive statements, they are:

- Shall, Will, Must - directive statements containing these words are mandatory requirements which must be applied by companies [12].
- Should, May, Recommended - used as recommendations to follow certain practices and are not mandatory [13].

3. ENGINEERING COMPLIANCE MANAGEMENT PROCESS METHODOLOGY

3.1 Engineering Compliance Management

Currently most of industrial or energy companies worldwide are performing Gap Analysis process in many various ways using MS Word, MS Excel or similar software office applications. This is a time consuming and difficult to manage process especially when the number of applicable Standards or Technical Practices is over a hundred. Gap Analysis process usually involves many engineering specialists from various disciplines and it becomes even more complicated when trying to manage a multi discipline Standard gap analysis process. To complete review of one such document may take up to a month or more due to people availability and document circulation between departments. This process requires a very well managed collaboration, planning and performance management in order to complete it with good quality and ensure that the results are not lost among the bureaucratic chains of verifications and approvals.

3.2 Compliance Management Process Methodology

This methodology describes implementation of the Gap Analysis process in a form of a computer database [8] application (web based or client based) to incorporate all the main aspects of Gap Analysis process and facilitate automated control over the process. The main elements of the Gap Analysis process are:

1. Defining the set of applicable standards and technical practices which an industrial company has to adhere to. (Master Standards Register)
2. Indexing each Standard to create the matrix of Shall and Should directive statements within the document.
3. Defining the structure of company facilities both operating and being designed (Facilities Register)
4. Defining sets of standards/practices from the company Master Standards Register) for each facility
5. Creating a Facility Gap Analysis Plan
6. Performing tracking of the Gap Analysis process based on the plan

7. Electronic approval
8. Reporting the compliance status on any organisational level (from a single unit within a facility up to the company top level).

The following diagram illustrates the basis of the proposed methodology in Figure 3.1.

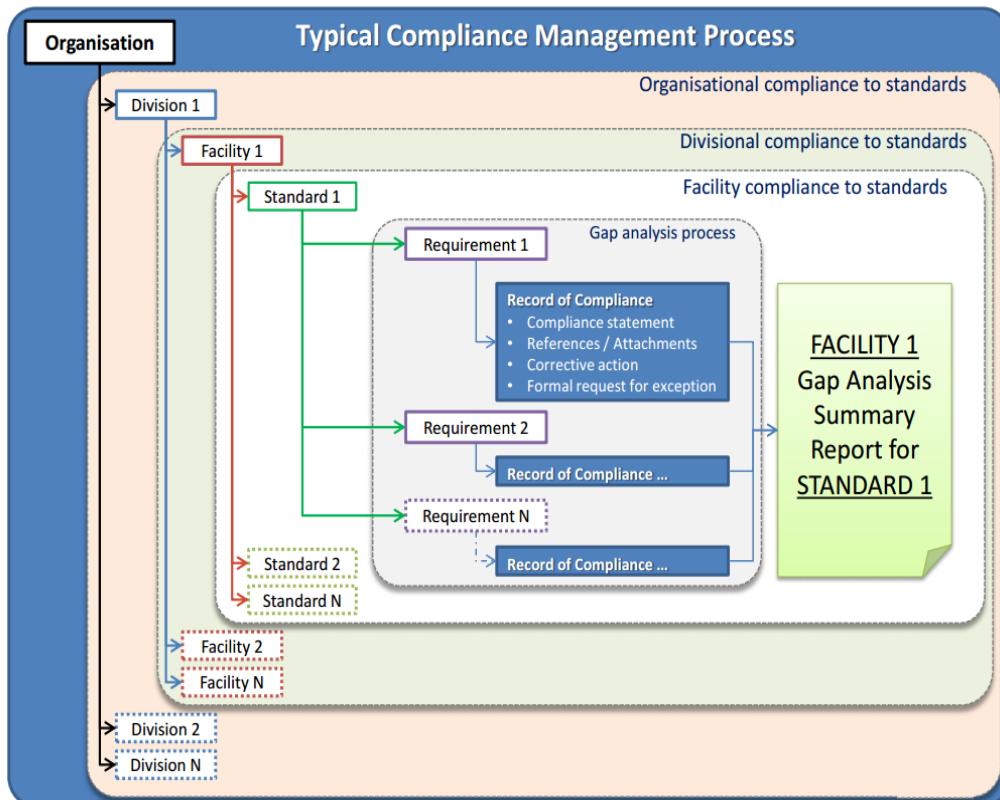


Figure 3.1 Typical Compliance Management Process

3.3 Engineering Compliance Management

This sub chapter describes the methodology and the process of Engineering Compliance Management [9]. The screenshots of a potential software application which can be developed based on this methodology are used for illustration purposes only.

3.3.1 The concept

The System is an integrated framework [10] for managing of company adopted Standards. It provides effective and convenient tools within the web-based multiuser environment for

- maintaining the master register of company adopted Standards
- maintaining the register of all company assets and facilities applicable Standards
- planning and performing Gap Analysis between standards and Company Documents,
- management of Actions and Exception Requests.
- transparent reporting of company compliance status at various organisational levels,

Implementing the flexible concept of organisation structures when developing a computer software is made it possible for this to be customizable for organizations of any scale and any industrial sector where the compliance to standards is crucial.

Creating a standard and integrated process of Compliance Management and Gap Analysis helps companies to save significant amount of manpower, eliminate paperwork related issues and simplify planning and execution process.

3.3.2 Modules

The system consists of the several modules which are designed to facilitate all the main functions of Compliance Management process. Working modules are the main working environment for compliance and Gap Analysis processes management. Administration modules provide functionality to manage user accounts and permissions, communications and logging across the system.

3.3.3 Working modules

The module provides environment to maintain and manage the master register of all company adopted Standards at the highest level of an organisation. This module is

deemed to be administered by a central team responsible for implementation of Standards across the whole organisation. Main functional elements include:

- Uploading Standards as PDF documents [14, 15] one by one or making bulk uploads.
- Each record contains the essential details about the Standards such as - Number, Title, Revision, Issue date,
- Key responsible person and Status (In Use / Active, Superseded or Void). The register allows multiple instances (revisions) of the same Standards to provide historical traceability.
- Automatically creating the matrix of indexes referencing each Directive Statement within the Standard(s). Each of these matrixes is then used as a master template for gap analysis and compliance reporting for assets/facilities
- Searching and filtration of the master register
- Making selection of Standards and using those to create new Asset/Facility record (refer to Assets/Facilities module description for more details)

Each Standard document uploaded into the system, as it has been stated above, is automatically indexed to create a matrix of indexes for a document. Up on uploading of a document, the system is performed scanning to locate directive statements (Must, Shall, Should etc.) and create a database (SQL server [11] has been used) of references to each. This database contains the directive statement itself, its position within the document and some other technical details which help to link a particular directive statement to a particular Standard. The database or Matrix of Indexes is stored in the Standards module and serves as a master template for all future Gap Analysis Records [16]. Master List of company adopted standards and practice documents in Figure 3.1.

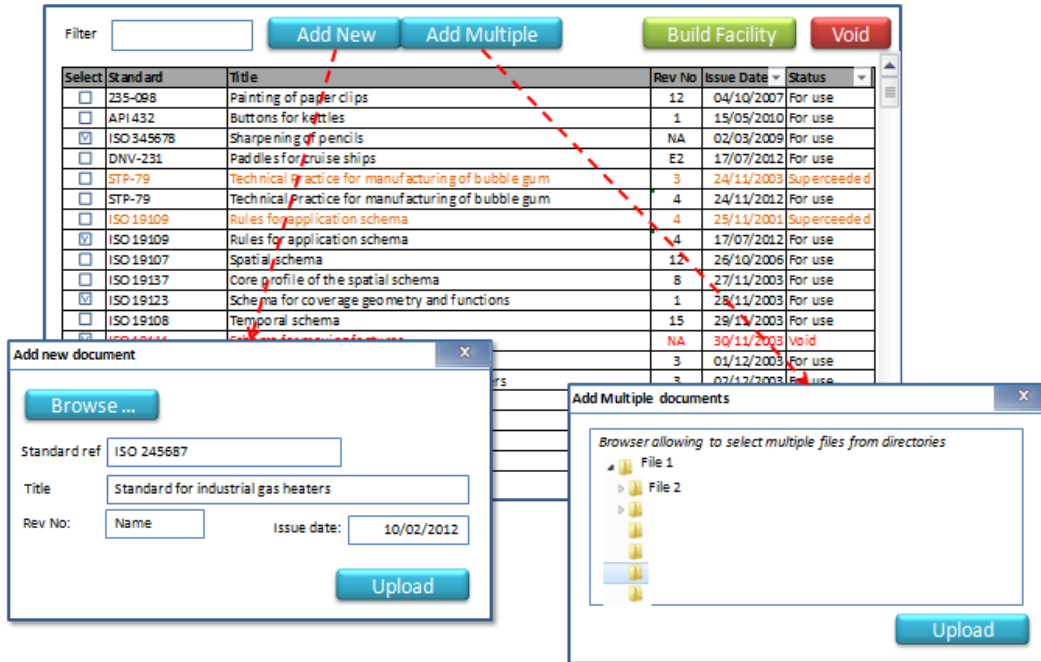


Figure 3.2: Master List of Ccompany Adopted Standards and Practice Documents

3.3.4 Assets/Facilities

This module provides functionality to create and manage the master register of company facilities and the hierarchy of the organisation. It consists of two elements - Assets/Facilities Register and Asset/Facility Record.

Assets/Facilities Register - List or hierarchy

- Master register of all assets/facilities which belong to the organisation
- Organisation can be presented in table or hierarchical view
- Searching and filtration of the register to find and select an item from the list/hierarchy

Filter <input type="text"/>								Add New
Facility/Asset	Region	Department	C&S BOD Approved	Status	Applicable Standards Tot	Gap Analysis Planned	Gap Analysis Completed	
North Bubble Gum Factor	Australia	Chewing Gum Production	12/05/2012	Project	142	95	32	
Car repair centre	Aberdeen	Transport	26/01/2011	Operating	15	17	17	
Chemicals plant	Brasil	Chemicals	02/06/2011	Project	189	173	165	
Kunguri 1 Ship Yard	Delhi	Marine	18/11/2000	Project	210	278	278	
Kunguri 1 Ship Yard	Delhi	Marine	18/11/2003	Operating	210	32	32	
PDI-5 Offshore platform	Oman	Oil Production	10/03/2009	Project	243	243	198	
PDI-5 Subsea Facilitie s	Oman	Oil Production	10/03/2009	Project	76	76	64	
Phoenix Power Staion	USA	Energy	15/09/2010	Operating	123	123	123	

Figure 3.3: Master List of company Assets/Facilities/Projects with Summary Details

Asset/Facility Record - Summary sheet.

- Summary of a selected Asset/Facility presenting the information in a form view. Details include - Facility/Asset name, Region, Department, Status, Total Number of Applicable Standards, Number of Gap Analysis exercises Planned for the Asset/Facility and number of Gap Analysis Completed
- List of all applicable Standards - “Standards/BOD” tab. The list can be created by picking from the master Standards module (as described above), or can be manually created directly on the Asset/Facility record screen from the dropdown list selection of company adopted Standards.
- The list provides functionality to select multiple Standards and create the Gap Analysis Plan

Facility Summary Duplicate Save

Department: Region:

Facility / Asset: Status:

Approved date: Document ref:

Responsibility: Abc defg:

Total Standards: Gap Analysis Planned: Gap Analysis Complete:

Gap Analysis % Complete:

Standards / BOD **Gap Analysis Plan**

Filter: Add to Plan Add New Void

Sel	Standard	Title	Rev	Issue Date	Status	Responsible Person
<input type="checkbox"/>	235-098	Painting of paper clips	12	04/10/2007	For use	Gu Hin Dzan
<input type="checkbox"/>	API 432	Buttons for kettles	1	15/05/2010	For use	Michael Spenser
<input checked="" type="checkbox"/>	ISO 345678	Sharpening of pencils	NA	02/03/2009	For use	Ivanov Ste pan
<input type="checkbox"/>	DNV-231	Paddles for cruise ships	E2	17/07/2012	For use	Michael Spenser
<input type="checkbox"/>	STP-79	Technical Practice for manufacturing of bubble gum	3	24/11/2008	Supereeeded	NA
<input type="checkbox"/>	STP-79	Technical Practice for manufacturing of bubble gum	4	24/11/2012	For use	Kunder Svonder
<input type="checkbox"/>	ISO 19109	Rules for application schema	4	25/11/2001	Supereeeded	Zin Peter
<input checked="" type="checkbox"/>	ISO 19109	Rules for application schema	4	17/07/2012	For use	Nicols David
<input type="checkbox"/>	ISO 19107	Spatial schema	12	26/10/2006	For use	Sevington Philip
<input type="checkbox"/>	ISO 19137	Core profile of the spatial schema	8	27/11/2003	For use	Krasnov Vadim
<input checked="" type="checkbox"/>	ISO 19123	Schema for coverage geometry and functions	1	28/11/2003	For use	Murkulas Grekas
<input type="checkbox"/>	ISO 19108	Temporal schema	15	29/11/2003	For use	Napolnasrakis Viktor
<input checked="" type="checkbox"/>	ISO 19141	Schema for moving features	NA	20/11/2008	Void	Konchini Felicio

Figure 3.4: Facility Compliance Summary – Applicable Standards and Engineering Practice Documents

“Gap Analysis Plan” tab - designed to aid in planning, performance tracking and management of the entire Gap Analysis process for an Asset/Facility.

Facility Summary Duplicate Save

Department: Region:
 Facility / Asset: Status:
 Approved date: Document ref:
 Responsibility: Abc defg:

Total Standards: Gap Analysis Planned: Gap Analysis Complete:
 Gap Analysis % Complete:

Standards / BOD Gap Analysis Plan

Filter: Add New Void

Gap Analysis record No	Description	Standard/Engineering Practice Number	Title	R	Issue	Target finish	Actual finish	Status
GAR-00001	Bubble gum extruders	STP-79	Technical Practice for manufacturing of bubble gum	4	24/11/2012	21/05/1900	04/04/1900	In prog
GAR-00002	Analysis of compliance for m	ISO 19109	Rules for application schema	4	17/07/2012	15/01/1900	17/01/1900	Verify
GAR-00003	Gap analysis against project s	ISO 19107	Spatial schema	4	26/10/2006	07/07/1900	21/06/1900	Approv
GAR-00004	Onshore terminal compliance	ISO 19123	Schema for coverage geometry and functions	12	28/11/2003	28/07/1900	04/10/1900	Void
GAR-00005	Wind farm generators	ISO 19108	Temporal schema	8	29/11/2003	28/07/1900	01/02/1900	Closed
GAR-00006	MOT centre documentation	ISO 345678	Sharpening of pencils	NA	02/03/2009	30/08/1900		Planne

Figure 3.5: Facility Basis of Design – Applicable Standards and Engineering Practice Documents

- The list displays the Gap Analysis Records (GAR) with unique GAR numbers, their progress, Start/Finish Dates, Priority (Hi/Med/Lo), Status and revision numbers.
- Plan items (GARs) can be built, as described above, from the “Standards/BOD” tab, or manually by clicking on the “Add New” button, this opens the new Gap Analysis Record screen where the details can be entered (see Gap Analysis module description for details)
- Filters can be used to search the GARs by any of available fields.
- Double click on the GAR number opens the corresponding Gap Analysis Record summary page to view and edit.

Duplicate - this function can be used to make a duplicate of the whole set of data applicable for a selected Asset/Facility to create a new (sister) Asset/Facility with same or similar set of standards and details. This function (if this option has been selected) can copy in addition the entire Gap Analysis Plan (without dates) creating new GAR numbers (revision numbers is set to 1 by default) for each copy of the Gap Analysis Record

preserving all the indexes, compliance flags, references and attachments, Action and Exception Requests numbers. It is turned status of each GAR to “Duplicate” to flag these to be revisited by relevant technical specialists.

3.3.5 Gap analysis

This module provides functionality to facilitate detailed gap analysis exercise on a selected Standard and introduce the results on the Summary page. This is the main working module of the system. The module consists of two functional elements:

- Gap Analysis Record Summary
- Gap Analysis Process View

Gap Analysis Record Summary: This element of Gap Analysis serves as an introductory and summary part of the GAR to provide all the necessary details on one page such as, Planning, Statistics of Gaps and Compliances, References, Links, Feedback, Approvals and other key details which describe the Gap Analysis Process on one particular Standard against a set of Company Documents.

Gap Analysis Record can be created in three ways:

1. By selecting the Standards which require being Gap Analysed from the Standards/BOD tab of the Asset/Facility Record screen and clicking on the “Add to plan” button. The system creates new unique GAR numbers for each Standard in the table on Gap Analysis Plan tab. System allows having same Standard to be used in many GARs. It is also populate the initial details for each Gap Analysis Record such as:

- Status - “Created”
- Created By - name of the person who has created this record(s) (user login details)
- Created Date - current date and time upon creation
- Attributes of the Standards - Number, Title, Revision, Discipline and Issue date

The Gap Analysis records which were created this way can be accessed by clicking on the GAR number to be able to populate all the remaining details.

2. By clicking on the “Add New” button on the Gap Analysis Plan tab of the Asset/Facility Record screen. The system opens the blank Gap Analysis Record screen (Screen 3.1) without a GAR number. It also populates the initial details on the form such as:

- Status - “Created”
- Created By - name of the person who has created this record (user login details)
- Created Date - current date and time upon creation

Standard for the Gap Analysis shall be selected manually from the dropdown list of the “Standard” field to enable the system to populate the remaining attributes of it - (Number, Title, Revision, Discipline and Issue date)

The new GAR number has be created on save.

3. By duplicating an existing GAR. To create a duplicate of an existing Gap Analysis Record a user should open a record which is going to be used as a basis and click on “Duplicate” button. The system opens a dialogue to enable user to specify which details of the original GAR should be duplicated to the new one. Options are -

- “Exact Copy” - to copy the entire set of data from one to another (except User related details and Approval history)
- “Initial Data Only” - resets all the Compliance Flags to default and copy the
 - ✓ Description
 - ✓ Introduction (should add a number of the original GAR for reference on top)
 - ✓ Details of the Standard (number, title, issue date, revision)
 - ✓ Discipline
 - ✓ Index of the Standard (copy form original GAR, not from the Standards Master Register)

The following fields has be set to their initial values on the duplicate GAR in either case.

- Status - “Duplicate”
- Created By - name of the person who has created this record (user login details)
- Created Date - current date and time upon creation

- Rev - 1

The new GAR number has be created on save

Summary Tab - This tab provides summary on planning details and statistics of the Gap Analysis Record in Figure 3.6.

Gap Analysis Record Summary Open Save Duplicate Void

GAR No: Rev Status:

Description:

Created by: Created date:

Standard:

Revision: Issue date: Discipline:


Summary
Introduction
References
Request for input
Exceptions / Actions
Approval

Planning		SHALL	SHOULD
	TARGET		
Start:	<input type="text" value="12/02/2012"/>	Total: <input type="text" value="57"/>	<input type="text" value="84"/>
Finish:	<input type="text" value="20/02/2012"/>	Gaps: <input type="text" value="3"/>	<input type="text" value="10"/>
		Exceptions: <input type="text" value="2"/>	<input type="text" value="0"/>
		Approved: <input type="text" value="1"/>	<input type="text" value="0"/>
		Actions: <input type="text" value="1"/>	<input type="text" value="10"/>
		Closed: <input type="text" value="0"/>	<input type="text" value="0"/>
Total hours worked: <input type="text" value="3.5"/>			

Feedback:

Figure 3.6: Gap Analysis Summary

Introduction Tab - Provides a space for users to describe the purpose, scope and applicability of this Gap Analysis Record in Figure 3.7.

Gap Analysis Record Summary Open  Save Duplicate Void

GAR No: Rev Status:

Description:

Created by: Created date:

Standard:

Revision: Issue date: Discipline:

Introduction / Executive Summary

Free text box to describe the purpose of the Gap Analysis exercise, scope and applicability.

Figure 3.7: Gap Analysis Summary

References Tab - Summary of all referenced documents which are going to be used in the Gap Analysis. The items shall be added to this list in order to make them available as dropdown list values in the Gap Analysis Items in Figure 3.8.

Gap Analysis Record Summary
Open
Save
Duplicate
Void

GAR No: Rev Status:

Description:

Created by: Created date:

Standard:

Revision: Issue date: Discipline:

Summary | Introduction | References | Request for input | Exceptions / Actions | Approval

Document References

##	Doc ref	Title	Rev / Date
1	EXT-20387-SPE-0005	Main gum extruder specification	12/05/2006
2	EXT-20387-SPE-0006	Auxiliary gum extruder specification	01/01/1998
3	EXT-20387-SPE-0007	Gum extruders power supply	25/06/2009

Attached documents

##	Title
1	Attachment 1
2	Attachment 2
3	Attachment 3

Figure 3.8: Gap Analysis Summary

Request for input Tab - This tab shows the summary list of all “Input required” flags from the body of the Gap Analysis. This is useful when it is needed to request for information regarding selected sections of the Standard, being currently analysed, from another person. User can select multiple lines from the table showing the chosen sections of the Standard and send a request to that persons e-mail. More details about this functionality are provided in the “Gap Analysis Process View” section below in Figure 3.9.

Gap Analysis Record Summary Open Save Duplicate Void

GAR No: Rev Status:

Description:

Created by: Created date:

Standard:

Revision: Issue date: Primary Discipline:

Summary Introduction References **Request for input** Exceptions / Actions Approval

Request Input for selected

Select	Section/Paragraph	Recipient	Status	Status Date
<input type="checkbox"/>	2.3	John Hilton	Sent	04/10/2011
<input type="checkbox"/>	2.4.b	Keith Maskel	Responded	15/10/2011
<input checked="" type="checkbox"/>	3.7.2.a			
<input checked="" type="checkbox"/>	5.1.3			

Request for input ×

Add Recipient:

Message: *Dear [Recipient],
Please provide your input in the following sections
[3.7.2.a](#); [5.1.3](#)*

Send

Figure 3.9: Gap Analysis Summary

Exceptions/Actions Tab - Represents summary of all Actions and Exception Requests linked to this Gap Analysis Record. Click on an Action or Exception Request number open the corresponding forms in new windows for further manipulations in Figure 3.10.

Gap Analysis Record Summary

GAR No: Rev Status:

Description:

Created by: Created date:

Standard:

Revision: Issue date: Primary Discipline:

Responsible:

Reviewed by:

Reviewed by:

Approved by:

Figure 3.10: Gap Analysis Summary

Approval tab - This tab represents the Gap Analysis workflow and can be customised to suit the organisation in Figure 3.11.

The person responsible for the Gap Analysis (the owner, or the person who is actually performing this exercise) starts the Gap Analysis (status changed to “In Progress”) by clicking on “Start” button. This populates Actual Start Date/Time and enable the timer to count hours worked on a document. The timer has be counting active time of the Gap Analysis Process View (e.g., when it is placed as a top window) and stop when the window comes inactive (e.g. minimised to tray or another window comes active). Once started the Start button becomes inactive. To open the Gap Analysis Process View user should click on “Open” button. Counter does not count hours when Gap Analysis Record Summary screen is active, only when Gap Analysis Process View is open and active.

Gap analysis process ends when the “Approve” button has been clicked by a relevant approver. This will Populate the Actual Finish date/time and stop the time counter. “Start” button changes its caption on “Raise Revision” and becomes active.

Once the Gap Analysis Exercise has been complete the Responsible person can Add Reviewer(s) and submit the Gap Analysis Record for review and verification (status changes to “Submitted”). System will send e-mail notifications to all the Reviewers at once and each one can provide his/her input at any time. There is no need to follow any order during the review and verification process. They can provide comments and suggestions using the “Comment” function and it will notify the Responsible person about each comment by e-mail (if this option has been selected). Otherwise the system will highlight the corresponding Reviewer lines if there is a new comment. Reviewers can add more reviewers if they feel necessary.

Gap Analysis Record Summary Open Save Duplicate Void

GAR No: Rev Status:

Description:

Created by: Created date:

Standard:

Revision: Issue date: Primary Discipline:

Summary Introduction References Request for input Exceptions / Actions Approval

Responsible: START Submit Add Reviewer

Reviewed by: Verify Comment Add Reviewer

Reviewed by: Verify Comment Add Reviewer

Approved by: Approve Comment

Figure 3.11: Gap Analysis Summary

When the reviewers are happy with contents of the Gap Analysis Record they click “Verify” button(s). Once all verify buttons have been clicked the system will notify the Responsible person and the Approver by e-mail (status will change to “Verified”). The approver can provide his comments same way as reviewers until he is ready to approve the completion of the Gap Analysis Record. Clicking on Approve Button stops the Gap

Analysis process (timer stops), Actual Finish Time set to current Date/Time, Status changes to “Closed”, The Gap Analysis Record becomes inactive (read-only).

The following controls are active after Gap Analysis Record has been approved:

- Open button
- Print
- Raise Revision button
- Duplicate button

Raising Revision of a GAR: In some cases it may be required to revisit a GAR which has been Closed, the responsible person can click on the “Raise Revision” button to re-open the GAR and be able to make necessary updates on it. On “Raise Revision” button click the dialogue box will request some initial details and once confirmed by the user (“Ok” button) the system will increase Revision number of the GAR, re-enable the counter from the point where it has stopped and make a record in the “Introduction” section showing the details of who and when has raised revision on this GAR. Status goes back to “In Progress”

GAR once resubmitted will have to follow the same review and approval process again with the same group of people involved in the first pass, unless delegate option is acting.

3.3.6 Gap analysis process view

The Gap Analysis Process View consists of three main sections in Figure 3.12.

1. Toolbar
2. Standard
3. Details

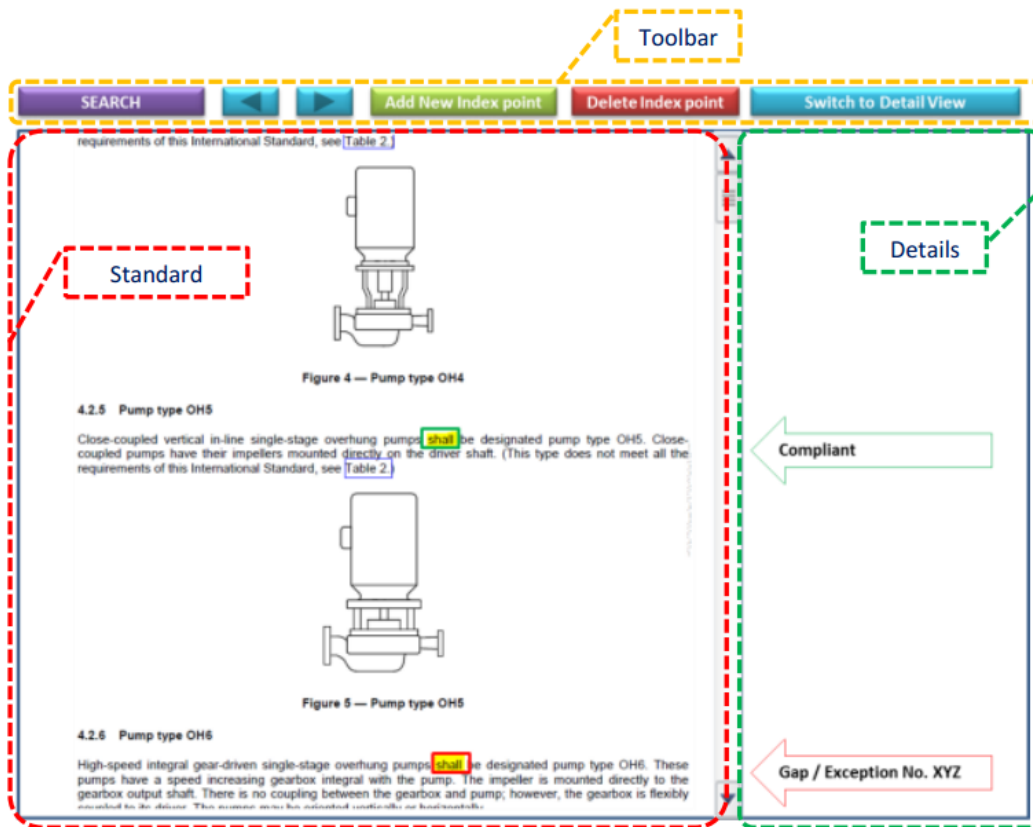


Figure 3.12: GAP View Overall

Toolbar - contains the main functions such as

- Search - enabling searching functionality within Standard and Detail sections
- Navigation buttons
- Adding or Deleting index points
- Switching between List/Detail views for the Details section.

Standard - section which encapsulates the Standard document text with preserved original formatting. The Directive Statements (Shall, Should etc.) are highlighted in different colours to aid in spotting those in the text.

Details - is the interactive space providing all necessary flags, and functionality to compile a comprehensive demonstration of compliance for each of the Directive Statements (if required) and for any of the manually indexed part of the text.

The aggregate of the Details (e.g. compliance flags, comments, references, links et.) corresponding to one Directive Statement (or one Index Point) is called a Gap Analysis Item .

Navigation through the document can be done by:

- scrolling,
- using the navigation controls
- using Search functionality

If the List View mode of the Details section has been selected then scrolling (or any other way of navigation) the text in Standard section will synchronously scroll the Details section to align the corresponding Gap Analysis Items to the Index Points - Key Words within the text of the document. The Gap Analysis Items (GAI) are represented as arrows pointing the corresponding Index Point (or a Key Word). The arrows are colour coded to help identifying the state of conformance to this Directive Statement(DS):

- Green - Conformance (compliance)
- Red - non-conformance (Gap)
- Grey - not yet analysed
- Yellow - Held, or waiting for input

Clicking on an arrow will switch the Details section to Detailed View mode to show the details corresponding to this GAI. Similarly, clicking on any Index Point (or a Key Word) within the text show the GAI details in the Detail section.

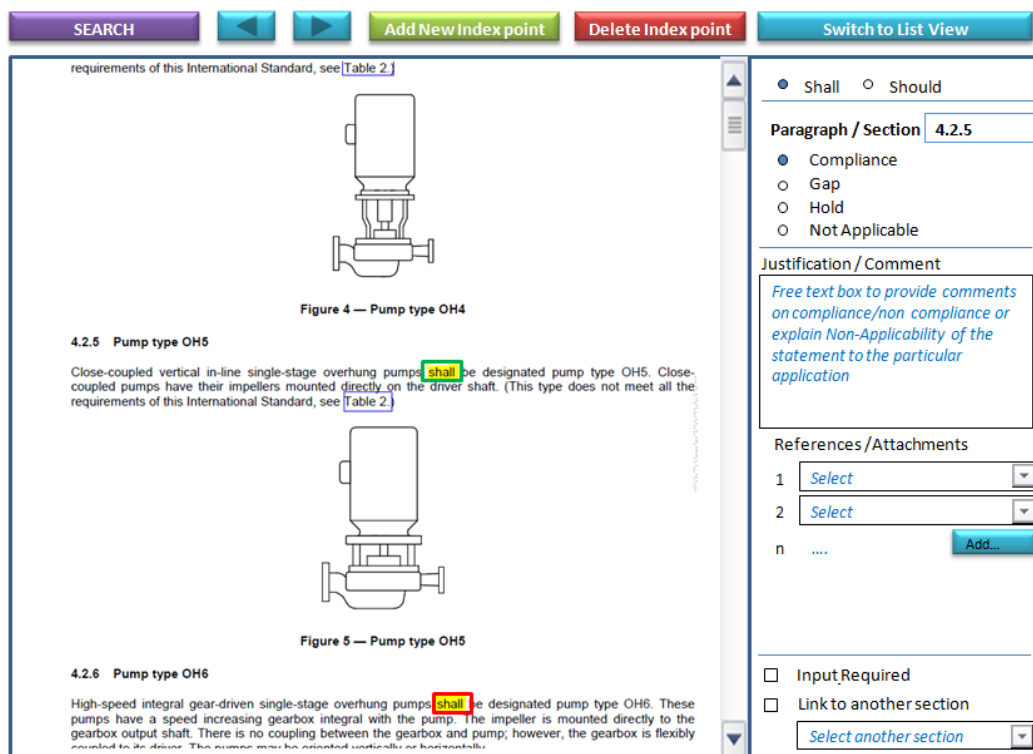


Figure 3.13: Gap Analysis Record - Main Working Window

Completing a Gap Analysis Item (GAI): A Gap Analysis Item can be explained in other words as a card which is linked to a particular Index Point (or a Key Word) of a Directive Statement and providing a space for Technical Specialist to identify a Gap, describe applicability or provide demonstration of compliance.

By default the GAI form is set to the following state:

- Paragraph/Section - blank
- None of the radio buttons (Compliance, Gap, Hold, Not applicable) selected
- Justification/Comment - blank
- References/Attachments - blank
- “Input Required” box - unticked
- “Link to another section” box - unticked
- “Select another section” dropdown list - blank and invisible. It comes visible when the “Link to another section” box is ticked
- Corrective Action and Exception Request – blank

In Case of Compliance:

1. Select a Directive Statement in the document and click on the Key Word to open the corresponding blank GAI in the Detail section.
2. Populate Paragraph/Section box if needed. Value which is entered in this box will be used as a reference if it is required to link other Index Points to this one. It may be helpful when a user is planning to complete one GAI for a number of Index Points. The list of all Paragraph/Section box values related to this particular GAR will be available in the “Select another section” dropdown list.
3. Select “Compliance” radio button to flag this GAI as Compliance
4. Provide Justification or Comments to describe compliance to the specified Directive Statement
5. Select any available Reference/Attachments from the dropdown list. The dropdown box will contain the list of all references, attachments which have initially been added on the “References” tab of the GAR Summary. Users can add multiple References/Attachments using “Add...” button

In Case of Input:

In case of input is required from another person.

1. Select a Directive Statement in the document and click on the Key Word to open the corresponding blank GAI in the Detail section.
2. Populate the Paragraph/Section box to identify which paragraph/section this request will be related to
3. Select “Hold” radio button
4. Tick the “Input required” box. This will create a record in the “Request for Input” tab on the GAR Summary
5. Repeat this process until all the sections which require any input are identified.
6. Go to the “Request for Input” tab on the GAR Summary and select the records from the table which need to have an input from another person. It is a good practice to send a request for input to another person with a list of sections rather than one by one. Once the required records have been selected click on “Request Input for Selected” button to open the dialogue where the Recipient’s name (e-mail) is identified and message to that person describing the purpose of the request can be provided. The system will automatically pre-populate a standard formal message text and the links to all the sections which require his/her input. The recipient can click on the links to go straight to that sections and populate the details of the corresponding GAIs.

In Case of a Non-Compliance (Gap):

1. Select a Directive Statement in the document and click on the Key Word to open the corresponding blank GAI in the Detail section.
2. Populate the Paragraph/Section box to identify which paragraph/section this GAI is be related to
3. Select “Gap” radio button
4. Provide Justification for non-compliance to the specified Directive Statement, recommendation for a corrective action or a request for an Exception
5. Once the recommendations (for an action or Exception Request) have been confirmed (external process) an Action or/and Exception Request can be created using the relevant “Create” buttons.

- a. To create and Action - click on the “Create” button in the Corrective Action section. This will open a new Action form, which will be automatically pre-populated with details of the Facility, Standard, Section/ Paragraph (or a list of sections/paragraphs if this record is linked to others), User Name, Discipline and date of creation. The remaining Action related details have to be populated manually by the user. Refer to the Actions section for more details.
 - b. To create an Exception Request - click on the “Create” button in the Request for exception section. This will open a new Exception Request from which will be automatically pre-populated with details of the Facility, Standard, Section/ Paragraph (or a list of sections/paragraphs if this record is to others), User Name, Discipline and date of creation. The remaining details related to the Exception request have to be populated manually by the user. Refer to the Exception Request section for more details.
6. Once created Action or Exception request number will be shown in the corresponding box on the Detail section and added into the list on the Exceptions/Actions tab of the GAR Summary in Figure 3.14.

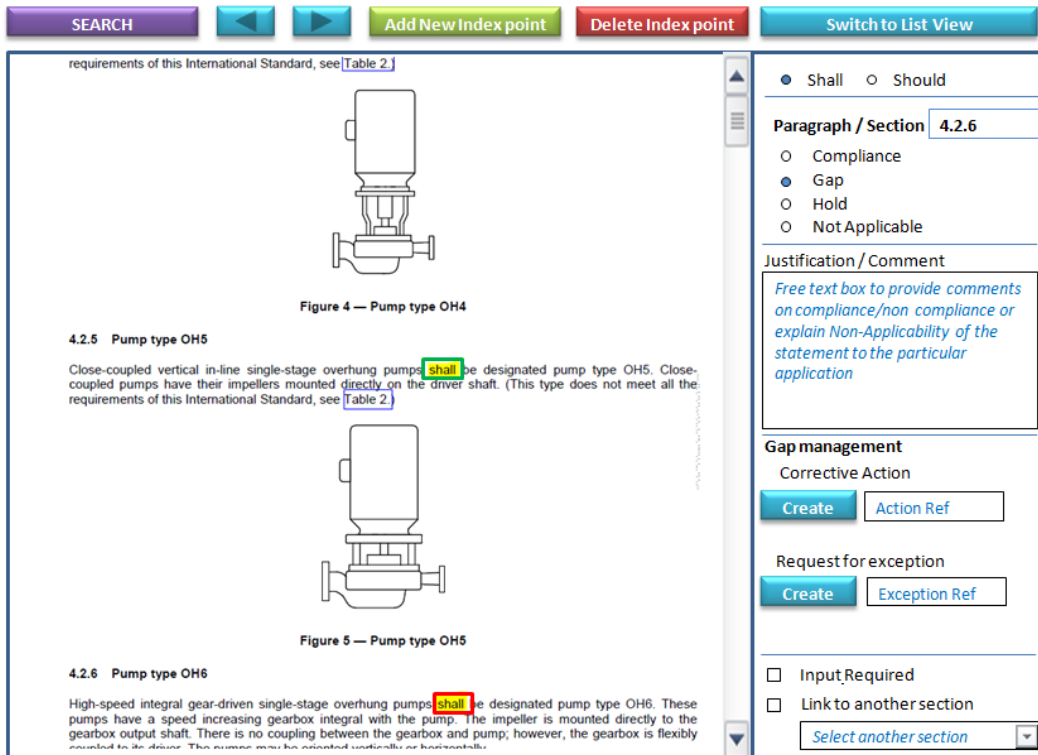


Figure 3.14: Gap Analysis Record - Main Working Window

In Case if a Directive Statement is Not Applicable: In case if a Directive Statement is not applicable to the current facility/asset.

1. Select a Directive Statement in the document and click on the Key Word to open the corresponding blank GAI in the Detail section.
2. Populate the Paragraph/Section box if needed to identify which paragraph/section this request will be related to
3. Select “Not applicable” radio
4. Provide explanation of Non-Applicability of the specified Directive Statement to the facility/asset design operability.

Linking GAIs: Sometimes it may be required to link the Directive Statements, which are related by meaning to each other, into a group and complete a single GAI to demonstrate compliance, justify non-compliance or non-applicability. For example if compliance to multiple Directive Statements from various parts of the Standard can be demonstrated by referring to one Company Document and are same in meaning and context, or there is

non-compliance to multiple relative Directive Statements can be managed by one single Corrective Action or an Exception Request.

Identify the Parent: To be able to link GAIs together and create a group, the first point of reference shall be identified by populating the Paragraph/Section box in the GAI of the first Directive Statement which will serve as a parent. The value from the Paragraph/Section box will be available from the dropdown list below the “Link to another section” tick box when it is ticked.

Link a GAI to the Parent:

1. Populate the Paragraph/Section box of a child GAI with the corresponding paragraph/section reference number to this Directive Statement
2. Tick the “Link to another section” tick
3. Select the reference number (Paragraph/Section) to the parent GAI from the dropdown list.

Once linked the system will copy the compliance flag (Compliance, Gap, Not applicable etc) from the parent GAI to the linked one. All the controls except the “Link to another section” tick box will become inactive on the child GAI Detail sections. References, Attachments, Actions and Exception Requests shall all be completed from the Parent GAI Detail section. To Un-Link a particular GAI the “Link to another section” tick box shall be un-ticked.

Adding/Deleting an Index Point: The system will use the template Matrix of indexes for a new Gap Analysis Record by default. Sometimes it may be required to add more index points to the matrix or delete some which are irrelevant to the Gap Analysis Process. It may happen that the system will miss some directive statements in a Standard due to mistyped text (e.g. “Shloud” instead of “Should”) and not create an index point for it. This can be corrected manually by the user during the course of the Gap Analysis Process on this Standard. Or if it is required to create an index point on a Directive Statement key word which is different from Shall or Should.

To add an index point

1. Select a word (or a phrase), which is going to be a Key Word, in the text in the Standard
2. Click on the “Add new Index point” button

If the “List View” mode is selected for Detail section then the new Grey arrow will appear against this section of the text indicating that the new Index has been created. If the “Detail view” mode is selected then the new blank GAI will be displayed in the Detail section ready to be populated with information.

To delete an index point:


1. Click on a Key Word which needs to be removed from the Matrix of Indexes in the text in the Standard section. The corresponding GAI will be displayed on the Detail section.
2. Click on the “Delete Index point” button. The dialog will appear requesting your confirmation to proceed with this action. If the selected Index is linked with a Parent GAI, or if this GAI has any Action or Exception Request referenced, the system will notify the user about it and will not delete anything.
3. If deletion has been confirmed by the user, the selected Index Point will be removed from the Matrix of Indexes along with the GAI data.

3.3.7 Exception requests management

This module provides functionality for management of Exception Requests via multi-level approval process. This module can be customized to fit the approval process for a particular organization therefore the description below is for basic functionality only. Optionally it can be integrated with an existing Exceptions Management process/system used by a client company.

The module consists of two parts - the Exceptions Requests register and the Exception Request Form.

Exception Requests Management: This element allows users to create new and view the list of all existing Exception Requests which were raised for their dedicated Asset/Facility. It provides functionality to search/filter, view selected ER key details in the bottom part of the screen, and print the register on paper or to a spread sheet file. Clicking on a selected ER Number will open the Exception Request Form for view or editing in Figure 3.15.

Filter 

ER Number	Revision	Title	Originators Name	Status	Created Date	GAR	Affected Standard	Section(s)	Discipline	Last updated Date	Action requi
ER-FN-000001	1	Green colour is not used	Gu Hin Dzan	Created	04/10/2007	GAR-00001	235-098	4.2.1	Process	04/10/2007	Gu Hin Dzan
ER-FN-000002	1	Buttons shape is rectangular	Michael Spenser	Verified	15/05/2010	GAR-00002	API 432	1.5.a	HSSE	15/05/2010	Michael Spenser
ER-FN-000003	1	Pencils are sharpened counter clockwise	Ivanov Stepan	Endorsed	02/03/2009	GAR-00003	ISO 345678	10	Mechanical	02/03/2009	Ivanov Stepan
ER-FN-000004	1	Cruise ships use no paddles	Michael Spenser	Approved	17/07/2012	GAR-00004	DNV-231	11.2 / 11.5	Mechanical	17/07/2012	Michael Spenser
ER-FN-000005	1	Gum compound is used in accordance with	Michael Spenser	Closed	24/11/2003	GAR-00005	STP-79	5.2	Process	24/11/2003	Sevington Philip
ER-FN-000006	1	Bubble gum will not produce bubbles	Kunder Svonder	Void	24/11/2012	GAR-00006	STP-79	7/8	Process	24/11/2012	Kunder Svonder
ER-FN-000007	2	Critical studies are not produced by technicians	Zin Peter	Created	25/11/2001	GAR-00001	ISO 19109	2.1.3	QA/AC	25/11/2001	Zin Peter
ER-FN-000008	1	Technicians uniform - gloves not used in site	Nicols David	Verified	17/07/2012	GAR-00002	ISO 19109	9.4.1	HSSE	17/07/2012	Nicols David
ER-FN-000009	3	Red dots are not used on road signs	Sevington Philip	Endorsed	26/10/2006	GAR-00003	ISO 19107	7.8 / 8.5	Civils	26/10/2006	Sevington Philip
ER-FN-000010	1	Special purpose couplings	Krasnov Vadim	Approved	27/11/2003	GAR-00004	ISO 19137	3.5	Mechanical	27/11/2003	Krasnov Vadim
ER-FN-000011	1	Separator inspection routines	Murkulas Grekas	Closed	28/11/2003	GAR-00005	ISO 19123	7.9.8	Maintenance	28/11/2003	Murkulas Grekas
ER-FN-000012	1	Hi Voltage Motor insulators	Napoinasrakis Viktor	Void	29/11/2003	GAR-00006	ISO 19108	4.b / 4.e	Electrical	29/11/2003	Napoinasrakis Viktor

Exception Request summary:

ER No: Buttons shape is rectangular Rev:

Originator: Date: Discipline: Status:

Exception Description:
API 432 Paragraph 1.5.a States: Buttons for kitchen kettles shall be made in round shapes to eliminate any sharp edges which could lead to accidents.
Specification for kettles JV-235-KT-0003 – specifies use of rectangular shaped buttons

Exception Justification:
Rectangular shaped buttons are only kind of buttons available in the market. Producing round shaped buttons will lead to increased cost of production

Figure 3.15: Exception Requests register

Exception Request Form: The Exception Request Form is the main working element of the Exceptions Management process. It provides functionality for users to create exception requests, provide justification, describe risks and risk mitigation actions, add references and attach documents. Multi-level verification and approval process of an ER is performed by means of e-mail notifications to the relevant people who can access the referred ER by clicking on the link provided in the message text.

In addition the form is linked to the Actions Tracking module and provides controls to create any ER related follow up actions in Figure 3.16.

Save

ER No: ER-FN-000002 Buttons shape is rectangular Rev: 1

Originator: Michael Spenser Date: 15/05/2010 Discipline: HSSE Status: Verified

Exception Description:
Rectangular shaped buttons are only kind of buttons available in the market. Producing round shaped buttons will lead to increased cost of production

Risk Assessment:
The rectangular shaped buttons can present a certain risk if the edges are sharp. This risk is eliminated by grinding off the sharp edges.

Submitted by: Michael Spenser Date: 16/05/2010 Add Reviewers Submit

Reviewed by: Vincent Cambridge Date: 16/05/2010 Verify Comment Add Reviewer

Reviewed by: Vincent Cambridge Date: 16/05/2010 Verify Comment Add Reviewer

Approved by: Alex Greenberg Date: 16/05/2010 Approve Comment

Follow-up Action
Create Action Ref Number Title Grind all the sharp edges from all the rectangular shaped buttons Status Created

Figure 3.16: Exception Request Form

3.3.8 Actions tracking

Provides an interactive environment for tracking and management of corrective actions aimed to close gaps, which have been identified during Gap Analysis process. This module can be customized to fit the actions tracking process for a particular organization. Optionally it can be integrated with an existing Exceptions Management process/system used by a client company.

The module consists of two parts - Actions Register and Action form.

Actions Register: This element allows users to create new and view the list of all existing Action which were raised for their dedicated Asset/Facility. It provides functionality to search/filter, view selected Action key details in the bottom part of the screen, and print the register on paper or to a spread sheet file. Clicking on a selected Action Number will open the Action Form for view or editing in Figure 3.17.

Filter

Action Nr	Title	Action Owner	Status	Priority	Created Date	Target completion	GAR	ER	Related to Standard	Discipline
AC-FN-000001	Green colour is not used	Gu Hin Dzan	Created	Hi	04/10/2007	15/01/2008	GAR-00001		235-098	Process
AC-FN-000002	Grind all the sharp edges from all the	Michael Spenser	Reported	Med	15/05/2010	19/06/2010	GAR-00002	ER-FN-000008	API 432	HSSE
AC-FN-000003	Pencils are sharpened counter clockwise	Ivanov Stepan	Approved	Lo	02/03/2009	06/04/2009	GAR-00003		ISO 345678	Mechanical
AC-FN-000004	Cruise ships use no paddles	Michael Spenser	Void	Hi	17/07/2012	21/08/2012	GAR-00004		DNV-231	Mechanical
AC-FN-000005	Gum compound is used in accordance with	Michael Spenser	Created	Med	24/11/2003	29/12/2003	GAR-00005		STP-79	Process
AC-FN-000006	Bubble gum will not produce bubbles	Kunder Svonder	Reported	Lo	24/11/2012	29/12/2012	GAR-00006		STP-79	Process
AC-FN-000007	Critical studies are not produced by techni	Zin Peter	Approved	Hi	25/11/2001	30/12/2001	GAR-00001		ISO 19109	QA/AC
AC-FN-000008	Technicians uniform - gloves not used in s	Nicols David	Void	Med	17/07/2012	21/08/2012	GAR-00002		ISO 19109	HSSE
AC-FN-000009	Red dots are not used on road signs	Sevington Philip	Created	Lo	26/10/2006	30/11/2006	GAR-00003		ISO 19107	Civils
AC-FN-000010	Special purpose couplings	Krasnov Vadim	Reported	Hi	27/11/2003	01/01/2004	GAR-00004		ISO 19137	Mechanical
AC-FN-000011	Separator inspection routines	Murkulas Grekas	Approved	Med	28/11/2003	02/01/2004	GAR-00005		ISO 19123	Maintenance
AC-FN-000012	Hi Voltage Motor insulators	Napolnasrakis Viktor	Void	Lo	29/11/2003	03/01/2004	GAR-00006		ISO 19108	Electrical

Exception Request summary:

Action No: Priority:

Action Owner: Target Date: Discipline: Status:

Action Description:

Action Completion Reporting:

Figure 3.17: Action Register

Action Form: The Exception Request Form is the main working element of the Actions Management process. It provides functionality for users to create actions, describe the detailed action plan, add references, attach documents and demonstrate completion. Multi-level verification and approval process of actions is performed by means of e-mail notifications to the relevant people who can access the referred Action by clicking on the link provided in the message text.

Each action is linked to a Gap Analysis Record or an Exception request where it was originated from. It is also possible to create standalone actions if required directly from the register screen.

“Smart” numbering is recommended to be used to identify the Actions by Facility, e.g. AC-FN-000001 where FN is a facility code.

Save

Action No: AC-FN-000002 Grind all the sharp edges from all the rectangular shaped buttons Priority: Med

Action Owner: Michael Spenser Target Date: 19/06/2010 Discipline: HSSE Status: Reported

GAR: GAR-00002 Analysis of compliance for machinery

Related to Std: API432 Follow-up on Exception request No: ER-FN-000008

##	Docref	Rev / Date
1	EXT-20387-SPE-0005	12/05/2006
2	EXT-20387-SPE-0006	01/01/1998
3	EXT-20387-SPE-0007	25/06/2009

Add Remove

##	Title
1	Attachment 1
2	Attachment 2
3	Attachment 3

Add Remove

Action Description:
Ensure that the sharp edges on all rectangular buttons are grinded off to prevent the risk of cuts or scratches

Action Completion Reporting:
All buttons were grinded. See attached documents and images for more information.

Submitted by: Michael Spenser Date: 16/05/2010 Add Reviewers Submit

Reviewed by: Vincent Cambridge Date: 16/05/2010 Verify Comment

Approved by: Alex Greenberg Date: 16/05/2010 Approve Comment

Figure 3.18: Action Form

3.3.9 Administrative modules

User Accounts Management module: This module provides interface for management of user accounts and permissions. The unified permission types and the typical table of user accounts is shown below in Table 3.1.

Table 3.1: User accounts and permissions.

User Name	Use ID	Password	Department	Region	Asset/Facility	Profile type	Permission Level
Name, Surname	userid	*****	Chemicals	Brasil	Carbochloro Chemicals Plant	General	Asset
						Approver	Region
						Administrator	Department
							Global

Logging Module: The system logs every action performed by any user for historical purposes in a clear text format that can be searched, filtered and tracked to individual event. This is useful for troubleshooting of the system functionality and other purposes.

4. RESULTS

4.1 iText and Hibernate

The Gap Analysis Process View was illustrated in detail in Chapter 3. The aggregate of the Details corresponding to one Directive Statement (or one Index Point) is called a Gap Analysis Item. The Gap Analysis Items (GAI) is represented as arrows pointing the corresponding Index Point (or a Key Word) by iText [17-20] in Java [21-23]. Development and improved code (iText Process) has been displayed on PDF file in Appendix 1.

It is found the Gap Analysis Items in PDF by PrintTextLocations function Appendix 2.

Appendix 1 and 2 functions provide opportunity Directive Statement then it write to database (SQL [24]) by processTextPosition. We can see clearly in Chapter 3 that they were exported and displayed from database on web by .js [25-27] as Gap Analysis Record - Main Working window Appendix 3.

Overall, the important tags of hibernate.cfg.xml in this thesis are as follows:



```
<hibernate-configuration>
  <session-factory>
    <property name="connection.driver_class">com.microsoft.sqlserver.jdbc.SQLServerDriver</property>
    <property name="hibernate.connection.url">jdbc:sqlserver://localhost:1433;databaseName=ECM</property>
    <property name="hibernate.connection.username">sa</property>
    <property name="hibernate.connection.password">12345</property>
    <property name="hibernate.dialect">com.ecm.webapp.controller.SQLServerNativeDialect</property>
    <property name="hibernate.default_schema">ECM</property>
    <property name="show_sql">>true</property>
    <property name="current_session_context_class">thread</property>

    <mapping class="com.ecm.model.Users"/>
    <mapping class="com.ecm.model.Department"/>
    <mapping class="com.ecm.model.Organisation"/>
    <mapping class="com.ecm.model.Standard"/>
    <mapping class="com.ecm.model.Facility"/>
    <mapping class="com.ecm.model.ChangePassword"/>
    <mapping class="com.ecm.model.PageTokenIndex"/>
    <!-- <mapping class="com.ecm.model.GapPlan"/> -->
    <mapping class="com.ecm.model.GapRecord"/>
    <mapping class="com.ecm.model.ExceptionAction"/>
    <mapping class="com.ecm.model.RecordToken"/>
  </session-factory>
  <!-- org.hibernate.dialect.SQLServerDialect -->
</hibernate-configuration>
```

The screenshot shows the XML code with several annotations on the left side:

- JDBC connection configuration
- Specifies the SQL variant to generate
- Size of conn pool
- Automatic generation of database schema
- Mapping files
- Filename: hibernate.cfg.xml

Figure 4.1: Hibernate.cfg.xml

4.2 Gap Analysis Detailed Report

It has been taken measures to check the quality for test of Gap Analysis detailed report in appendix 4. This report has been developed based the ISO standards and first of all, directive statements (must, shall, should) are found with paragraphes, futhermore, an engineer can make easily gap analysis by defining exceptions and actions as explained in chapter 3. Table 4.1 is the result of gap analysis of one of the ISO files that has been found 98 total directive statements from the file. 12 statements out of 98 have been conducted Gap Analysis and as a result, only one exception and eleven actions have been defined and worked on them.

Table 4.1: Report

Summary				
Key Word	Total	Gaps	Exceptions	Actions
Must	6	2	0	2
Shall	30	3	1	2
Should	62	7	0	7

As we can see from the Figure 4.1 probabilities of exceptions and actions are distributed and it helps a company to analysis of performance of its industry. Because if probability of exceptions is high in this case the company should arrange the measures according to the directive statement.

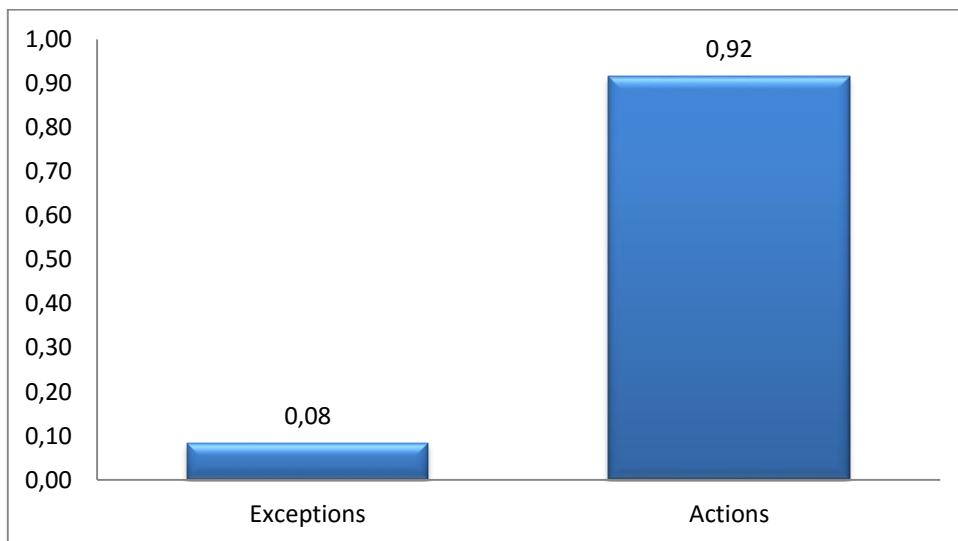


Figure 4.1: Probability Distribution of the Performance of Gap Analysis

5. CONCLUSION

It is possible that compliance and gap analysis process management system fits smoothly every internal documents of company with software platform in business environment. The main objective of this study gets with many useful feature by improving and developing software for managers and engineers authorising to see them how compliance and gap analysis process undergo a set of reports. According to an estimate, the process can save up to about thirty percent of the time related to perform the gap analysis.

The reporting functionality gives the go-ahead to managers and supervisors to stay on top of the process and intensify on the quality rather than spending time gathering information and structuring the reports.

The process is based on industry standards and easily assimilated with systems mostly used in existing circles such as databases, document management systems, exception management systems, email systems and action tracking and ticketing.

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APPENDICES

Appendix 1:

```
public PrintTextLocations() throws IOException {
    super.setSortByPosition(true);
}

public static void parsePDF(InputStream is) throws Exception
{
    PDDocument document = null;
    document = PDDocument.load( is );
    try {
        if (document.isEncrypted()) {
            try {
                document.decrypt("");
            } catch (Exception e) {
                System.err.println("Error: Document is
encrypted with a password.");
                System.exit(1);
            }
        }
        PrintTextLocations printer = new
PrintTextLocations();
        List allPages =
document.getDocumentCatalog().getAllPages();
        for (number = 0; number < allPages.size(); number++)
        {
            PDPage page = (PDPage) allPages.get(number);
            System.out.println("Processing page: " +
number);
            PDStream contents = page.getContents();
            if (contents != null) {
                printer.processStream(page,
page.findResources(), page.getContents().getStream());
            }
        }
    } finally {
        if (document != null) {
```

```
        document.close();
    }
}
static List<PageTokenIndex> indexes= new
ArrayList<PageTokenIndex>();
```

Appendix 2:

```
protected void processTextPosition(TextPosition text) {
    System.out.println(word);
    if(text.getCharacter().equals(" ")){
        if(word.equals("shall") || word.equals("should")){
            PageTokenIndex pti = new PageTokenIndex();
            pti.setPAGENUMBER(number); //+1
            pti.setSTANDARDID(23);
            pti.setTOKENVALUE(word);
            pti.setLocation(text.getX() + "___"+text.getY());
            indexes.add(pti);
        }
        word="";
    } else{
        word+=text.getCharacter();
    }
}
```

Appendix 3:

```
Ext.onReady(function(){
    Ext.tip.QuickTipManager.init();
    var form= Ext.create('Ext.ux.panel.PDF', {
        hideTitle    : true,
        id           : 'pdfId',
        width        : 595+20, //595
        height       : 842+40, //842
        x:0,y:0,
        pageScale: 1.00    ,
        src: '/sample/analyzePDF?id=35'
    });
    var btn = new Ext.Button({
        id:'pointer',
        hidden: true,
        text: 'shall',
        cls:'btnx',
        width:32,
        height:15,
        z:1000,x:0,y:0,
        handler: function(){
            debugger;
        }
    });
    var formOuter = new Ext.FormPanel({
        layout:'absolute',
        width    : 595+20+2, //595
        height   : 842+40+2, //842
        renderTo : 'fi-form2',
        items:[form, btn]
    });
});
function changeSrc(id){
    Ext.getCmp('pdfId').setSrc('/sample/analyzePDF?id='+id);
}
function nextPage(){
```

```

        Ext.getCmp('pdfId').moveNext();
    }
    function previousPage() {
        Ext.getCmp('pdfId').movePrevious();
    }
    function showPointer() {
        Ext.getCmp('pointer').setVisible(true);
        Ext.getCmp('pointer').setPosition(111,111);
    }
    var x=null;
    function selectChange(param) {
        x = document.getElementById("tokenSelect").value;
        var arr = x.split('_');
        var tokenIndexId = arr[0];
        document.getElementById("selected").value=x;
        var pageNumber = parseInt(arr[1])+1;
        var x_loc=arr[2];
        var y_loc=arr[5];
        console.log(parseInt(x_loc),parseInt(y_loc));
        Ext.getCmp('pointer').setVisible(true);
        Ext.getCmp('pointer').setPosition(parseInt(x_loc)-28,
parseInt(y_loc)-10);
        Ext.getCmp('pdfId').renderPage(pageNumber);
        document.getElementById("pageId").value=pageNumber;
    }

```

Appendix 4:

GAP ANALYSIS DETAILED REPORT

GAR-00254

FOR

ISO/IEC25434

Second edition 2007-06-15

Information technology — Data interchange on 120 mm and 80 mm optical disk using +R DL format — Capacity: 8,55 Gbytes and 2,66 Gbytes per side (recording speed up to 8x)

Completed by: John Castor	Reviewed by: Michael DeCosta	Approved by: Stanley Merton
12/09/2015	21/10/2015	

Documents and Specifications referenced in the Gap Analysis

- 1 EXT-20387-SPE-0165 Data interchange Specification
- 2 EXT-20387-SPE-0315 IT Hardware Installation and Management
- 3 EXT-20387-SPE-0318 IT Interfaces Periodic Maintenance Specification

Summary				
Key Word	Total	Gaps	Exceptions	Actions
Must	6	2	0	2
Shall	30	3	1	2
Should	62	7	0	7

Standard statement	Flag	Compliance Statement
<p>10.7.2 Track mode</p> <p>+R DL disks shall only use the so-called Opposite Track Path (OTP) mode. In this mode, tracks are readstarting on Layer 0 at the inner diameter of the Information Zone, continuing on Layer 1 from the outerdiameter towards the inner diameter. Thus, there is a Middle Zone at the outer diameter on both layers (see Figure 8).</p> <p>The spiral track is running from the inside to the outside on Layer 0 and in the reverse direction on Layer 1.</p>	Y	10.7.2
		Referred in EXT-20387-SPE-0165 Paragraph 7.5.a
<p>10.8 Rim area</p> <p>The rim area is that area extending from diameter d7 to diameter d1. In this area the surfaces are permitted to both extend beyond Reference Plane Q or Reference Plane Ph6 = 0,1 mm max.</p> <p>The outer corners of the disk shall be free of any burrs or sharp features and shall be rounded off or chamfered by h7 = 0,2 mm max.</p>	Y	10.8
<p>10.9 Remark on tolerances</p> <p>All heights specified in the preceding clauses and indicated by hi are independent from each other. This means that, for example, if the top surface of the third transition area is below Reference Plane Q by up to h2, there is no implication that the bottom surface of this area has to be above Reference Plane P by up to h3.</p> <p>Where dimensions have the same - generally maximum - numerical value, this does not imply that the actual values have to be identical.</p>		10.9
<p>11 Mechanical characteristics</p>		11
<p>11.1 Mass</p> <p>The mass of the disk shall be in the range of 13,0 g to 20,0 g (see also Annex A).</p>	N	11.1
		25,0 g Disks are used
		Exception Request: ER-FR-7582
<p>11.2 Moment of inertia</p>	NA	11.2

Standard statement	Flag	Compliance Statement
<p>The moment of inertia of the disk, relative to its rotation axis, shall not exceed 0,040 g·m² (see also Annex A).</p>		<p>Moment of inertia is measured at 0.052 g·m² due to the heavier disks referred in 11.1. This is acceptable for DIXON CD Drives as referred in EXT-20387-SPE-0315 / 8.3.d</p>
<p>11.3 Dynamic imbalance The dynamic imbalance of the disk, relative to its rotation axis, shall not exceed 2,5g·mm (see also Annex A).</p>	Y	<p>11.3 Stated in the EXT-20387-SPE-0315 / 8.5</p>
<p>11.4 Axial runout When measured by the optical system with the Reference Servo for axial tracking, the disk rotating at the reference velocity of 3,83 m/s (see 9.5), the deviation of each recording layer from its nominal position in the direction normal to the Reference Planes shall not exceed 0,30 mm. Some explanation about the use of the Reference Servo as a measurement tool and the way to translate the measurement results to a practical implementation for a high-speed servo is given in Annex L.</p>	Y	<p>11.4 Stated in the EXT-20387-SPE-0315 / 8.6</p>
<p>14.4.1 ADIP information The data to be recorded onto the disk must be aligned with the ADIP information modulated in the wobble. Therefore 93 wobbles shall correspond to 2 Sync Frames. Of each 93 wobbles, 8 wobbles are phase modulated with ADIP information (see Figure 19). 1 wobble equals 32 Channel bits (= 32T) one ADIP unit = 8 modulated wobbles per 2 Sync Frames</p>	Y	<p>14.4.1 Stated in the EXT-20387-SPE-0315 / 8.7</p>
	Y	23

Standard statement	Flag	Compliance Statement
<p>23 Multi-session Layout</p> <p>To enable data retrieval by Read-Only devices, the disk should have a Lead-in Zone, no blank areas in the Data Zone, and some form of Lead-out Zone. However one also wants to have the ability to append additional data to a partially recorded disk. For this purpose the following Multi-session concept is specified.</p> <p>On a Multi-session disk there can exist more than one session. A session with an Intro and a Closure is called a Closed Session. The first Session shall be preceded by a Lead-in Zone instead of an Intro Zone, the final Session shall be followed by a Lead-out Zone instead of a Closure Zone. Once a Lead-out Zone has been recorded, the disk is called “finalized” and no additional recordings to the disk shall be allowed. The general layout of a Multi-session disk is shown in Table 12.</p> <p>A session with a partially recorded Lead-in or Intro Zone and no Lead-out or Closure Zone is called an Open Session. All sessions must be Closed Sessions, except for the last one, which is allowed to be an Open Session. User Data can only be appended to an Open Session. If all session are closed, a new Open Session has to be created first (see 24.1).</p> <p>The first Closed Session on the disk shall have a Lead-in that complies with clause 18. Subsequent Closed Sessions shall have an Intro as defined in 23.1. Every Closed Session shall have a Closure as defined in 23.3, except for the Final Session, which shall have a Lead-out as defined in clause 22. Sessions (and also their Intro's and Closures) are allowed to span the layer jump (see also 16.1).</p>		<p>Stated in the EXT-20387-SPE-0315 / 8.8</p>