Project Completion Check List
Country Office: Bangladesh.
Project No/Output ID. 00112735-Conversion of Domestic Refrigerator Manufacturing Facility- Walton [BGD/REF/80/INV/01+ and BGD K-CEP Window 2 (MLF)]

I confirm that all of the following matters have been considered and resolved:

n/a	No outstanding NEX advances – in either local currency or USD
✓	No other outstanding advances in either local currency or USD
n/a	No outstanding PDRs
✓	No open Purchase Orders (POs)
✓	No receipt accruals
✓	No outstanding commitments
✓	No pending prepayments and other non PO advances
✓	No pending vouchers
✓	All pre-financing activities have been recovered and/or reimbursed.
n/a	No pending GMS or Direct Project Charging (Formerly ISS). (If Off-the-top GMS was used, extra-budgetary income taken must be reconciled to actual expense/delivery. A pro-rata return of GMS based on the balance of unspent funds must be done);
✓	No pending GLJEs
✓	No unapplied deposits or other unrecorded income
✓	No outstanding Accounts Receivable to be received from donors per signed agreements;
n/a	No AR direct journals in budget error or incomplete status
n/a	All assets are transferred or otherwise disposed of. Asset Transfer letters/documents are in place.
n/a	Ensure all transactions for sale/transfer/donation/disposal etc. of assets have been processed and GMS charged
n/a	All items held as inventory should be distributed or transferred to recipient or returned to donor as specified in the donor agreement.
✓	All Project Petty Cash and Project Cash Advance Accounts are cleared;
n/a	Project Bank Account is fully reconciled and closed.
✓	All accrued employee benefits are fully accounted.
✓	No other pending liabilities
✓	The CDR for the previous quarter shows zero encumbrances
✓	Final LPAC / Steering committee minutes are available
n/a	All audit gaps are closed with supporting documentation (FAPAD Audit)
✓	The final CDR is signed by UNDP and the Implementing Partner. Final report submitted by responsible parties
n/a	If cost sharing project, the unexpended balance has been agreed to the general ledger.
n/a	Consultations with donors on the disposition of unexpended cost sharing balances, where required by the contribution agreement, have taken place and documented in writing.

n/a	All refunds to donors have taken place and the project balance is zero
n/a	Notified Treasury Contributions Unit if the donor agreement requires interest to be refunded to the donor if specified in the agreement
n/a	Notified the GSSC to close any associated contract in the contracts module
n/a	All donor reports, as established in the Cost Sharing agreement, were submitted and acknowledged receipt by the donor representative

For the Cluster:

Name: Mohammad Rezaul Haque
Title: Programme Associate
Signature: _____
Date: 23/02/2021

Name: Arif Mohammad Faisal
Title: Programme Specialist
Signature: _____
Date: 23/02/2021

For Finance & Operations:

Name: Mohammad Mustafizur Rahaman
Title: Finance Associate
Signature: _____
Date: 23-Feb-2021

Name: _____
Title: _____
Signature: _____
Date: _____

For Business Dev. & Partnerships:

Name: Khondker Pervez Ahmed
Title: Partnerships and Resource Mobilization Associate
Signature: _____
Date: _____

Name: Sarder M Asaduzzaman
Title: Head of Partnerships
Signature: _____
Date: _____

For Senior Management:

Name: Van Nguyen
Title: Deputy Resident Representative
Signature: _____
Date: _____

Name: _____
Title: _____
Signature: _____
Date: _____

The check list must be signed by the Resident Representative/Head of Office or a senior official designated by the Resident Representative/Head of Office.

Project Closure Checklist | **Financial Closure Checklist** | Status History and Attachments

eChecklist Instructions:

*In order to be able to close the project financially all items in the list need to be checked as (**YES**). If any of the items is not applicable for the project then it can be checked as (**YES**). This list provides details based on standard queries based on the output ID so it might not reflect some of the exceptions. Therefore; it should be used as a guide for the closure but manual verification as per the POPP is required by the CO to ensure all the exceptions have been considered and resolved.*

Financial Closure Checklist

TASK	YES	No	NOTES
Ensure that all financial transactions are in Atlas General Ledger (Based on final report from the Implementing Partner)			Atlas Transaction Check Account / Atlas Balance: Transaction Currency / Base Currency (USD)
No outstanding NEX advances-in either local currency or USD (Account 16005)	☑	☐	Outstanding Advances 0.00 $ 0.00
No other outstanding advances-in either local currency or USD (Account 14001, 14056, 14057, 14501, 16006, 16010, 16015, 17008, 17009)	☑	☐	Outstanding Advances Other 0.00 $ 0.00
No outstanding Project Delivery Reports (PDRs);	☐	☐	PDR: http://unex.undp.org
No open Purchase Orders (POs);	☑	☐	Open Purchase Orders 0.00 $ 0.00
No Receipt Accruals;	☑	☐	Receipt Accruals 0.00 $ 0.00
No Outstanding Commitments;	☐	☐	Please ensure commitments outside Atlas are resolved (Non-PO Commitments) - Supporting documents if any should be uploaded to Atlas (Attachments Tab)
No outstanding prepaid vouchers (Account 16065)	☑	☐	Prepaid Vouchers 0.00 $ 0.00
No pending vouchers;	☐	☐	No Pending Vouchers - Please run the query link to verify and check any pending vouchers.
All pre-financing activities have been recovered and/or reimbursed.	☐	☐	Supporting documents if any should be uploaded to Atlas (Attachments Tab)
No pending GMS or Direct Project Charging (Formerly ISS). (If Off-the-top GMS was used, extra-budgetary income taken must be reconcilied to actual expense/delivery. A pro-rata return of GMS based on the balance of unspent funds must be done);	☑	☐	Charged GMS Rate % % 0.00 % 0.00
No pending GLJEs;	☑	☐	GLJEs Not Posted 0.00 $ 0.00
No unapplied deposits or other unrecorded revenue;	☑	☐	Unapplied Deposits by Office 0.00 $ 0.00
No outstanding Accounts Receivable to be received from donors per signed agreements;	☑	☐	Contract Pending Events 0.00 $ 0.00
No outstanding Contribution Receivable to be collected from donor (GL Account 14015 Balance including FX Revaluation)	☑	☐	Contribution Amount Not Collected 0.00 $ 0.00
No AR direct journals in budget error or incomplete status;	☐	☐	No Pending AR direct journals - Please run the query link to verify and check any pending AR direct journals.
All assets are transferred or otherwise disposed of; Asset Transfer letters/documents are in place. (GL 18xxx Accounts) (Click Link for ISR Report)	☑	☐	Assets $ 0.00 $ 0.00
All un-used inventory items held at the end of the project has been disposed off or transferred to other projects	☐	☐	Supporting documents if any should be uploaded to Atlas (Attachments Tab)
Ensure all transactions for sale/transfer/donation/disposal etc. of assets have been processed and GMS charged.	☐	☐	Supporting documents if any should be uploaded to Atlas (Attachments Tab)
All items held as inventory should be distributed or transferred to recipient or returned to donor as specified in the donor agreement.	☐	☐	Supporting documents if any should be uploaded to Atlas (Attachments Tab)
All Project Petty Cash (11015 (old), 16105(new)) and Project Cash Advance Accounts (Acc. 16106, 16107, 16108 and 16007) are cleared;	☑	☐	Petty Cash & Cash Advance 0.00 $ 0.00
Project Bank Account is fully reconciled and closed.	☐	☐	Project staff should coordinate with Implementing partner to close Project Bank account.
All Staff Receivables in USD Only (Acc. 14005, 14020, 14022, 14023, 14025, 14030, 14035, 14040, 14042, 14045, 14046, 14050, 14055, 14085) are cleared;	☑	☐	Staff Receivables 0.00 $ 0.00
All accrued employee benefits are fully accounted.	☑	☐	Employee Benefits 0.00 $ 0.00
No other pending liabilities in USD Only; (GL 2xxxx Accounts - Excluding 21005)	☑	☐	Pending Liabilities 0.00 $ 0.00
The CDR for the previous quarter shows Zero future expenses (commitments).	☐	☐	Copy of CDR should be uploaded to Atlas (Attachments Tab)
Final LPAC / Steering committee minutes are available.	☐	☐	Minutes should be uploaded to Atlas (Attachments Tab)
All audit observations are closed with supporting documentation.	☐	☐	Supporting documents if any should be uploaded to Atlas (Attachments Tab)
The final CDR is signed by UNDP and the Implementing Partner. Final report submitted by responsible parties.	☐	☐	Supporting documents should be uploaded to Atlas (Attachments Tab)
If cost sharing project, the unexpended balance has been agreed to the general ledger. (The Balances excludes Open Purchase Orders reflected in the Output Financials) AND (Excludes Outstanding Contribution Receivable to be collected from donor) if any.	☐	☐	General Ledger Cash Balance Fund / Donor / Amount USD 63040 12958 $ 155.28
Consultations with Donors on the disposition of unexpended cost-sharing balances, where required by contribution agreement, have taken place and are documented in writing.	☐	☐	UNDP Issue refunds to donor as the very last step before designating a project as financially complete in ATLAS .If the donor requests a refund at any earlier point then you need to the approval of the Chief, Account Division or Treasurer to issuing the refund. Please refer to Refunds to Donors in the POPP.
All refunds to donors have been transferred to Account 21030 (Pending Refund to Donors) and the project Balance is Zero. (Only in Base Currency)	☐	☐	Pending Refund to Donor $ 0.00 $ 0.00
Notified Treasury Contributions Unit if the donor agreement requires interest to be refunded to the donor if specified in the agreement.	☐	☐	Supporting documents if any should be uploaded to Atlas (Attachments Tab)
Notified the GSSC to close any associated contract in the contracts module.	☐	☐	Supporting documents if any should be uploaded to Atlas (Attachments Tab)
All donor reports, as established in the Cost Sharing agreement, were submitted and acknowledged receipt by the donor representative.	☐	☐	Supporting documents if any should be uploaded to Atlas (Attachments Tab)
Ensure project accounts are closed.	☐	☐	Closure of any project-based financial accounts or funds. Once confirmed, project status in Atlas will be set to "Financially Closed". No further financial transactions can be made. For more information on project closure procedures and policies, please refer to Closing a Project and Financial Closure of Development Projects and Financial Closure of Trust Funds in the POPP.

Management Comments (if any): Find First 1 of 1 Last

Author	DateTime Stamp

Save

Project Closure Checklist | Financial Closure Checklist | Status History and Attachments

Mohammad Rezaul Haque

From: Nejat Ncube
Sent: Friday, February 5, 2021 9:42 PM
To: Mohammad Rezaul Haque; Jatupon Thongying
Cc: Khondker Pervez Ahmed; Loise Nganga
Subject: RE: URGENT - please help re-open project 00112735 - FW: Please approve PO for Roberto Peixoto to add 2 days

Dear Rezaul,

Kindly go ahead and FC the project. Once it's financially closed, we'll refund the balance to the donor.

Many thanks,
Nejat

From: Mohammad Rezaul Haque
Sent: Friday, February 5, 2021 4:52 AM
To: Jatupon Thongying <jatupon.thongying@undp.org>
Cc: Khondker Pervez Ahmed <khondker.ahmed@undp.org>; Nejat Ncube <nejat.ncube@undp.org>
Subject: RE: URGENT - please help re-open project 00112735 - FW: Please approve PO for Roberto Peixoto to add 2 days

Dear Jack, Thanks. We are now going to close the Project Financially in Atlas. Hope, it does not effect HQ action. Kind regards Rezaul

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From: Jatupon Thongying <jatupon.thongying@undp.org>
Sent: Wednesday, January 27, 2021 6:55 PM
To: Mohammad Rezaul Haque <rezaul.haque@undp.org>
Cc: Khondker Pervez Ahmed <khondker.ahmed@undp.org>; Nejat Ncube <nejat.ncube@undp.org>
Subject: RE: URGENT - please help re-open project 00112735 - FW: Please approve PO for Roberto Peixoto to add 2 days

Dear Rezaul,

HQ will take care of the fund balance.

Best regards,
Jack

From: Mohammad Rezaul Haque <rezaul.haque@undp.org>
Sent: Wednesday, January 27, 2021 3:58 PM
To: Jatupon Thongying <jatupon.thongying@undp.org>
Cc: Khondker Pervez Ahmed <khondker.ahmed@undp.org>; Rodolfo Alonday <rodolfo.alonday@undp.org>
Subject: RE: URGENT - please help re-open project 00112735 - FW: Please approve PO for Roberto Peixoto to add 2 days
Importance: High

Dear Jack, We are going to Financial Closure of Project 00112735. Can you please let us know whether BRH/HQ will take action on balance of USD 155.28. Please guide us. This is very urgent. Kind regards Rezaul

General Ledger Cash Balance

Fund	Donor	Amount USD
63040	12958	$ 155.28

From: Jatupon Thongying <jatupon.thongying@undp.org>
Sent: Sunday, November 15, 2020 1:58 PM
To: Mohammad Rezaul Haque <rezaul.haque@undp.org>
Cc: Khondker Pervez Ahmed <khondker.ahmed@undp.org>; Rodolfo Alonday <rodolfo.alonday@undp.org>
Subject: RE: URGENT - please help re-open project 00112735 - FW: Please approve PO for Roberto Peixoto to add 2 days

Dear Rezaul,

HQ successfully did the needful. Please close the project in Atlas.
Thank you so much for the follow-up!

Best regards,
Jack

From: Mohammad Rezaul Haque <rezaul.haque@undp.org>
Sent: Saturday, November 14, 2020 3:49 PM
To: Jatupon Thongying <jatupon.thongying@undp.org>
Cc: Khondker Pervez Ahmed <khondker.ahmed@undp.org>
Subject: RE: URGENT - please help re-open project 00112735 - FW: Please approve PO for Roberto Peixoto to add 2 days

Dear Jack, We would like to Project the Close. Please confirm if you have any issues. Kind regards Rezaul

From: Mohammad Rezaul Haque
Sent: Thursday, October 22, 2020 9:50 PM
To: Jatupon Thongying <jatupon.thongying@undp.org>
Subject: Fwd: URGENT - please help re-open project 00112735 - FW: Please approve PO for Roberto Peixoto to add 2 days

FYI

Sent from my iPhone

Begin forwarded message:

> **From:** Khondker Pervez Ahmed <khondker.ahmed@undp.org>
> **Date:** 22 October 2020 at 7:58:19 PM GMT+6
> **To:** Mohammad Rezaul Haque <rezaul.haque@undp.org>
> **Cc:** Munir Hossain <munir.hossain@undp.org>
> **Subject: RE: URGENT - please help re-open project 00112735 - FW: Please approve PO for Roberto Peixoto to add 2 days**
>
> Project re-opened and extended as requested below.
>
> Kind regards,
> Pervez

From: Khondker Pervez Ahmed
Sent: Thursday, October 22, 2020 2:21 PM
To: Mohammad Rezaul Haque <rezaul.haque@undp.org>
Cc: Munir Hossain <munir.hossain@undp.org>
Subject: RE: URGENT - please help re-open project 00112735 - FW: Please approve PO for Roberto Peixoto to add 2 days

Request sent.
Pervez

From: Mohammad Rezaul Haque <rezaul.haque@undp.org>
Sent: Thursday, October 22, 2020 2:18 PM
To: Khondker Pervez Ahmed <khondker.ahmed@undp.org>
Cc: Munir Hossain <munir.hossain@undp.org>
Subject: FW: URGENT - please help re-open project 00112735 - FW: Please approve PO for Roberto Peixoto to add 2 days

Dear Pervez, Again HQ requested to re-open the Project 00112735 up to 13November 2020. Please see below request. Kind regards Rezaul

From: Jatupon Thongying <jatupon.thongying@undp.org>
Sent: Thursday, October 22, 2020 1:52 PM
To: Mohammad Rezaul Haque <rezaul.haque@undp.org>
Cc: Khurshid Alam <khurshid.alam@undp.org>; Rodolfo Alonday <rodolfo.alonday@undp.org>
Subject: RE: URGENT - please help re-open project 00112735 - FW: Please approve PO for Roberto Peixoto to add 2 days

Dear Rezaul,

As discussed, could you please re-open this project up-to 13 November 2020, after which, you could re-close it. This is to make sure that our unit in HQ could obtain PO approval and process the payment successfully.
Thank you!

Best regards,
Jack

From: Jatupon Thongying
Sent: Thursday, October 22, 2020 11:56 AM
To: Mohammad Rezaul Haque <rezaul.haque@undp.org>
Cc: Khurshid Alam <khurshid.alam@undp.org>; Rodolfo Alonday <rodolfo.alonday@undp.org>
Subject: URGENT - please help re-open project 00112735 - FW: Please approve PO for Roberto Peixoto to add 2 days
Importance: High

Dear Rezaul bhai,

Could you please help liaising with relevant colleagues to re-open the project 00112735, as soon as possible?
The request has just come from HQ, as you can see below. We are amending a PO for our global LTA to include a line, but the approval process stuck, as the project 00112735 has been closed.

After this PO amendment, our unit in HQ will close the PO, and then we will coordinate with you to re-close the project in Atlas.

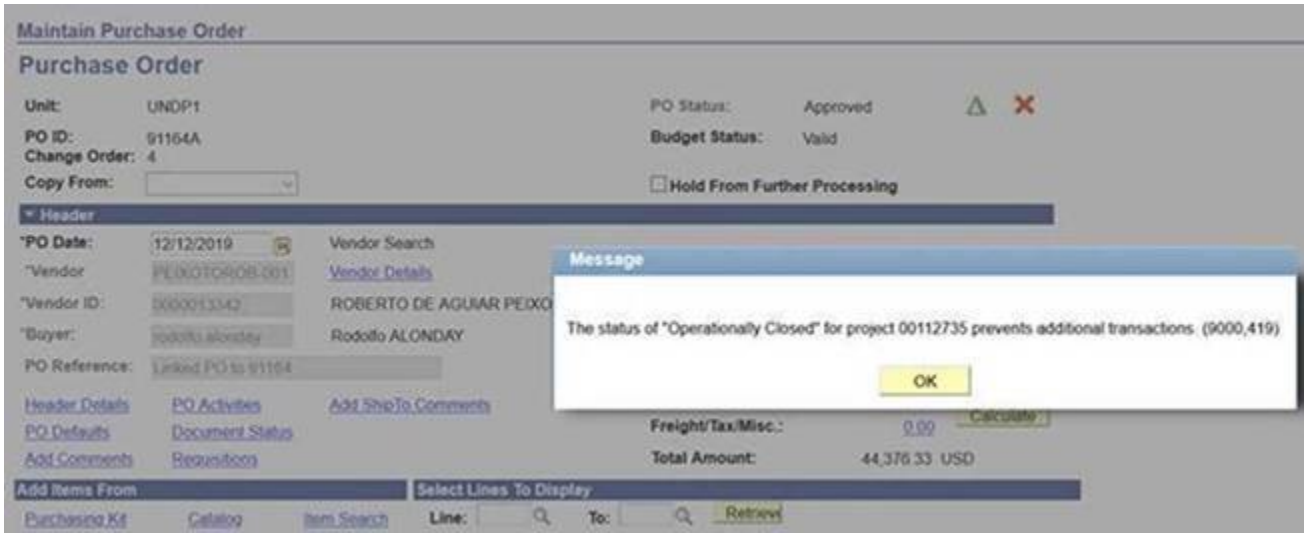
Thanks for your understanding and for your quick support on this.

Best regards,
Jack

From: Rodolfo Alonday <rodolfo.alonday@undp.org>
Sent: Thursday, October 22, 2020 11:49 AM
To: Jatupon Thongying <jatupon.thongying@undp.org>
Cc: Paloma Somohano <paloma.somohano@undp.org>
Subject: FW: Please approve PO for Roberto Peixoto to add 2 days
Importance: High

Dear Jack,

As discussed with you earlier, the PO that we just amended for Roberto Peixoto can't be dispatched as one the projects under this PO (previous COA's provided by the CO) have been operationally closed. As such, may I kindly ask your assistance to request the CO to re-open the project 00112735? This is all we need so we can proceed with the payment.



Combined Delivery Report by Activity

UN Development Programme

Report ID: unglcdrb
Run Time: 10-03-2019 04:03:23

Selection Criteria :

Business Unit : BGD10
Period : Jan-Dec (2018)
Selected Project Id : ALL
Selected Fund Code : ALL
Selected Dept. IDs : ALL
Selected Outputs : 00112735

Project Id : 00114895 Conversion from HFC-134a to is		**Period :**	**Jan-Dec (2018)**
Output # : 00112735 Conversion from HFC-134a to is		**Impl. Partner :**	**00262 UNDP (Direct Execution)**
		Location :	**Bangladesh**

	Govt Exp	UNDP Exp	UN Agencies Exp	Total Exp
Activity : ACTIVITY1 (Conversion of HFC – 134a based)				
Fund : 63030 (MP Prog Res Gen Prog)				
72105 - Svc Co-Construction & Engineer	0.00	583,205.04	0.00	583,205.04
Total for Fund 63030	**0.00**	**583,205.04**	**0.00**	**583,205.04**
Total for Activity ACTIVITY1	**0.00**	**583,205.04**	**0.00**	**583,205.04**
Activity : ACTIVITY2 (HFC-134a to Isobutane)				
Fund : 63030 (MP Prog Res Gen Prog)				
72105 - Svc Co-Construction & Engineer	0.00	9,540.02	0.00	9,540.02
Total for Fund 63030	**0.00**	**9,540.02**	**0.00**	**9,540.02**
Total for Activity ACTIVITY2	**0.00**	**9,540.02**	**0.00**	**9,540.02**
Activity : ACTIVITY3 (134a based compressor one line)				
Fund : 63030 (MP Prog Res Gen Prog)				
72105 - Svc Co-Construction & Engineer	0.00	615,831.90	0.00	615,831.90
Total for Fund 63030	**0.00**	**615,831.90**	**0.00**	**615,831.90**
Total for Activity ACTIVITY3	**0.00**	**615,831.90**	**0.00**	**615,831.90**
Activity : KCEP-ACTIVITY1 (HFC phase-out K-CEP)				
Fund : 63040 (MP Cost Sharing Activities)				
72105 - Svc Co-Construction & Engineer	0.00	79,897.64	0.00	79,897.64
Total for Fund 63040	**0.00**	**79,897.64**	**0.00**	**79,897.64**
Total for Activity KCEP-ACTIVITY1	**0.00**	**79,897.64**	**0.00**	**79,897.64**

Combined Delivery Report by Activity

UN Development Programme
Report ID: unglcdrb

Project Id : 00114895 Conversion from HFC-134a to is		**Period :**	**Jan-Dec (2018)**
Output # : 00112735 Conversion from HFC-134a to is		**Impl. Partner :**	**00262 UNDP (Direct Execution)**
		Location :	**Bangladesh**

	Govt Exp	UNDP Exp	UN Agencies Exp	Total Exp
Total for Output : 00112735	**0.00**	**1,288,474.60**	**0.00**	**1,288,474.60**
Project Total :	**0.00**	**1,288,474.60**	**0.00**	**1,288,474.60**

Signed By : _____ Date : _____

Signed By : _____ Date : _____

Combined Delivery Report by Activity

UN Development Programme

Report ID: unglcdrb
Run Time: 10-03-2019 04:03:24

Selection Criteria :

Business Unit : BGD10
Period : Jan-Dec (2018)
Selected Project Id : ALL
Selected Fund Code : ALL
Selected Dept. IDs : ALL
Selected Outputs : 00112735

Project Id : ALL		**Period : Jan-Dec (2018)**		
Output # : ALL		**Impl. Partner :** **Location :**		
	Govt Exp	**UNDP Exp**	**UN Agencies Exp**	**Total Exp**
39205 - Bangladesh -Energy & Envirnmnt	0.00	1,288,474.60	0.00	1,288,474.60

Combined Delivery Report by Activity

UN Development Programme

Report ID: unglcdrb

Run Time: 10-03-2019 04:03:27

Funds Utilization

Selection Criteria :

Business Unit : BGD10
Period : Jan-Dec (2018)
Selected Project Id : ALL
Selected Fund Code : ALL
Selected Dept. IDs : ALL
Selected Outputs : 00112735

No Data found for the Selection Criteria

Combined Delivery Report By Project

UN Development Programme

Report ID: unglcdrp

Run Time: 23-02-2021 09:02:37

Selection Criteria :

Business Unit : BGD10
Period : Jan-Dec (2019)
Selected Project Id : ALL
Selected Fund Code : ALL
Selected Dept. IDs : ALL
Selected Outputs : 00112735

Project Id : 00114895 Conversion from HFC-134a to is		**Period :**	**Jan-Dec (2019)**
Output # : 00112735 Conversion from HFC-134a to is		**Impl. Partner :**	**00262 UNDP (Direct Execution)**
		Location :	**Bangladesh**

	Govt Exp	UNDP Exp	UN Agencies Exp	Total Exp
Dept: 39205 (Bangladesh -Energy & Envirnmnt)				
Fund : 63030 (MP Prog Res Gen Prog)				
71305 - Local Consult.-Sht Term-Tech	0.00	0.00	0.00	0.00
71360 - Local Consult-Security	0.00	61.37	0.00	61.37
71405 - Service Contracts-Individuals	0.00	22,124.84	0.00	22,124.84
71410 - MAIP Premium SC	0.00	10.01	0.00	10.01
71415 - Contribution to Security SC	0.00	829.55	0.00	829.55
71635 - Travel - Other	0.00	117.26	0.00	117.26
72105 - Svc Co-Construction & Engineer	0.00	1,893,750.95	0.00	1,893,750.95
72515 - Print Media	0.00	71.06	0.00	71.06
75705 - Learning costs	0.00	802.88	0.00	802.88
76125 - Realized Loss	0.00	70.62	0.00	70.62
76135 - Realized Gain	0.00	- 0.33	0.00	- 0.33
Total for Fund 63030	**0.00**	**1,917,838.21**	**0.00**	**1,917,838.21**
Fund : 63040 (MP Cost Sharing Activities)				
71305 - Local Consult.-Sht Term-Tech	0.00	11,785.50	0.00	11,785.50
71605 - Travel Tickets-International	0.00	691.60	0.00	691.60
71615 - Daily Subsistence Allow-Intl	0.00	1,962.61	0.00	1,962.61
71635 - Travel - Other	0.00	5,355.30	0.00	5,355.30
72105 - Svc Co-Construction & Engineer	0.00	14,114.00	0.00	14,114.00
72110 - Svc Co-Agricultural Management	0.00	20,255.55	0.00	20,255.55
72115 - Svc Co-Natural Resources & Env	0.00	21,230.00	0.00	21,230.00
72445 - Common Services-Communications	0.00	4,657.22	0.00	4,657.22
76125 - Realized Loss	0.00	4.67	0.00	4.67
76135 - Realized Gain	0.00	- 0.63	0.00	- 0.63
Total for Fund 63040	**0.00**	**80,055.82**	**0.00**	**80,055.82**
Total for Dept : 39205	**0.00**	**1,997,894.03**	**0.00**	**1,997,894.03**
Total for Output : 00112735	**0.00**	**1,997,894.03**	**0.00**	**1,997,894.03**
Project Total :	**0.00**	**1,997,894.03**	**0.00**	**1,997,894.03**

Signed By : _____ Date : _____

Signed By : _____ Date : _____

Combined Delivery Report By Project

UN Development Programme

Report ID: unglcdrp
Run Time: 23-02-2021 09:02:37

Selection Criteria :

Business Unit : BGD10
Period : Jan-Dec (2019)
Selected Project Id : ALL
Selected Fund Code : ALL
Selected Dept. IDs : ALL
Selected Outputs : 00112735

Project Id : ALL		**Period : Jan-Dec (2019)**		
Output # : ALL		**Impl. Partner :** **Location :**		
	Govt Exp	**UNDP Exp**	**UN Agencies Exp**	**Total Exp**
39205 - Bangladesh -Energy & Envirnmnt	0.00	1,997,894.03	0.00	1,997,894.03

Combined Delivery Report By Project

UN Development Programme

Report ID: unglcdrp
Run Time: 23-02-2021 09:02:39

Funds Utilization

Selection Criteria :

Business Unit : BGD10
Period : Jan-Dec (2019)
Selected Project Id : ALL
Selected Fund Code : ALL
Selected Dept. IDs : ALL
Selected Outputs : 00112735

Project/Award: 00114895 Conversion from HFC-134a to is **Period : As at Dec 31, 2019**

Output # 00112735	Impl. Partner :00262 UNDP (Direct Execution)	UNDP AMOUNT
Outstanding NEX advances		**0.00**
Undepreciated Fixed Assets		**0.00**
Unamortized Intangible Assets		**0.00**
Inventory		**0.00**
Prepayments		**0.00**
Commitments		**0.00**

Combined Delivery Report By Project

UN Development Programme

Report ID: unglcdrp

Run Time: 23-02-2021 09:02:27

Selection Criteria :

Business Unit : BGD10
Period : Jan-Dec (2020)
Selected Project Id : ALL
Selected Fund Code : ALL
Selected Dept. IDs : ALL
Selected Outputs : 00112735

Project Id : 00114895 Conversion from HFC-134a to is		**Period :**	**Jan-Dec (2020)**
Output # : 00112735 Conversion from HFC-134a to is		**Impl. Partner :**	**00262 UNDP (Direct Execution)**
		Location :	**Bangladesh**

	Govt Exp	UNDP Exp	UN Agencies Exp	Total Exp
Dept: 39205 (Bangladesh -Energy & Envirnmnt)				
Fund : 63030 (MP Prog Res Gen Prog)				
71205 - Intl Consultants-Sht Term-Tech	0.00	8,459.00	0.00	8,459.00
72105 - Svc Co-Construction & Engineer	0.00	- 2,352.92	0.00	- 2,352.92
76135 - Realized Gain	0.00	- 911.46	0.00	- 911.46
Total for Fund 63030	**0.00**	**5,194.62**	**0.00**	**5,194.62**
Fund : 63040 (MP Cost Sharing Activities)				
71205 - Intl Consultants-Sht Term-Tech	0.00	4,274.01	0.00	4,274.01
71211 - Intl Consult Security Charge	0.00	177.37	0.00	177.37
71405 - Service Contracts-Individuals	0.00	11,388.78	0.00	11,388.78
71415 - Contribution to Security SC	0.00	595.69	0.00	595.69
72105 - Svc Co-Construction & Engineer	0.00	- 32.14	0.00	- 32.14
75705 - Learning costs	0.00	3,500.00	0.00	3,500.00
76135 - Realized Gain	0.00	- 12.45	0.00	- 12.45
Total for Fund 63040	**0.00**	**19,891.26**	**0.00**	**19,891.26**
Total for Dept : 39205	**0.00**	**25,085.88**	**0.00**	**25,085.88**
Total for Output : 00112735	**0.00**	**25,085.88**	**0.00**	**25,085.88**
Project Total :	**0.00**	**25,085.88**	**0.00**	**25,085.88**

Signed By : _____ Date : _____

Signed By : _____ Date : _____

Combined Delivery Report By Project

UN Development Programme

Report ID: unglcdrp
Run Time: 23-02-2021 09:02:27

Selection Criteria :

Business Unit : BGD10
Period : Jan-Dec (2020)
Selected Project Id : ALL
Selected Fund Code : ALL
Selected Dept. IDs : ALL
Selected Outputs : 00112735

Project Id : ALL		**Period : Jan-Dec (2020)**		
Output # : ALL		**Impl. Partner :** **Location :**		
	Govt Exp	**UNDP Exp**	**UN Agencies Exp**	**Total Exp**
39205 - Bangladesh -Energy & Envirnmnt	0.00	25,085.88	0.00	25,085.88

Combined Delivery Report By Project

UN Development Programme

Report ID: unglcdrp
Run Time: 23-02-2021 09:02:29

Funds Utilization

Selection Criteria :

Business Unit : BGD10
Period : Jan-Dec (2020)
Selected Project Id : ALL
Selected Fund Code : ALL
Selected Dept. IDs : ALL
Selected Outputs : 00112735

Project/Award: 00114895 Conversion from HFC-134a to is **Period : As at Dec 31, 2020**

Output # 00112735 Impl. Partner :00262 UNDP (Direct Execution)	UNDP AMOUNT
Outstanding NEX advances	**0.00**
Undepreciated Fixed Assets	**0.00**
Unamortized Intangible Assets	**0.00**
Inventory	**0.00**
Prepayments	**0.00**
Commitments	**0.00**

REVIEW OF THE CLOSURE REPORT "HFC INVESTMENT PROJECT CONVERSION OF THREE REFRIGERATION LINES AND ONE COMPRESSOR LINE AT WALTON HI-TECH INDUSTRIES LIMITED, BANGLADESH"

Background

The report focuses on the information related to a project completion at Walton Hi-Tech Industries Limited, Bangladesh, phasing-out the use of HFC-134ain refrigerators and compressors manufacturing processes. Three (3) refrigerator manufacturing lines, and the compressor manufacturing line were converted for the adoption of HC-600a, isobutane, as a low-global warming alternative refrigerant. Refrigerators and compressors for the use of HC-600a were redesigned. The project modified the three refrigerator manufacturing lines, and the compressor manufacturing line, created a new refrigerant storage area and implemented adaptations in the plant that are needed for the use safe of HC-600a. The project completion resulted in the to phase-out the annual consumption of 230.63 metric tonnes (329,801 CO_2-equivalent tonnes) of HFC-134a. This was achieved through the elimination of the refrigerators HFC-134a initial charge, and replacing for HC-600a.

In 2016, Walton annual production was about 2.2 million refrigerators, with a 80% market share in Bangladesh. The installed capacity in the three manufacturing lines to be converted is 921,200 units per year. In the period 2014-2016 the average refrigerator production at Mabe was 536,024 units/year, with an average HFC-134a consumption of 61.32 MT. The project was implemented following UNDP implementation guidelines, and under close coordination and supervision of the National Ozone Unit of the Ministry of Environment and Forestry (MOEF) of Bangladesh, and its duration was 24 months.

Project Implementation and Manufacturing Conversion Aspects

The report presents clearly the steps that were adopted for the project implementation:
Project initiation, Design and Optimization Phase, Compressor conversion, Refrigerator conversion, Storage and Supply Systems, Commissioning of the plant; and Final Audit for safety and for project completion.

It is described in the report the activities carried out for refrigerators re-designing and for their manufacturing facility conversion

- Refrigerator re-design. The following components were re-resigned: filter dryer, condenser, electrical devices and evaporator
- Refrigerator manufacturing facility conversion. The following production lines and installations were modified: Refrigerant Storage and Distribution/Feeding Lines; Heat Exchanger manufacturing; Sheet metal processing; Plastic Processing; Refrigerant Charging; Ultrasonic Welding and Punching System; Explosion Proof Vacuum Pumps and motor; Ventilation and Safety System; Leak Detection system; Refrigerant Recovery system; Drier Filter production; R&D Testing facility.

The report also presents the activities for compressors re-designing and their manufacturing facility conversion.

- Compressor re-design. The compressor designed for hydrocarbon refrigerant needed a higher volumetric capacity compared to a traditional HFC-based compressor, this required substantial modifications to the core components of the compressor (e.g. crank case/shaft, piston, motor, internal assembly and others).
- Compressor manufacturing facility conversion. The following production lines and installations were modified: Casting and Foundry plant; Machining unit; Sheet metal Processing Unit; Motor production unit; Die casting unit; Internal and External assembly line.

In the areas, where there are handling of the flammable refrigerant HC600a, calorimetric testing and lifetimes test machines/chambers safety systems have been implemented

The reviewer considered that the information provided in the report are consistent with the requirements for the safe use of the refrigerant HC-600a and shows that the company has taken the appropriate technical measures for the re-design of their products as well for the manufacturing lines conversion.

Performance of the converted refrigerators and compressors

Due to the changes in the compressors and refrigerators design, the company reports that the results of the tests indicated an energy saving between 10% and 35% for the different refrigerator models considering the HFC-134a based models. The report say that the models are in compliance with the MEPs established by the Bangladesh´s Standards and Testing Institute.

Incremental Costs

The report presents detailed information about the incremental costs, both capital (ICC) and operational (IOC), incurred by the project implementation, comparing with the requested and approved values and explaining the differences from these values with the incurred ones.

The ICC requested for refrigerator manufacturing conversion, including re-design, was USD 2,212,057, and the approved and incurred values were USD 1,160,678 and USD 2,645,177, respectively.

For the compressor manufacturing conversion, including re-design, the ICC requested was USD 2,574,450, and the approved and incurred values were USD 1,810,932 and USD 3,832,911, respectively.

The IOC requested was USD 3,018,060, and the incurred value was USD 471,420, due to the unpredicted savings. There was no IOC approved by MLF

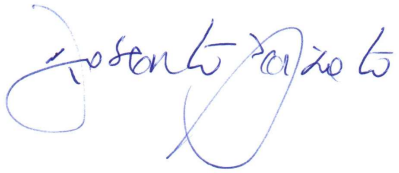
The reviewer supports the values presented in the project closure report for the Incremental Capital Cost and Incremental Operating Costs.

Implementation Period

The project implementation in a period of 24 months, reported in the document, is considered acceptable.

Concluding Remarks

The reviewer recommends the company project Closure Report approval



Roberto de Aguiar Peixoto. Ph.D.
05/03/2020

FINAL REPORT

RAC Plant and Equipment Safety Audit for Refrigerator Manufacturing Lines at Walton Hi-Tech Industries Limited

Prepared for

UNDP, Bangladesh

and

Ozone Cell, DOE, Bangladesh

Prepared by

Chemical Engineering Department

Bangladesh University of Engineering and Technology (BUET)

Dhaka-1000

November 19, 2019

Executive Summary

1. Introduction

The Montreal Protocol, ratified by all countries in the world was declared to protect the ozone layer by phasing-out production and consumption of industrial chemicals that deplete the Ozone layer. Under the mandates of the Montreal Protocol, Ozone depleting substances such as hydrochlorofluorocarbons (HCFCs) were restricted from further use. HCFCs are not only ozone depleting substances (ODS) but also potential Greenhouse Gases (GHGs) because of their high Global Warming Potential (GWP). The alternatives to HCFCs include 'ozone and climate friendly alternatives' such as natural refrigerants - hydrocarbons, ammonia and carbon dioxide; and lower global warming potential (GWP) HFCs, both saturated HFCs and unsaturated HFCs. The HFCs should be replaced with more environmental-friendly refrigerants such as hydrocarbons (HCs). As a part of this mission, in 2016 Walton has already replaced one of their manufacturing lines of R134a with R600a (iso-butane) with financial aid from United Nations Development Programme (UNDP). However, refrigerants such as R600a are flammable and have issues related to explosive gas atmosphere and potential fire hazards. Therefore, modification like this must be undertaken with proper caution maintaining standards and safety features. Keeping this in mind, UNDP Bangladesh has awarded a contract to the Department of Chemical Engineering, BUET, for performing a safety evaluation of the three converted lines of refrigerator manufacturing facility using R600a as a refrigerant at Walton Hi-tech Industries Limited and reviewing the measures taken to address the possible safety concerns.

2. Purpose and Scope of the Study

2.1 Objectives of the Study

The objectives of the safety audit in refrigerator plants and equipment were as follows:

- Safety audit for the conversion of the three manufacturing lines of refrigerators from R134a to R600a as refrigerant at Walton Hi-tech Industries Limited.
- Safety audit of the compressor plant

2.2 Scope of the Study

The scope of services for "Safety audit in refrigerator plants and equipment" were as follows:

- Reviewing the detail plant layouts and the process flow diagrams to ensure the proper safety in plant design.

- Desk reviewing of the various changes/modifications undertaken in the plant for conversion to Hydrocarbon refrigerant under the project;
- Reviewing of regulations, industry standards etc. as applicable for safe transport, storage and use of HCs including national regulations (*e.g.*, Bangladesh National Building Code, Bangladesh Fire Prevention & Extinction Rule- 2014, Bangladesh Energy Regulatory Commission LPG Storage, Bottling, Transportation and Dispensing Codes and Standards, 2016 (Draft), International Standard IEC 60079-10-1:2015);
- Undertaking site inspections for reviewing implementation of safety requirements in different parts of the manufacturing facilities. This includes equipment infrastructure, civil works, electrical works, training of plant personnel etc.;
- Providing a safety audit report confirming of Walton with safety requirements according to the zones classified under International Standard IEC 60079-10-1:2015 for the operations using HCs.
- Identifying gaps that need to be addressed and corrective actions to be undertaken by Walton;
- Reporting the confirmation of corrective actions to be taken by the enterprise, if required.
- Presenting the draft safety report in the Project Assessment Committee (PAC) Meeting
- Incorporating the comments of the Project Assessment Committee (PAC) in the final report.

3. Consultant Team

The team undertaking this study consists of the following faculty members from Chemical Engineering Department, BUET.

1.	Dr. M. A. A. Shoukat Choudhury	Professor and Team Leader
2.	Dr. Syeda Sultana Razia	Professor and Safety Expert
3.	Dr. Shoeb Ahmed	Associate Professor

4. Conversion of Refrigerator Manufacturing Lines from R134a to R600a as Refrigerant

Walton has four production lines (Line-1, Line-2, Line-3, and Line-4) for fridge manufacturing. Of them, Line- 3 was converted in 2016 and was safety inspected at that time. Now, other three lines (Line-1, Line-2 and Line-4) have undergone conversion from R134a to R600a. These converted lines for refrigerator manufacturing using R600a or iso-butane as refrigerant have the following new additional components:

i. R600a or iso-butane storage tank
ii. Supply pipeline for R600a
iii. R600a charging station
iv. R600a leak detection system

In addition, the use of R600a as refrigerant needs some changes in the compressor and subsequently, the compressor plant has undergone some modifications. This study also looked into the safety aspect of the modified compressor plant.

4. Relevant Regulations and Codes

New refrigerator manufacturing lines of Walton consist of iso-butane storage area, charging stations and a pipeline system connecting both. The storage area is located outdoor whereas, the charging station is housed indoor in the refrigerator assembling facilities. The connecting pipeline lines run both indoor and outdoor. The new lines of manufacturing refrigerators were reviewed following relevant codes and standards. The list of the primary codes used in this safety assessment is given below.

Table A: List of Applicable Codes

	Code Type	**Applicable code**
1	Storage	Bangladesh Energy Regulatory Commission LPG Storage, Bottling, Transportation and Dispensing Codes and Standards, 2016 (Draft)
2	Building	Bangladesh National Building Code 2015 (draft)
3	Fire prevention	Bangladesh Fire Prevention and Extinction Act 2003 Bangladesh Fire Prevention & Extinction Rule 2014
4	Electrical installation	International Standard IEC 60079-10:2015

5. Recommendations

The manufacturing facility was visited thrice on 28 August, 19 October and 4 November, 2019. Relevant information, documents, photos were collected. The findings/observations have been made and communicated based on the site visits, documents supplied by Walton and directives of the relevant applicable codes. In summary, Walton satisfy most of the safety requirements. In addition, the following safety measures can be undertaken by Walton authority to ensure safe working place.

i. Although fridge 1 facility passes the requirements of BNBC, the working space is not worker friendly due to the crowded layout. We recommend moving the facility of fridge 1 to a larger space whenever it is convenient for Walton.
ii. For Line-2, though the motor casing was resized and the cooling unit was removed, the exit pathway is still cannot be considered uninterrupted. It is recommended that the motor orientation is changed and make the exit path uninterrupted.
iii. Gas leak detection system used in storage tank area and in the charging station should be regularly inspected and tested. A log book in this regard should be maintained.
iv. It was observed that there is tendency to store materials temporarily in the exit areas. This must be stopped. All exit areas must be kept free all time.
v. It is recommended to maintain all exits clearly visible and exit access corridors and passages leading to the exit clearly marked and signposted to guide the occupancy traffic. Exit signs must be illuminated so that they are clearly visible during darkness.
vi. With new BNBC requirement, any industry having more than 150 people must exercise fire-drill every month. Walton is currently doing it every six months. They need to increase its frequency to comply with the new BNBC requirement.
vii. Emergency response drill can be performed quarterly to ensure that employees can safely evacuate the work area during an emergency.
viii. Ensuring Sufficient fire water storage and availability for different facilities is recommended.
ix. In compressor plant section, head and feet protection is recommended.
x. In ED paint area, proper hazard sign and MSDS should be placed. Proper ventilation and training to handle the chemicals for employees should be ensured.
xi. Emergency management, particularly chemical spill management should get highest priority in ED paint area with available water shower and approved respirator.
xii. It is high time that Walton should have a strong HSE (Health, Safety and Environment) department to look after the issues related to environment and safety so that it can grow sustainably in an environmentally friendly manner.

6. Remedial Actions by Walton

The team leader of safety audit team visited the plant site on November 4, 2019 and found that Walton performed all suggested remedial actions. However, for line 2, they need to take additional actions to re-orient the motors of the conveyer belt and ensure an uninterrupted exit.

Disclaimer

This Safety Audit refers only to the status of project site at the time of inspection. Walton passed the safety audit. It is to be clearly stated that a safety audit is not a guarantee, and it has no extension. It is a static event. A positive safety audit merely states that at the time of the inspection the plant was safe.

Contents

1. Background

The Montreal Protocol, ratified by all countries in the world was declared to protect the ozone layer by phasing-out production and consumption of industrial chemicals that deplete the Ozone layer. Under the mandates of the Montreal Protocol, Ozone Depleting Substances (ODS) such as hydrochlorofluorocarbons (HCFCs) were restricted from further use. HCFCs are not only ozone depleting substances (ODS) but also potential Greenhouse Gases (GHGs) because of their high Global Warming Potential (GWP). The alternatives to HCFCs include 'ozone and climate friendly alternatives' such as natural refrigerants - hydrocarbons (HCs), ammonia and carbon dioxide; and lower global warming potential (GWP) HFCs, both saturated HFCs and unsaturated HFCs. The transition from HCFCs to environment-friendly alternatives is a challenging task, particularly for a developing country like Bangladesh, which needs to achieve its Sustainable Development Goals (SDGs) in an environmental friendly manner.

Walton has been the pioneer in refrigerator manufacturing in Bangladesh and currently holds the major market share. They are already free of HCFCs and use HFCs. Though some of the HFCs are not ozone depleting, but they are responsible for global warming significantly. These refrigerants should be replaced with something more environmentally friendly. Recent trend is to use hydro-carbon based refrigerants, which has zero ODP and very low GWP. As a part of this mission, Walton had replaced one of their manufacturing lines of R134a with R600a (iso-butane) in 2016. They have recently converted the remaining three Refrigerator manufacturing lines from R134a to R600a with the help of financial aid from United Nations Development Programme (UNDP). Iso-butane (R600a) is a hydrocarbon and highly flammable in nature. The use of flammable refrigerant has its own concerns in terms of explosive nature and other potential fire hazards. Therefore, modification like this must be undertaken with proper caution maintaining standards and safety features. Keeping this in mind, UNDP Bangladesh has awarded a contract to the Department of Chemical Engineering, BUET, for performing a safety evaluation of the three converted lines of refrigerator manufacturing facility using R600a as a refrigerant at Walton Hi-tech Industries Limited and reviewing the measures taken to address the possible safety concerns.

2. Purpose and Scope of the Study

2.1 Objectives of the Study

The objectives of the safety audit in refrigerator plants and equipment were as follows:

- Safety audit for the implementation of the industrial conversion of the manufacturing refrigerators with R600a at Walton Hi-tech Industries Limited.
- Safety audit of the compressor plant

2.2 Scope of the Study

The scope of services for "Safety audit in refrigerator plants and equipment" were as follows:

- Reviewing the detail plant layouts and the process flow diagrams to ensure the proper safety inside the plant design.
- Desk reviewing of the various changes/modifications undertaken in the plant for conversion to Hydrocarbon refrigerant under the project;
- Reviewing of regulations, industry standards etc. as applicable for safe transport, storage and use of HCs including national regulations (*e.g.*, Bangladesh National Building Code, Bangladesh Fire Prevention & Extinction Rule- 2014, Bangladesh Energy Regulatory Commission LPG Storage, Bottling, Transportation and Dispensing Codes and Standards, 2016 (Draft), International Standard IEC 60079-10-1:2015);
- Undertaking site inspections for reviewing implementation of safety requirements in different parts of the manufacturing facilities. This includes equipment infrastructure, civil works, electrical works, training of plant personnel etc.;
- Providing a safety audit report confirming of Walton with safety requirements according to the zones classified under International Standard IEC 60079-10-1:2015 for the operations using HCs.
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The team undertaken this study consisted of the following faculty members from Chemical Engineering Department, BUET.

4. Dr. M. A. A. Shoukat Choudhury — Professor and Team Leader
5. Dr. Syeda Sultana Razia — Professor and Safety Expert
6. Dr. Shoeb Ahmed — Associate Professor

4. Review of the Refrigerator Manufacturing Lines using R600a as Refrigerant

Walton has four lines for manufacturing refrigerators having a total capacity of 7000 refrigerator production each day. They previously used R134a (Tetrafluoroethane, CF_3CH_2F) from the family of HFC refrigerants. Because of high GWPs, HFCs are phased down gradually all over the world. Walton also converted one of their manufacturing lines (Line 3) in 2016 from R134a to R600a refrigerants. R600a is an iso-butane based non-toxic refrigerant with zero ODP and very GWP (about 4). Now, Walton has converted the remaining three lines for using R600a as refrigerant instead of R134a. Three converted lines for manufacturing refrigerators using R600a or iso-butane as refrigerant (MSDS attached in Appendix - B) have many things similar to the previous refrigerator manufacturing lines except the following new additional components specific to this project considered in this study:

i. R600a or iso-butane storage tank
ii. Supply pipeline for R600a
iii. R600a charging station
iv. R600a leak detection system

In addition, the use of R600a as refrigerant needs some changes in the compressor and subsequently, the compressor plant has undergone some modifications. This study also looked into the safety aspects of the modified compressor plant.

4.1 R600a or iso-butane storage tank

Two tanks, each of 17 m^3 capacity, along with necessary instrumentations have been installed to store R600a. The tanks are installed above the ground. A photograph is shown in Fig 4.1.

Tanks have proper safety relieve valves (SRVs), drain valves, isolating valves, non-return valves, pressure gauges, temperature and level measuring devices. The Piping and Instrumentation Diagram (P&I Diagram), the tank drawing diagram, tank specification and tank certifications provided in Appendix – A are reviewed by the team and were checked during the plant visit. They were found satisfactory. R600a is transported to the site using standard iso-tanks and then it is unloaded from the iso-tank to the storage tanks. The unloading pumps installed for this purpose is found to be flame-proof and of Ex-d standard (Fig. 4.2) as per the nameplate of the pump. The tank area has a physical dike protection. Tanks and other equipment are found to be properly earthened or grounded. The tank area has gas leak detector sensors connected to a gas leak detection system. The gas leak detector system is installed with visible and audible alarms (Fig 4.3 and 4.4). As per LPG storage requirements or standards, at least 5% of the tank volume must be remained empty all time. This requirement is maintained manually during loading of the iso-butane and also by taking daily readings of temperature, pressure and level of the tanks. The tanks and accessories were designed following BS PD 5500:2012. The detailed technical specifications from the manufacturer of the tanks are provided in Appendix – A. The technical specifications have been reviewed and found satisfactory. The tank was third party inspected and certified by TUV SUD South Asia, Bombay, India. The certificate is also attached in the Appendix-A. The tank area has a fire-fighting system with fire extinguishers, sand buckets, fire hydrants and water sprinklers.

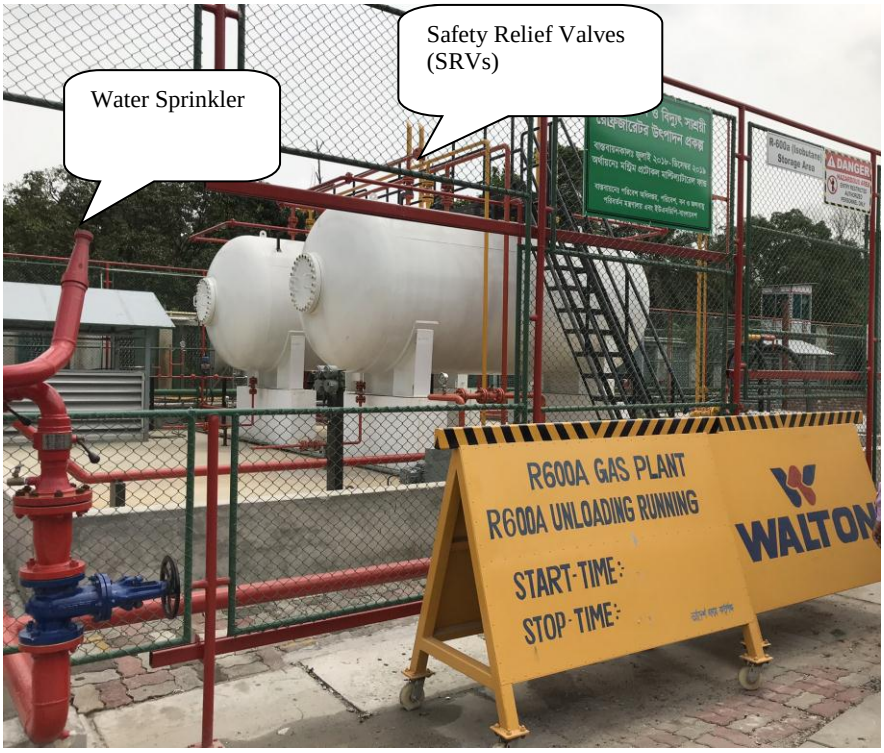


Fig 4.1: Storage Tanks for R600a or iso-butane

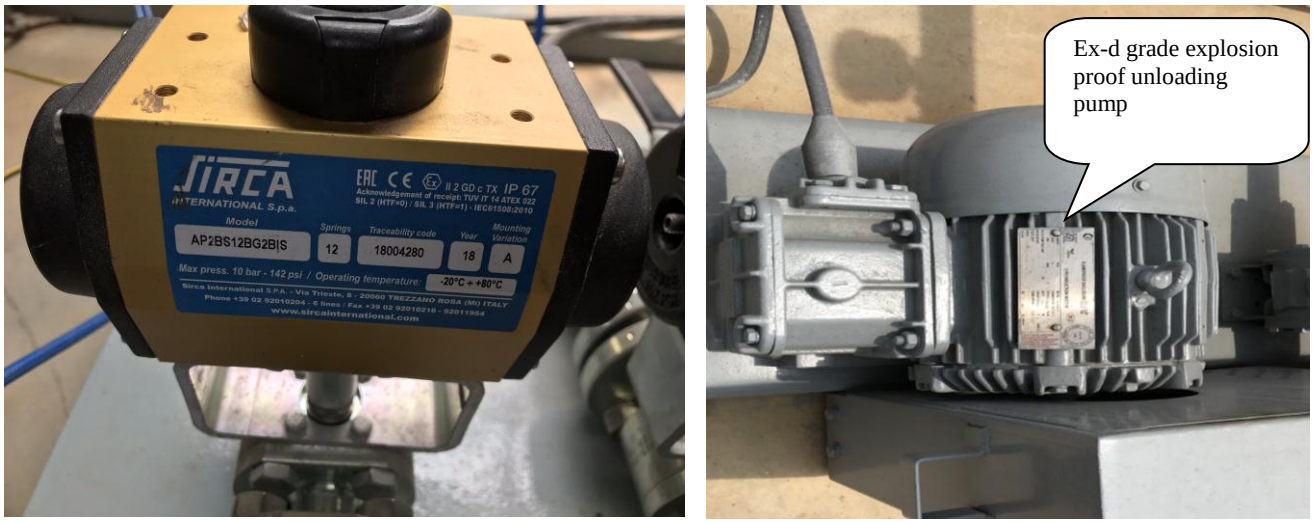


Fig 4.2: Ex-d standard Explosion Proof Pump

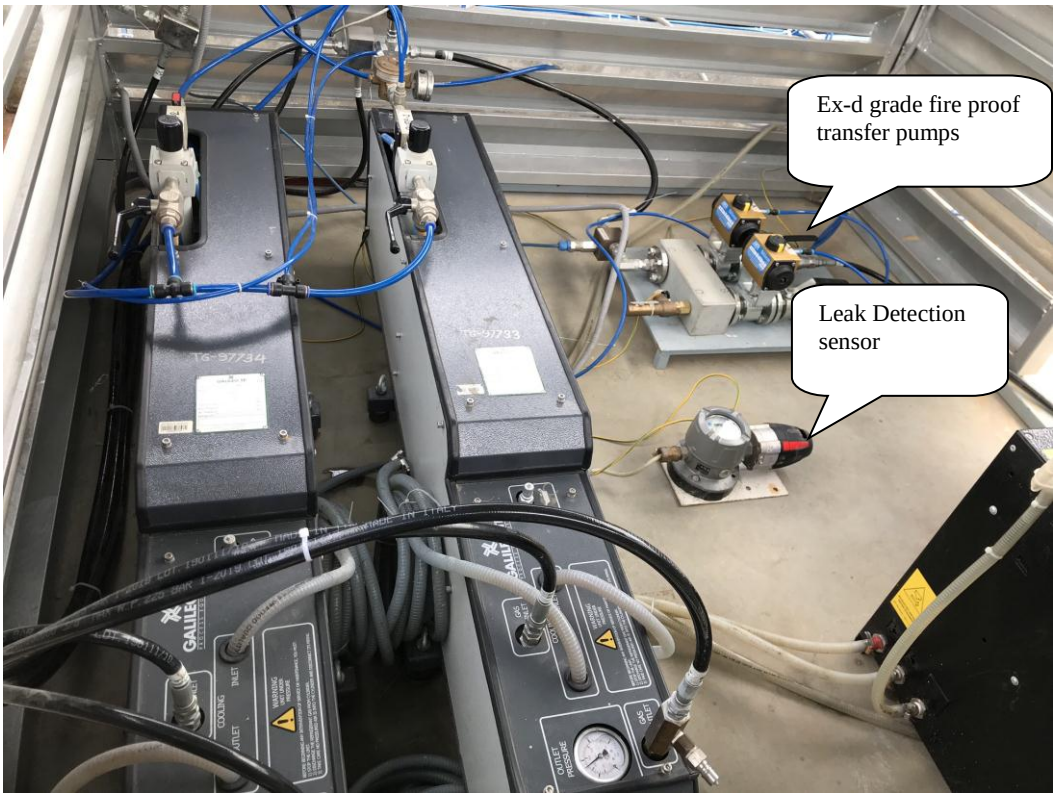


Fig. 4.3: Gas Leak Detection Sensor and Ex-d standard transfer pumps

Figure 4.4: Control Room for Storage Tank including visible and audible alarm outside

4.2 Supply Pipe Line for R600a

R600a is pumped through a 3/4" supply line to the charging station. Special fire-proof pump (Ex-d standard) is used for supplying R600a in the main supply pipeline (Fig 4.3). The supply pipeline is made of GI pipe. The main supply pipeline has a remotely operated automatic valve (Fig 4.5). The main supply line feeds the branch pipelines of the respective manufacturing lines. The pumps, valves and other instrumentations are found satisfactory. Specifications for Tank, Valve, Piping and Unloading pump are attached in Appendix-A.

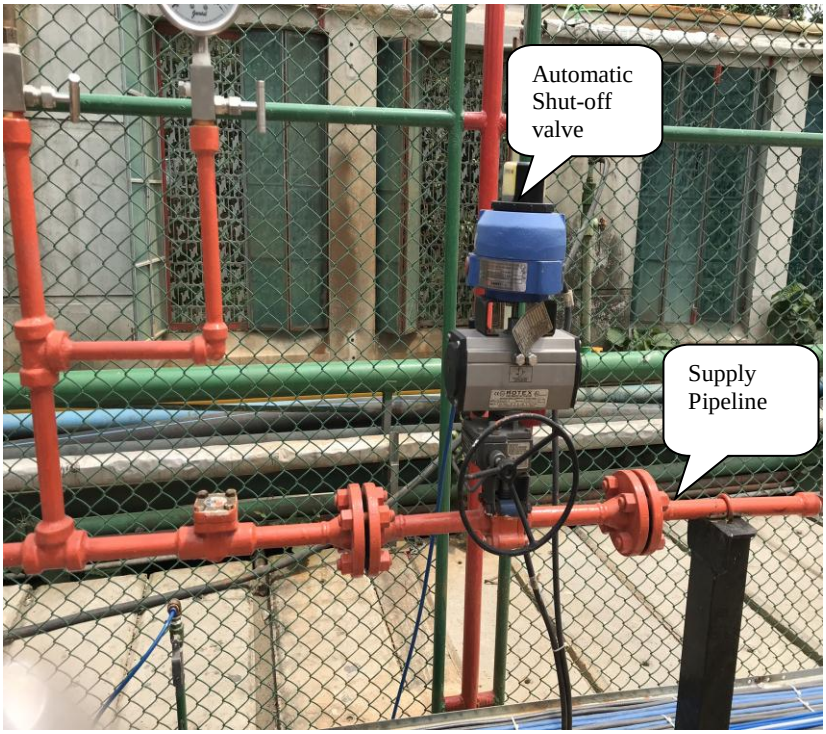


Fig. 4.5: Pipeline with remotely controlled electric valve

4.3 R600a charging station

R600a is pumped through the pipelines from the storage tanks to charging stations located in the manufacturing lines. Charging stations are used for charging R600a refrigerants in the refrigerators (Fig. 4.6). The charging stations are equipped with refrigerant charging guns, which are directly connected to the R600a supply pipeline. The charging stations have also gas leak detection sensors, flushing alarms, continuous ventilation systems and firefighting equipment. The charging station was purchased from Galileo TP (Automatic Evacuation and Refrigeration Charging), an Italian company. The equipment and accessories are found as per standard.

Fig. 4.6: *R600a Charging Stations with visible and audible alarms.*

4.4 Gas Leak Detection System

The storage tank area and the gas charging station have their own gas leak detection system. In the charging station, there are couple of gas leak detector sensors. In each charging station, there is a continuous ventilation system in place to ventilate the area so that there is no accumulation of iso-butane in case of any gas leak. In addition, there is a series of gas leak detection mechanisms that a refrigerator needs to pass as a requirement of quality check before it is ready to be packaged for sale.

5. Review of Relevant Regulations and Codes

The converted refrigerator manufacturing lines of Walton consist of iso-butane storage areas, charging stations and connecting pipelines. The storage areas are located outdoor whereas, the charging stations are housed indoor inside the refrigerator manufacturing facilities. The connecting pipelines run both indoor and outdoor. In Bangladesh, the percentage of butane in LPG varies from 30 - 60%. Therefore, the draft regulation of "Bangladesh Energy Regulatory Commission LPG Storage, Bottling, Transportation and Dispensing Codes and Standards, 2016 (Draft)" is applied to iso-butane storage area for safety assessment. "Bangladesh National Building Code 2015 (draft)" is applied to the charging station as it is inside an industrial facility. Furthermore, "Bangladesh Fire Prevention and Extinction Act 2003" and

"Bangladesh Fire Prevention & Extinction Rule 2014" and "International Standard IEC 60079-10:015" are applied for fire safety management and electrical instrument installations, respectively. The list of the primary codes used in this safety assessment is given in Table 5.1.

Table 5.1: List of Applicable Codes

	Code Type	Applicable code
1	Storage	Bangladesh Energy Regulatory Commission LPG Storage, Bottling, Transportation and Dispensing Codes and Standards, 2016 (Draft)
2	Building	Bangladesh National Building Code, 2015 (draft)
3	Fire prevention	Bangladesh Fire Prevention and Extinction Act 2003 Bangladesh Fire Prevention & Extinction Rule 2014
4	Electrical installation	International Standard IEC 60079-10.015

5.1 Bangladesh Energy Regulatory Commission LPG Storage, Bottling, Transportation and Dispensing Codes and Standards, 2016 (Draft)

Salient features of the regulation are summarized below:

- Vessels and material of construction should meet the ASME boiler and pressure vessel code.
- A minimum 15 m horizontal distance between the LPG storage and other facilities must be maintained.
- Proper drainage system and remote impoundment area to prevent liquid spill are required.
- A minimum 5% of air space in the storage tank should be maintained.
- Pressure relief valve, vent, flare, level indicator and high-level alarm, shut off valve should be installed following ASME, API codes.
- Emergency shut off valve for loading unloading system is required.
- Piping, seam, joints, unions, thermal expansion provision should follow ASME codes.
- Pumps with proper sealing and compressors with scrubber or liquid knockout drum should be installed.
- Static electricity protection system should be in place.
- Equipment for adding odorant should be in place.
- Adequate firefighting system along with fire proofing of LPG vessels are required.
- Wiring and electric control should follow NFPA 70.
- Appropriate safety precautions signage is required.
- The facility must have adequate emergency exits.

5.2 Bangladesh National Building Code 2015 (draft)

Although the charging station is dealing with iso-butane, a flammable Class IA liquid, the charging station is exempted from class J i.e. hazardous building status as the storage in the charging station is less than 115 liters. Therefore, the requirements for industrial building (G) will be applied in this case. National building code mainly offers directives related to occupational safety, emergency exit requirements and fire prevention. The requirements include occupant loads, minimum number of exits, travel distance from work area to exit, minimum width of the stairs, requirements for corridors and passage ways, fire alarms, fire extinguishers etc. They are listed in Table 5.2.

Table 5.2: BNBC Requirements

BNBC-2015	**Requirement**
Occupant load	
Occupant load (unit of floor area per person)	10 m^2 gross
Maximum Occupant load	0.3 m^2 of usable floor space
Exit requirement	
Required width for exit per occupant	Stairways: 8 mm Doors: 4mm
Minimum ceiling height of corridors and passageways	2.4 m
Maximum occupant load and travel distance for spaces with one exit door	Maximum 50 person and maximum 23 m
Minimum width and height of exit door	1 m and 2 m, respectively
Number of exits	One exit for occupant load less than 50
Travel path	60 m for un sprinklered path
Minimum width of passage and corridors	1.12 m or 3.7 ft

5.3 Bangladesh Fire Prevention & Extinction Rule 2014

Fire Prevention and Extinction Act 2003 provides that owner of warehouse or workshop shall have to take license from the Directorate General of Fire Service and Civil Defense. The Fire Prevention and Extinction Act 2003 is supplemented by the Fire Prevention and Extinction Rules 2014 which enumerates that the owner of the building shall have to apply for occupancy certificate of the building at the end of the construction. The fire prevention requirements mostly cover issues such as firefighting plan, access to the building, provisions and adequacy of firefighting system etc. and Bangladesh National Building Code covers some of these provisions. Since Walton was required to take a compliance certificate from Bangladesh Fire Service and Civil Defense, this item was not covered thoroughly in this study. However, Walton regularly carries Fire drill with the help of Fire Service and Civil Defense. Some documents related to it are provided in Appendix-C.

5.4 International Standard IEC 60079-10:2015

Based on the guidelines of IEC 60079-10:2015, different areas of a facility dealing with flammable materials are classified into different zones for explosive gas atmosphere. It is the responsibility of the user or designer to select and apply the proper protection for each Zone. The protection types are design measures and electrical measures carried out on the equipment to achieve explosion protection in the areas subject to explosion hazard. Electrical equipment/installations are tested and marked in accordance with the type of protection needed for each type of zone. Electrical equipment for hazardous areas must comply with the general requirements of EN 60079-0 and the specific requirements for the relevant type of protection in which the equipment is listed**.** According to the standard, the definitions of the zones are as follows.

Zone 0: An area in which an explosive gas atmosphere is present continuously, or for long periods or frequently.

Zone 1: An area in which an explosive gas atmosphere is likely to occur in normal operation.

Zone 2: An area in which an explosive gas atmosphere is not likely to occur in normal operation, and if it does occur, is likely to do so only infrequently and will exist for a short period only.

6. Site Inspection

The consultant team visited the production facility of Walton on 28th August 2019, 19th October, 2019 and 4th November, 2019. The current status of implementation of safety requirements in different parts of the manufacturing facilities was reviewed. The following documents were obtained from Walton and have been reviewed:

1. Storage Tank: capacity, flow rate, pipeline diameter including approved drawing
    a. Piping and Instrumentation Diagram of the storage tank
    b. Pipeline connecting storage tank to charging station
    c. Equipment layout
    d. Charging Station
    e. Third party inspection certificates

2. Manufacturing line layouts with dimensions and locations of fire extinguishers
3. Location of gas detection system, fire alarm, fire-fighting equipment and fire exits in layout diagrams
4. Gas leak detection monitoring data (at charging point, pipelines, storage tank station) for last six months
5. Gas leak detection alarm testing and drill data
6. Layout diagram of the compressor plant with the locations of the fire extinguishers and fire exits
7. MSDS of different chemicals (mainly paints and solvents) used in compressor plant

7. Safety Analysis of R600a Storage Tanks and Supply Lines

The converted manufacturing lines were classified in hazard zones as per IEC-60079-10:2015 standard. They are shown in Figure 7.1. The zones are classified using the definitions from the above standards. The vapour volume in the storage tank above the liquid surface corresponds to ‘Zone-0’ (Figure 7.1a). Considering any release from the safety valves installed at the top of the tank, the circular area with radius 3 meter from the top of safety valve is classified as ‘Zone -1’ (Figure 7.1a). The 3-meter radius circular areas around the supply pipeline and the charging gun are classified as ‘Zone-2’. Areas surrounding the storage tanks also fall into ‘Zone-2’. (Figure 7.1a, 7.1b and 7.1c).

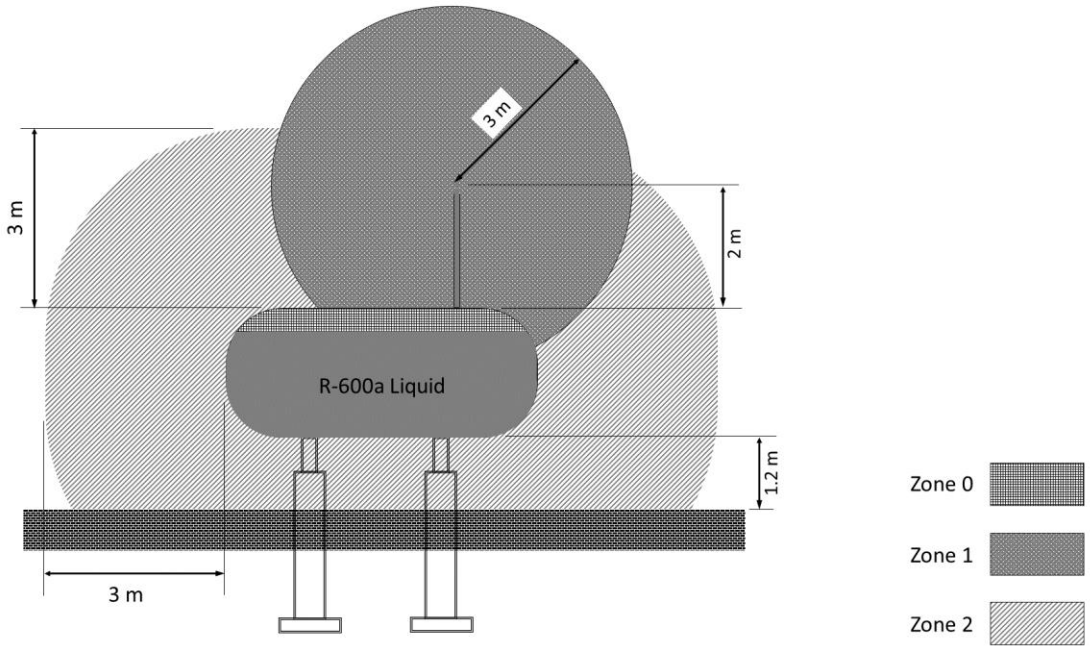


Figure 7.1a: Classification of Zones as per IEC-60079-10:2015. Storage Tanks

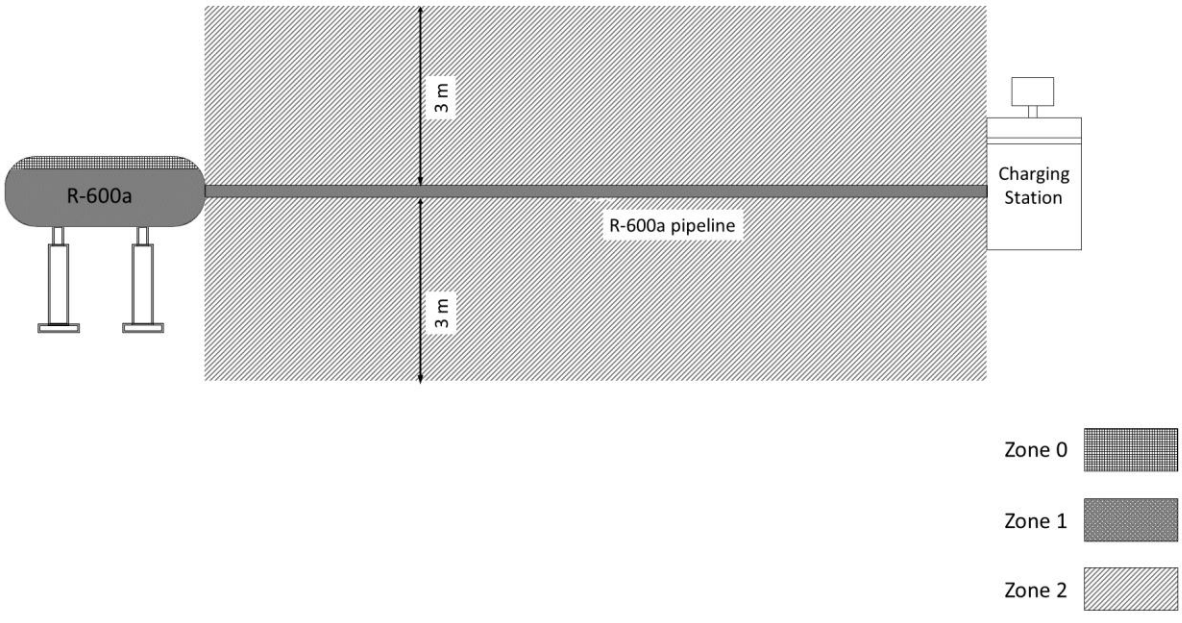


Figure 7.1b: Classification of Zones as per IEC-60079-10:2015. Supply Lines

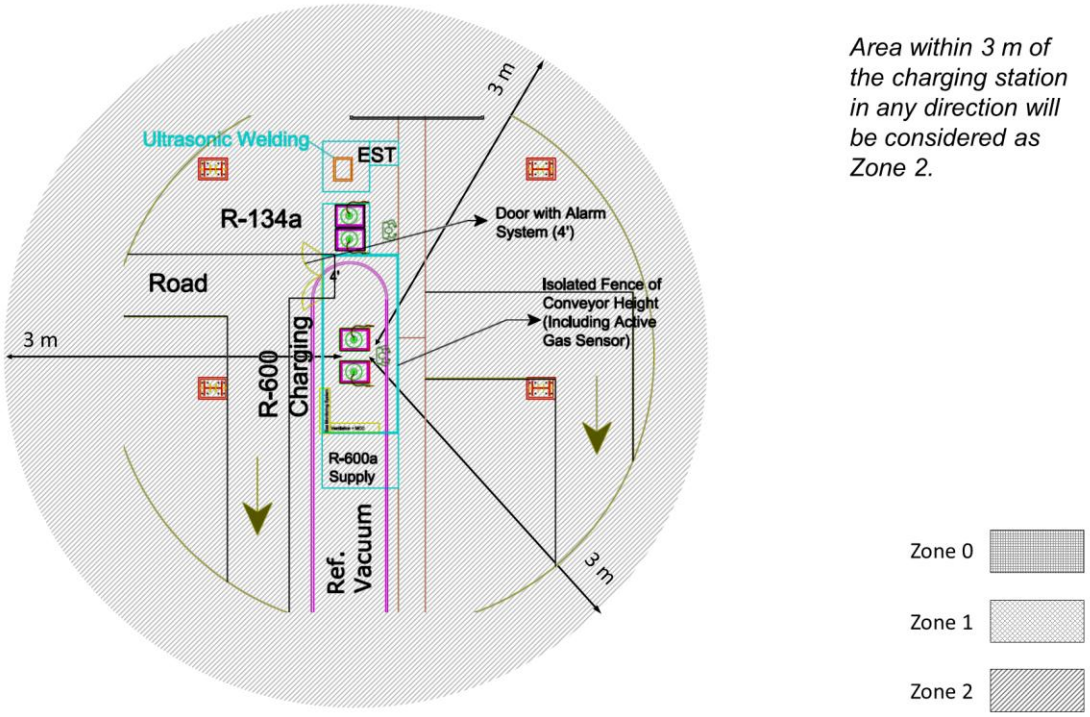


Figure 7.1c: Classification of Zones as per IEC-60079-10:2015. Charging Stations

Safety analysis of the storage tanks and supply lines were performed and different requirements and their current status are listed in Table 7.1.

Table 7.1: Classification of Hazard Zones as per IEC-60079-10:2015 Standard

Zone	**Identified area** (Shown on plant layout)	**Electrical Installation requirement**	**Finding/Observations**
Zone 0	Vapor portion inside storage tanks, inside pipeline	Equipment protection by flameproof enclosures 'd' according to EN 60079-0/1	All pumps are found to be Ex ‘d’ grade
Zone 1	Vent from storage tank, charging station		
Zone 2	Surrounding area of storage tank, charging station and surrounding area of pipeline		

7.1 Storage and piping facility (According to The LPG Codes and Standards -2016 of Bangladesh)

1. R600a storage tanks must be designed and manufactured following an International standard such as ASME boiler and pressure vessel code. The tanks and accessories were designed by OPTECH Engineering PVT Ltd, India. It was tested and certified by TUV SUD South Asia.
2. Gas detector alarm and lights are located outside the control room (Fig. 4.4). The tank is found to be properly earthened/grounded.
3. There must be a level alarm attached to each storage tank. This is not found. However, Walton informed that the requirement of 5% empty space in each tank is maintained during manual loading of the refrigerant. It is also maintained by taking pressure, temperature and level readings of each tank every 24 hours.
4. A remotely accessible shut off system should be installed so that process and supply can be stopped remotely in case of an accident. This has been installed (Fig. 4.5).

Table 7.2: Safety Analysis Results of Storage Tanks

Article	**Requirement**	**Findings/Observations**
Vessel construction	Material of construction and ASME boiler and pressure vessel code	Approved by certification body/ classification society TUV-SUD South Asia and RINA (Italy)
Minimum distance of the storage from other facilities	15m	**satisfactory**
Drainage system and Remote impoundment area	Required	Drainage system in place
Air space in the storage tank	Not less than 5%	Filling of storage tank is done manually by observing level indicators and 5% air space is maintained inside the tank
Level indicator and high-level alarm	required	
Pressure relief valve	Follows ASME code with adequate flow	Made according to BS PD 5500 – Specification for Unfired Fusion Welded Pressure Vessels

Article	**Requirement**	**Findings/Observations**
Vent and flare	Vent height 3m above the operating platform	Proper vent and flare system in place
Shut off valves in case of fire exposure	required	Shut off valve in place
Valves	API std (AISI shall not be used)	ASTM codes are followed
Piping seam, joints, unions, thermal expansion provision	ASME code	ASA (American Standards Association) codes are followed
Pumps and compressors	Pumps with proper sealing, compressor with scrubber or liquid knockout drum	Unloading pump of ductile iron with double mechanical seal, rotor of SS, flame-proof motor along with isolating and no return valves. The unloading pump is made by Corken USA
Emergency shut off valve for loading unloading system	Manual, automatic and remote shutdown capability	Remote controlled shut off valve in place
Static electricity protection	Proper grounding	Double earthing for each tank in place
Fire water system	Adequate fire protection capacity	Gas leak sensors and alarm are in place, ISI (Indian Standards Institute) codes are followed
Fire detection and alarm	Required	
Fire proofing of LPG vessels	NFPA 58	1. Tank surface is prepared with sandblasting to SA 2 ½ and 60 micron surface preparation 2. Painted with zinc silicate and high build epoxy primer.
Wiring and electric control	NFPA70	No standard is mentioned
Emergency exit	Required	Adequate exit from the outdoor LPG storage area are in place.

8. Manufacturing Lines (According to BNBC)

Walton has four production lines (Line-1, Line-2, Line-3, and Line-4) for manufacturing refrigerators. Of them, Line- 3 was converted in 2016 and was safety inspected at that time. Now, other three lines (Line-1, Line-2 and Line-4) have been converted for using R600a as refrigerant instead of R134a. The following are the observations on the safety aspects following Bangladesh National Building Code 2015/2006 (draft).

8.1 Observations on Manufacturing Lines

Based on the supplied information and on-site observations a checklist for each production line is prepared summarizing the requirements of BNBC 2015.

Table 8.1: Summary Table for Line - 1 known as Fridge - 1

BNBC-2015	**Requirement**	**Existing Condition/ observations**
Occupant load		
Occupant load (unit of floor area per person)	10 m^2 gross	More than 20 m^2 gross
Maximum Occupant load	0.3 m^2 of usable floor space	More than 0.3 m^2 of usable floor space
Exit requirement		
Required width for exit per occupant	Stairways: 8 mm Doors: 4mm	More than the requirement
Minimum ceiling height of corridors and passageways	2.4 m	Satisfied
Maximum occupant load and travel distance for spaces with one exit door	maximum 50 person and maximum 23 m	Both conditions satisfied
Minimum width and height of exit door	1 m and 2 m, respectively	Satisfied
Number of exits	One exit for occupant load less than 50	Satisfied
Travel path	60 m for unsprinklered path	Satisfied

Minimum width of passage and corridors	1.12 m or 3.7 ft	The width of north side passage to stairs adjacent to conveyer belt is 2.6 ft. This has been corrected by WALTON by making an additional stair of sufficient width (see section 11: remedial action by Walton)

Table 8.2: Summary Table for Line - 2 known as Fridge - 2

BNBC-2015	**Requirement**	**Existing Condition/ observations**
Occupant load		
Occupant load (unit of floor area per person)	10 m^2 gross	25 m^2 gross
Maximum Occupant load	0.3 m^2 of usable floor space	More than 0.3 m^2 of usable floor space
Exit requirement		
Required width for exit per occupant	Stairways: 8 mm Doors: 4mm	More than the requirement
Minimum ceiling height of corridors and passageways	2.4 m	More than the requirement
Maximum occupant load and travel distance for spaces with one exit door	maximum 50 person and maximum 23 m	satisfied
Minimum width and height of exit door	1 m and 2 m, respectively	Satisfied
Number of exits	One exit for occupant load less than 50	Satisfied
Travel path	60 m for unsprinklered path	Satisfied
Minimum width of passage and corridors	1.12 m	Satisfied

Table 8.3: Summary Table for Line - 4(1) known as Fridge - 4(I)

BNBC-2015 **Article No**	**Requirement**	**Existing Condition/ observations**
Occupant load		
Occupant load (unit of floor area per person)	10 m^2 gross	38 m^2 gross
Maximum Occupant load	0.3 m^2 of usable floor space	More than 0.3 m^2 of usable floor space
Exit requirement		
Required width for exit per occupant	Stairways: 8 mm Doors: 4mm	More than the requirement
Minimum ceiling height of corridors and passageways	2.4 m	More than the requirement
Maximum occupant load and travel distance for spaces with one exit door	maximum 50 person and maximum 23 m	satisfied
Minimum width and height of exit door	1 m and 2 m, respectively	Satisfied
Number of exits	One exit for occupant load less than 50	Satisfied
Travel path	60 m for unsprinklered path	Satisfied
Minimum width of passage and corridors	1.12 m	Satisfied

9. Observations on the Compressor Plant

The compressor manufacturing area may be classified as Industrial Buildings G2 (Moderate hazard industries) as per Bangladesh National Building Code. The regulatory requirements for G2 facilities under draft "Bangladesh National Building Code 2015" and findings and observations made during the facility visits are summarized in Table 9.1. Table 9.2 summarizes safety requirements and findings for ED paints, phosphating agent and toner storage in ED paint area as per supplied MSDS.

Table 9.1: Fire prevention requirements for compressor manufacturing as per BNBC 2015

Article	Requirement	Findings/Observations
Occupant load (unit of floor area per person)	10 m^2 gross	33.78 m^2
Number of exits	One exit door for occupant load not exceeding 50	5 emergency exit doors and 5 exit doors for movement
Travel distance from any point of work area to exit	60 m	Crankshaft Premachining 6.92 m Crankshaft Grinding 20.10 m Cylinder Head 21.20 m Shell Washing Line 23.45 m Phosphating Line 31.56 m Flange Bearing 41.24 m Crankcase 11.45 m Valve Plate Line 34.14 m Internal Assembly 38.21 m External Assembly 14.38 m Final Assembly 25.23 m ED Paint Line 25.23 m Shell Welding 35.28 m Rotor Shrinking Line 41.20 m Piston Line 16.55 m Rotor 22.48 m Conrod Line 28.50 m Lamination Press 26.65 m Heat Treatment 16.65 m
Ramp, passage	1.12 m	4.2 m

corridors		
Doorway	Width and height not less than 1 m and 2 m, respectively	Width: 1.7 m Height: 2.13 m
Fire door type	Side swinging	Side swinging left and right
Fire door	Certified for Fire resistance rating of at least 20 minutes in accordance with ASTM E152	Yes, certification from FSCD is under process
Corridors and passageways	Celling height and passage way 2.4 m with fire resistance rating of 1 hour	Corridors Width 2.63 m certification from FSCD is under process
Exit signs	Clearly visible signs and illuminated in dark guiding to exit as per NFPA 170	There are visible exit signs in the area.
Fire water requirement	1900 liter/min for 75 minutes	2840 litre/ min for 210 min
Fire pump	As per table 4.4.2 of BNBC 2015	Has electric, diesel and jockey pump with capacity of 750 GPM
Fire and smoke detection system	Required	To be installed
Fire alarm system	Fire alarm system with hydrants for above 750 m^2 for undivided space	To be installed
Fire drill	Monthly fire drill for industry having more than 150 occupancy	Fire drill in every 6 months as per labor law is carried out. Monthly drill is recommended
Fire safety plan	Approved by Fire Service and Civil Defense	To be approved
Building access road	Carriageway width of 4.8 m and the	Meets the requirement

	minimum vertical clearance shall be 5m.	
Auto vent system	Required	The facility has venting system
Indoor fire extinguisher	According to NFPA 10	**Yes**
Additional requirements for compressor area		
Personal Protection	Head and foot protection	Foot protection is observed. Additional head protection is recommended

Table 9.2: Additional requirement for ED paint area

Item	**Requirement**	**Findings/Observations**
Storage	• Appropriate Hazard signs and MSDS, and training for employee • CED and Phosphating agent: Ventilated, dark and cool place, below 30℃ above 5℃ • Toner: Store in a dry, well-ventilated and cool area away from incompatible substances with containers tightly closed	Appropriate Hazard signs and MSDS, and training for employee and Additional ventilation is recommended
Spill control and safe disposal	• Provision for absorbing and/or containing spill with inter-material, (sand, vermiculite), • For large spills: Neutralize spill area with inter-material (soda ash or lime, diluted acetic acid) and Flush spill area with water spray	Walton use: Powder absorbent OKO PUR Plus and Granules absorbent OKO PUR Kompact **Provision for water flushing is recommended**
Exposure controls	Eyewash facility and a safety shower	Eyewash facility available in ED paint area, Installation of safety shower is recommended
Personal protection	• Eyes: Chemical safety goggles or eyeglasses. • Skin: Uniform, apron and Rubber gloves. • Ventilation: Approved respirators should be used if airborne concentration exceeds recommended limit	Use of goggles, apron and gloves are recommended. Approved respirators should be made available for use in case of emergency.

10. Signages and Floor Markings

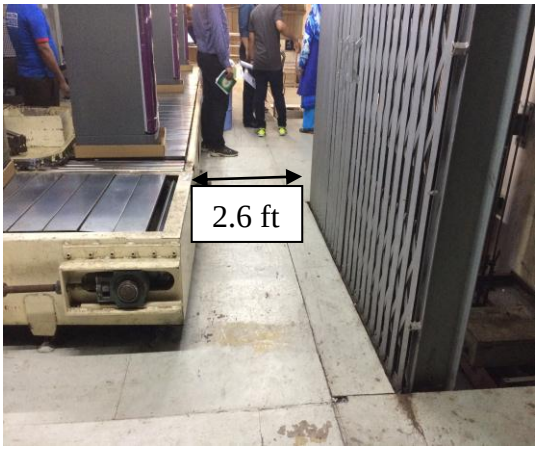
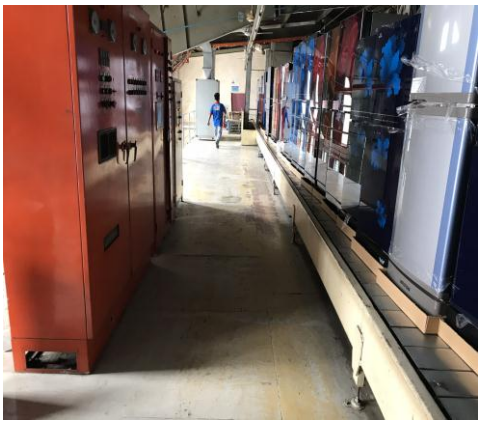
All exits shall be clearly visible and exit access corridors and passages leading to the exit shall be marked and signposted to guide the occupancy traffic. Exit signs in public places used during the hours of darkness shall be illuminated in accordance with the provisions of sec 15 of part 8 of National Building Code for Industrial Buildings. All directions and signs of fire exits need to be placed at a higher elevation so that these are visible from far.

11. Remedial Action by Walton

Observations and remedial actions by Walton are presented as before and after case in tabular forms below.

11.1 Line – 1 (Fridge 1)

Table 11.1: Observations (Before) and Remedial Action (After) for Line-1 (Fridge-1)

	Observations (Before)	Remedial Action (After)
i	Line 1 (Fridge 1) facility satisfies most of the BNBC requirements for safe means of egress i.e. safe exit except the one of the exit passage, which is only 2.6 feet wide (See Figure -PA1a). 	Walton has installed another stair of sufficient width as remedial action of comment (see Figure below). 
ii	The south side of the charging area is currently occupied with materials/person used in other activities (See Figure - below). This area has to be kept clear. 	The passage has been cleared and the orientation has been changed. Now employees are working on the other side, not in the pathway 

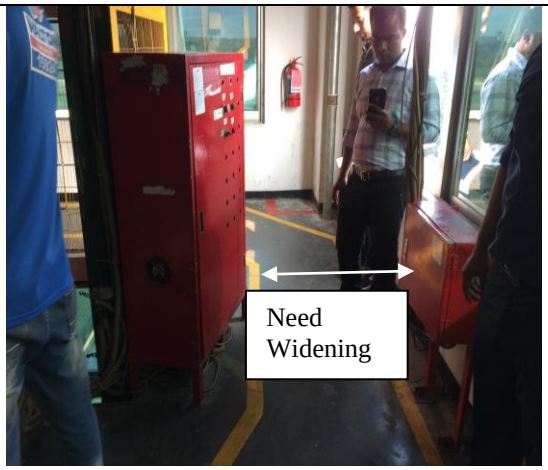
iii	HVAC duct was blocking the stairs. This should be moved upward.	HVAC duct has been moved upward to clear the stairway. 

Although fridge 1 facility passes the requirements of BNBC, the working space is not worker friendly due to the crowded layout. We recommend moving the facility of fridge 1 to a larger space.

11.2 Line – 2 (Fridge 2)

Table 11. 2: Observations (Before) and Remedial Action (After) for Line-2 (Fridge-2)

	Observations (Before)	Remedial Action (After)
i	Line 2 (Fridge 2) facility satisfies most of the BNBC requirements for safe means of egress i.e. safe exit. There are two narrow areas in the exit passage that need to be widened.	Walton has removed the electrical board and re-organized the place. The passage has been widened

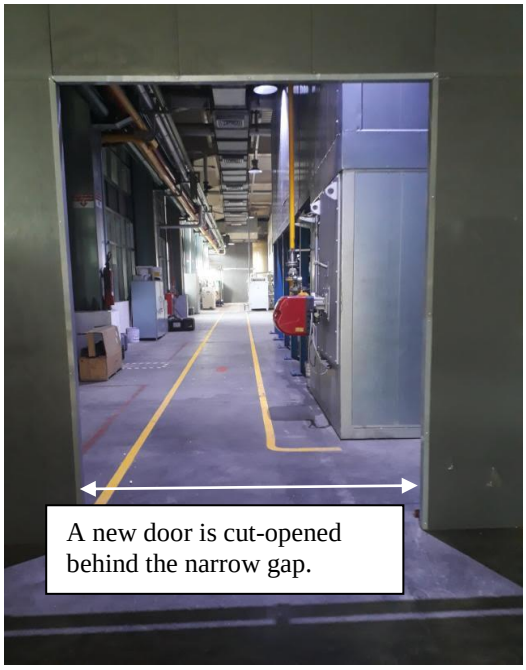
	 	 
ii	There are two obstructions by motors and cooling units in one of the exit paths. 	Cooling unit has been removed and the motor casing has been resized 

11.3 Line – 4 (Fridge – 4)

Line-4 of the manufacturing Facilities satisfies most of the BNBC requirements for safe means of egress. There are multiple exit doors on the floor where the production area is located.

11.4 Compressor Plant

Table 12.3: Observations (Before) and Remedial Actions (After) for Compressor Plant

	Observations (Before)	Remedial Action (After)
i	In the compressor painting area, one of the exit was narrow and did not meet the BNBC specification (See Figure Below) 	Walton has installed another proper exit just behind the narrow exit. Now The passage has been widened 

11.5 Signages and Floor Markings

Walton has installed enough number of illuminated exit signs. Floor areas are sign-posted to guide the traffic to safe egress.

12. Conclusions and Recommendations

Based on the site visit, supplied documents and applicable codes, the expert team found that most of the installation works undertaken by Walton for the new manufacturing line of refrigerators using R600a as refrigerant meet the safety requirements as specified by the standards listed earlier. The following additional safety measures and recommendations can be undertaken by Walton authority to ensure good safety practice.

i. Although fridge 1 facility passes the requirements of BNBC, the working space is not worker friendly due to the crowded layout. We recommend moving the facility of fridge 1 to a larger space.

ii. For Line-2, though the motor casing was resized and the cooling unit was removed, the exit pathway is still cannot be considered uninterrupted. It is recommended that the motor orientation is changed and make the exit path uninterrupted.

iii. Gas leak detection system used in storage tank area and in the charging station should be regularly inspected and tested. A log book in this regard should be maintained.

iv. It was observed that there is tendency to store materials temporarily in the exit areas. This must be stopped. All exit areas must be kept free all time.

v. It is recommended to maintain all exits clearly visible and exit access corridors and passages leading to the exit clearly marked and signposted to guide the occupancy traffic. Exit signs must be illuminated so that they are clearly visible during darkness.

vi. With new BNBC requirement, any industry having more than 150 people must exercise fire-drill every month. Walton is currently doing it every six months. They need to increase its frequency to comply with the new BNBC requirement.

vii. Emergency response drill can be performed quarterly to ensure that employees can safely evacuated the work area during an emergency.

viii. Ensuring Sufficient fire water storage and availability for different facilities is recommended

ix. In compressor plant section, head and feet protection is recommended.

x. In ED paint area, proper hazard sign and MSDS should be placed. Proper ventilation and training to handle the chemicals for employees are to ensured.

xi. Emergency management particularly chemical spill management should get highest priority in ED paint area with available water shower and approved respirator.

xii. Use of goggles, apron and gloves are recommended.

xiii. It is high time that Walton should have a strong HSE (Health, Safety and Environment) to look after the issues related to environment and safety so that it can grow sustainably in an environmentally friendly manner.

13. Verification

The team leader of safety audit team visited the plant site on November 4, 2019 and found that Walton performed remedial actions for most of the observations mentioned earlier. However, for line 2, Walton need to take additional actions to re-orient the motors of the conveyer belt and ensure that the exit is uninterrupted.

Disclaimer

This Safety Audit refers only to the status of project site at the time of inspection. Walton passed the safety audit. It is to be clearly stated that a safety audit is not a guarantee, and it has no extension. It is a static event. A positive safety audit merely states that at the time of the inspection the plant was safe.

APPENDICES

Appendix A1: Layout Diagrams for Fridge Manufacturing Lines and Compressor Plants

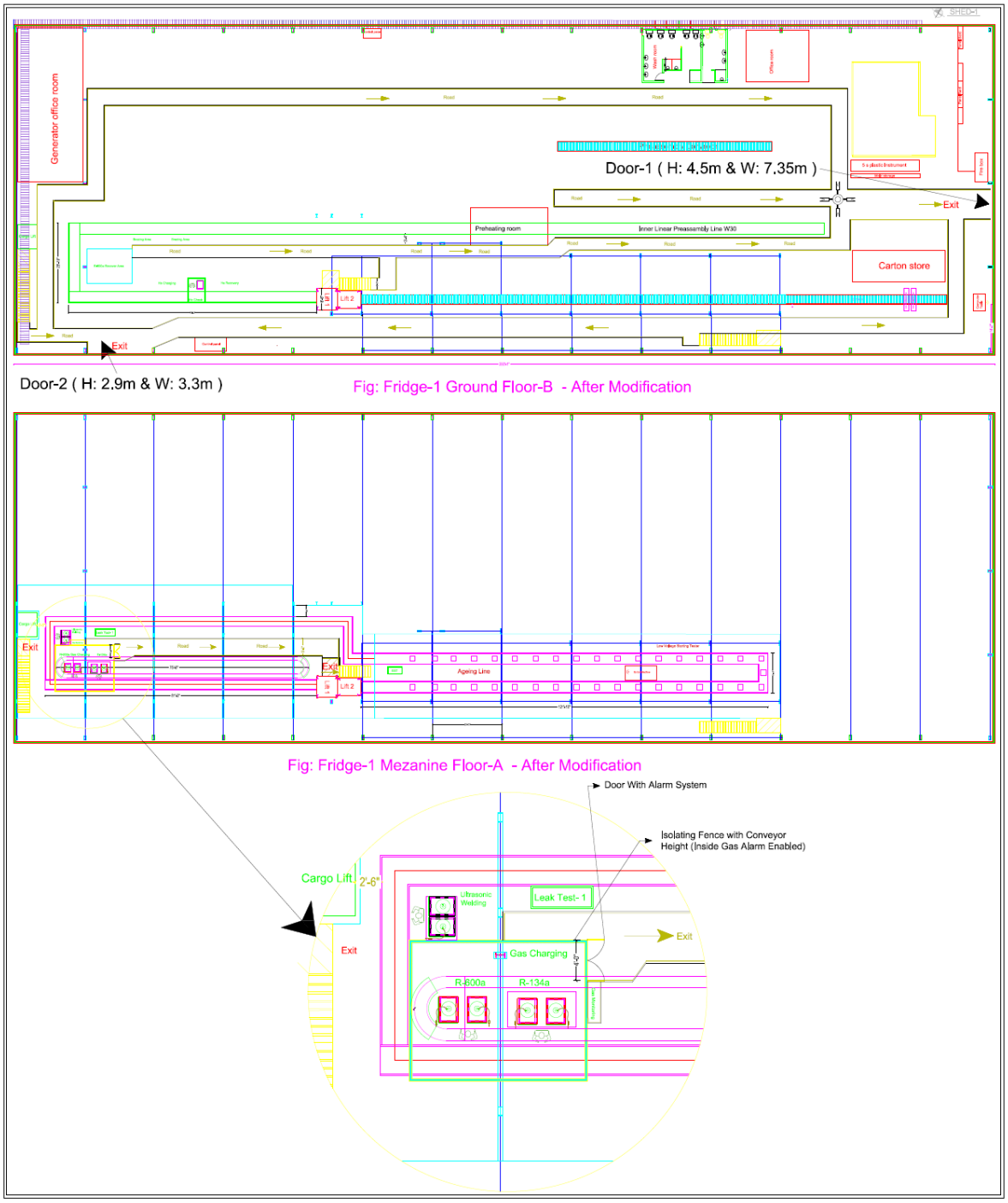


Figure A1-1 : Line – 1, Fridge 1 Layout

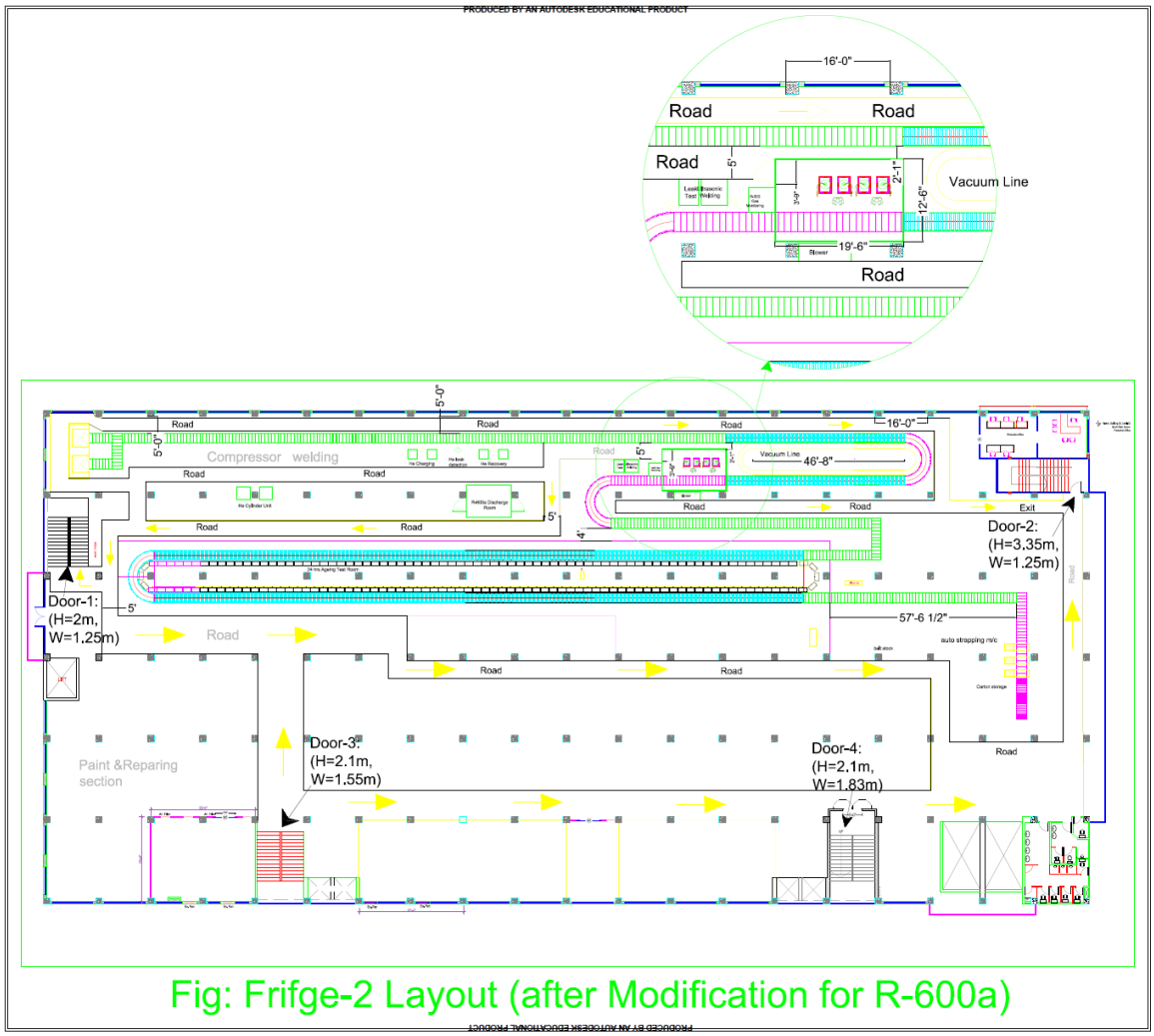


Figure A1- 2: Line – 2, Fridge 2 Layout

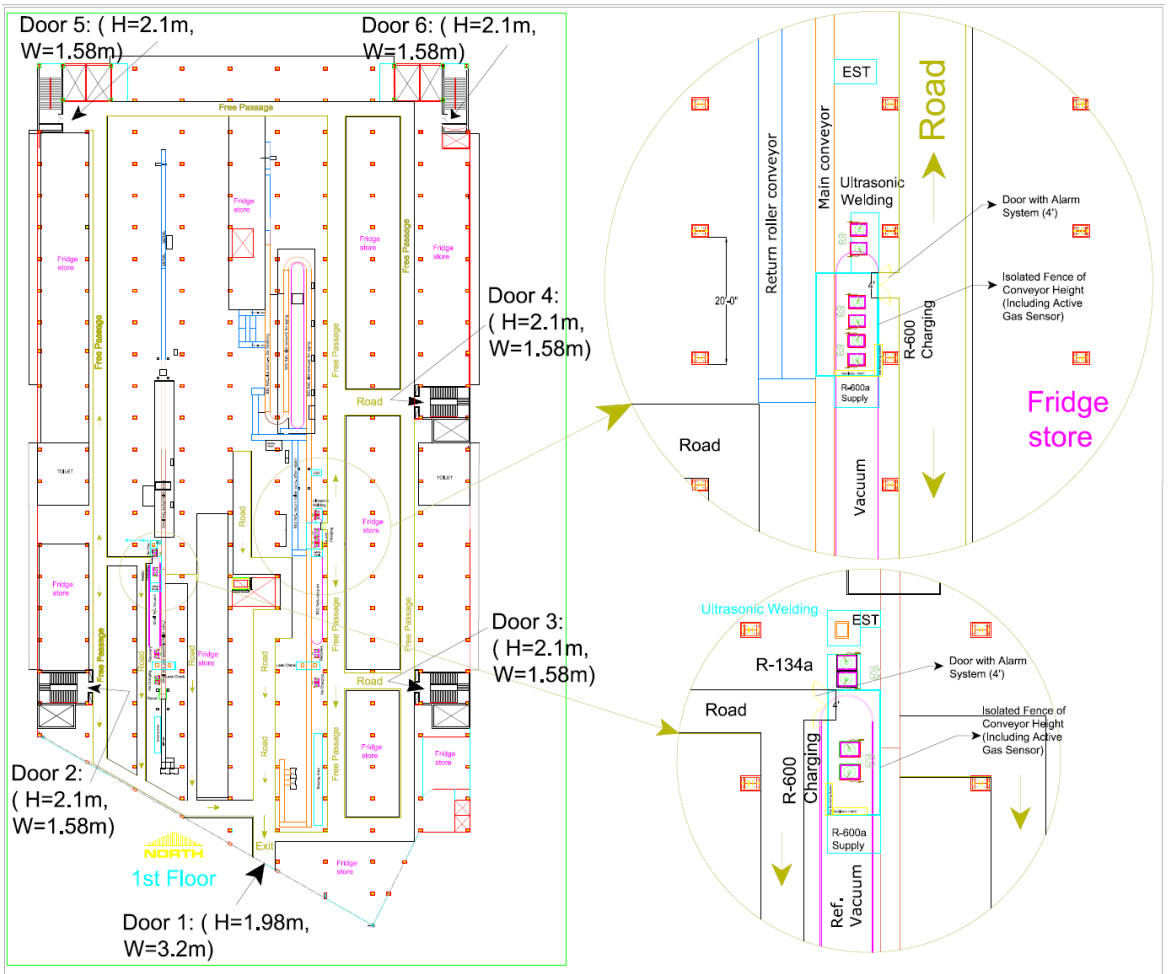


Fig: Fridge-4 Layout after Modification

Figure A1-3: Line – 4, Fridge 4 Layout

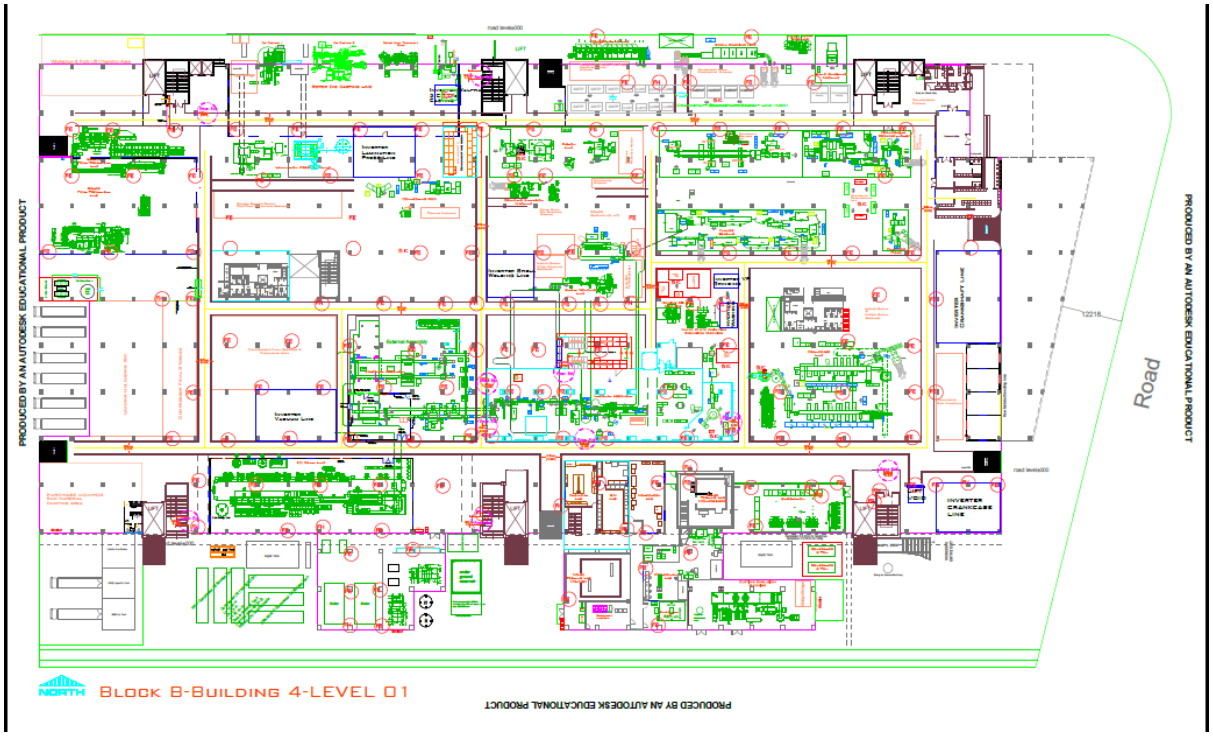
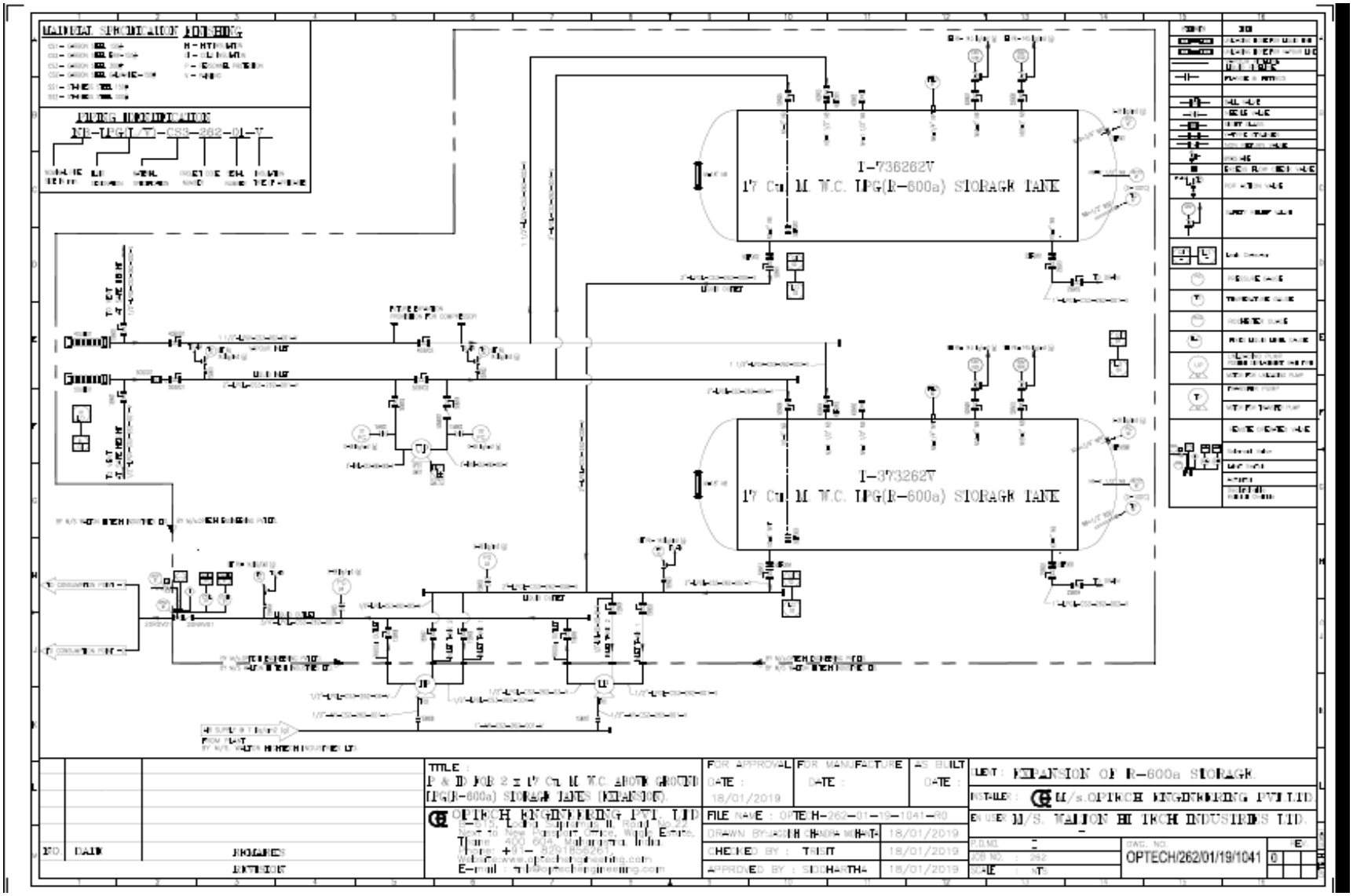


Figure A1-4: Compressor Plant Layout

Appendix-A2: P&ID Diagram of R600a Storage Tanks



Appendix-A3: Specifications, Approved Drawings and Inspection Certificate for Storage Tanks

OPTECH

TECHNICAL SPECIFICATION & DESIGN CALCULATIONS

17 KL X 2 NOS R 600 A TANK

A. 17 KL X 2 NOS ABOVEGROUND TYPE STORAGE TANK

R 600 A Storage Tank	Quantity 2Nos.
Storage Capacity	8.1 MT Each (85% filling at 0.56 Sp gravity)
Water capacity	17 m3
Design code	**PD5500**
Design approval	DNV/Mec Elec/TUV
Design pressure	14.50 Kg/cm2
Design Temperature	-6 Deg C to +55 Deg C
Hydro test pressure	19.5 Kg/cm2 g + Static Head
Corrosion allowance	1.5 mm
Radiography	100%
Third party Inspection	DNV/ SGS/TUV
Joint efficiency	1.0
Heat treatment	As per rule
Construction	Cylindrical horizontal shell with two nos. Hemispherical dished ends With One Manhole on shell and all Process Connections on top of the tank
Shell/ Dished ends	SA 516 Gr 70 or SA 537 Class 1
Supports	Bearing Pads
Nozzle neck	SA 516 Gr 70 or SA 537 Class 1
Manhole cover	SA 516 Gr 70 or SA 537 Class 1
Nuts	SA 320 Gr.L7 / SA 194 Gr 7
Studs	SA 320 Gr L7
Flanges	SA 350 LF 2
Pipes	SA 333 Gr.6
Couplings	SA 350 LF 2
Gasket	SS Spiral wound
CCOE Approval No	PV(M)/799 Dated 29.06.2010

B. PAINTING SYSTEM FOR THE TANK (EXTERNAL ONLY)

Surface Preparation	Sand Blasting to SA 2 ½ and 60 Micron Surface Preparation
Paint System	Zinc Silicate / Phosphate Primer 50 Microns of Berger Make
Application Method	High Bulid Epoxy Primer of Berger Make Manual by Brush

C. NOZZLES FOR EACH TANK AND ASSOCIATED SAFETY FITTINGS

Sr No.	Type of nozzle	Type, Size and Make of Associated Fittings
1	Safety Relief Valve 2"NB NB, 300#	2 Nos. Fitted with Top Discharge Type SRVs of Anil Make Valves Make and One Shut off Valve of Audco/Microfinish Make and Spool Pieces of 2m Height of 100NB.
2	Liquid Inlet 2" NB, 300#	1 Nos Fitted with SS 304 Sandwitch type EFCV of Anil Make and One Shut off Valve of Audco/Microfinish Make
3	Vapor In from Fill Point 11/2" NB, 300#	1 Nos Fitted with SS 304 Sandwitch type EFCV of Anil Make and One Shut off Valve of Audco/Microfinish Make
4	Vapor Out to consumption 11/2" NB, 300#	1 Nos Fitted with SS 304 Sandwitch type EFCV of Anil Make and One Shut off Valve of Audco/Microfinish Make
5	Liquid Outlet 2"NB, 300#	1 Nos Fitted with SS 304 Sandwitch type EFCV of Anil Make and One Shut off Valve of Audco/Microfinish Make
6	Drain 1" NB, 300#	1 Nos Fitted with SS 304 Sandwitch type EFCV of Anil Make and One Shut off Valve of Audco/Microfinish Make
7	Fixed Liquid Level Gauge ¼" NPT	1 Nos Fitted with Fixed liquid level gauge of Anil Make
8	Rochester Guage	1 Nos Dish end mounted Rochester Gauge USA
9	Pressure Gauge ¼"NPT	1 Nos Fitted with 0-42Kg/cm2, 4" Dial, Pressure Gauge of Tushar Make with a Brass EFCV of Anil Make with isolation needle valve.
10	Thermowell ½"NPT x 6"LG	1 Nos Fitted with Temperature Gauge of 0-100 Deg C, 4" Dial of Tushar Make
	ADDITIONAL FITTINGS	
11	Level Transmitter	1 Nos Fitted with Magneto restrictive Level Transmitter of Omntec USA/ Veeder Root/OPW Make with Remote Display for Volume and Temperature.

OPTECH

D. UNLOADING PUMP

Type	Positive Displacement, Vane Type
Make	Corken
Model	Z 2000
Body	Ductile Iron
Vane	Plastic
Rotor	SS 304
Seal	Double Mechanical Seal with Stellite-Graphite Ring
Flow Rate	250 LPM
By Pass	Internal Type
Motor	5HP, Flameproof , Squirrel Cage construction Of Make Crompton Greaves, Siemens or Kirloskar
DOL Starter	5HP, Flameproof to IS 2148
Pop action Valve	2 Nos, One each before and after the Pump
Isolating Valves	One Each before and after the Pump
Non Return Valve	One at the Pump discharge
Strainer and Sight Flow indicator	One each the pump suction

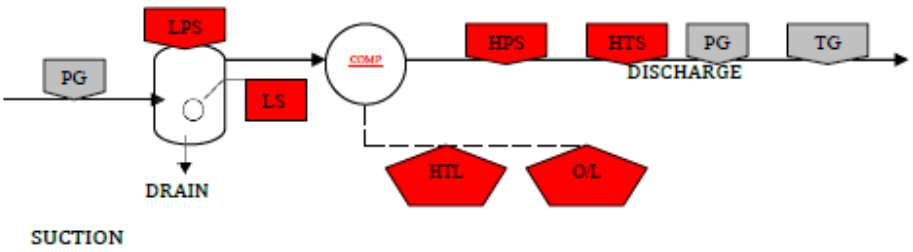
OPTECH

E. UNLOADING COMPRESSOR (OPTIONAL)

Quantity	1Nos
Make	Corken USA
Model	291
Type	Vertical, Non lubricating, with Inlet knock out drums.
Piston Displacement	At 300 rpm : 160 Lit/Min At 825 rpm : 440 Lit/Min
Max Pressure	24.14 bars
Drive	7.5 HP Flame proof, TEFC Squirrel cage Induction motor of Crompton Greaves/ Siemens Make.
Push Button Starter	7.5HP, Flameproof to IS 2148
Instrumentation:	
Measurements	Pressure at Suction and Discharge Temperature at Discharge
Filtration	11/2" Strainer at the Suction
Isolation Ball Valves	Four Nos, for interchanging the suction and discharge ports.

F. AUTOMATION FOR UNLOADING COMPRESSOR (OPTIONAL)

Safety Interlocks	High Tank Level (HTL) Overload Protection (O/L) High level at the suction drum (LS)



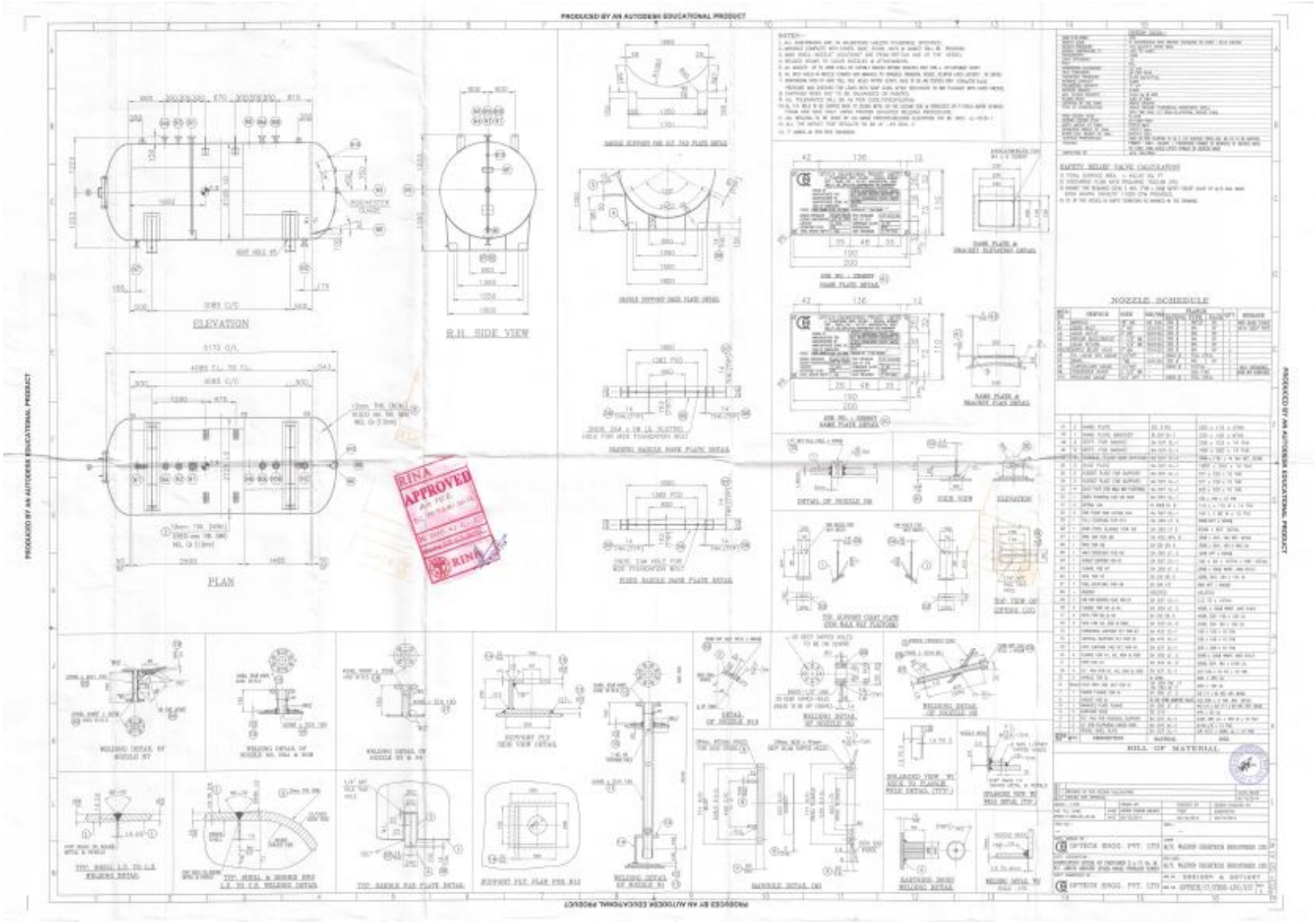
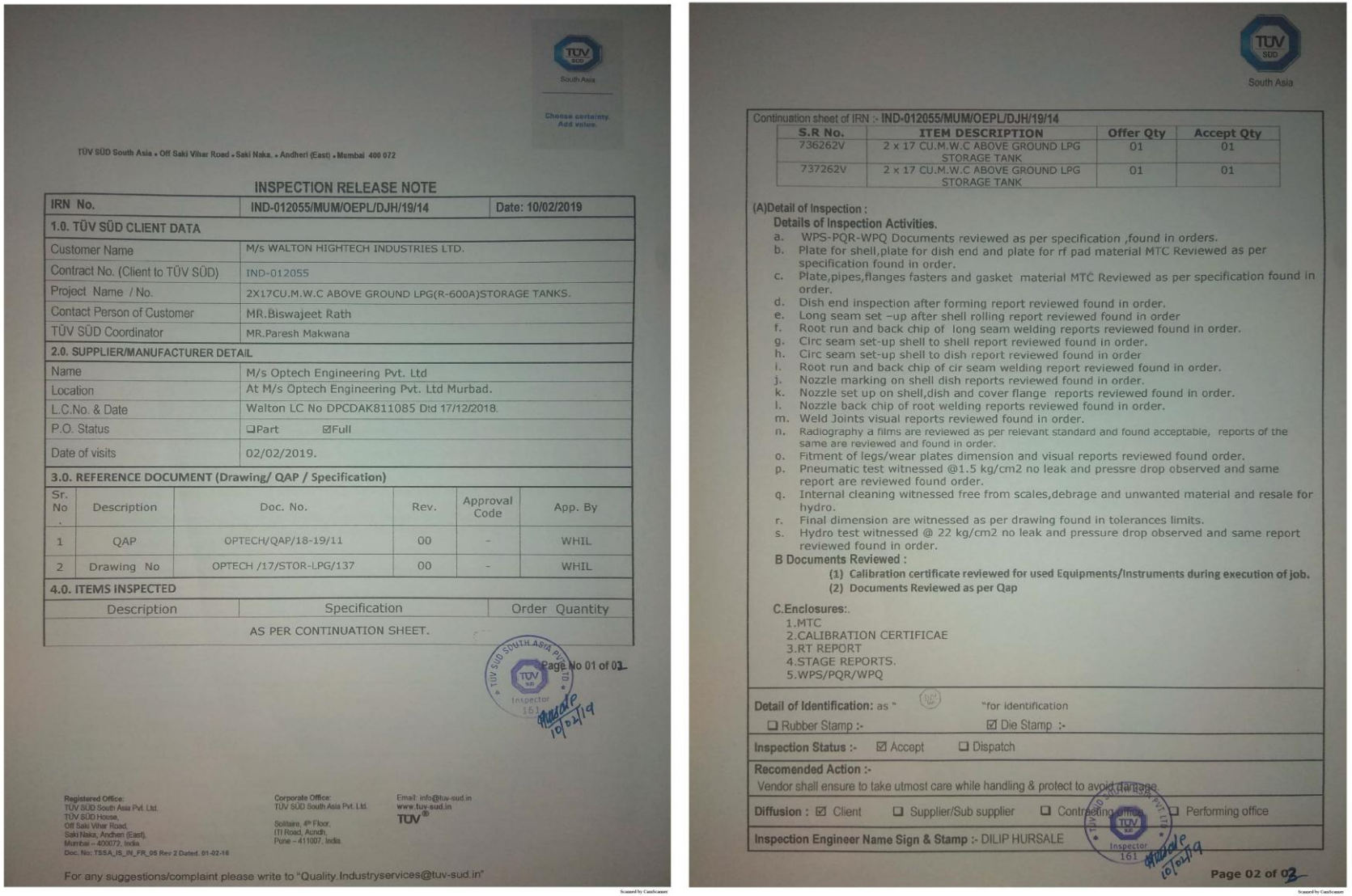


Figure A3-1: Tank Approval Drawing



TÜV SÜD South Asia • Off Saki Vihar Road • Saki Naka. • Andheri (East) • Mumbai 400 072

INSPECTION RELEASE NOTE

IRN No.	IND-012055/MUM/OEPL/DJH/19/14	Date: 10/02/2019
1.0. TÜV SÜD CLIENT DATA		
Customer Name	M/s WALTON HIGHTECH INDUSTRIES LTD.	
Contract No. (Client to TÜV SÜD)	IND-012055	
Project Name / No.	2X17CU.M.W.C ABOVE GROUND LPG(R-600A)STORAGE TANKS.	
Contact Person of Customer	MR.Biswajeet Rath	
TÜV SÜD Coordinator	MR.Paresh Makwana	
2.0. SUPPLIER/MANUFACTURER DETAIL		
Name	M/s Optech Engineering Pvt. Ltd	
Location	At M/s Optech Engineering Pvt. Ltd Murbad.	
L.C.No. & Date	Walton LC No DPCDAK811085 Did 17/12/2018.	
P.O. Status	❑Part ☑Full	
Date of visits	02/02/2019.	

3.0. REFERENCE DOCUMENT (Drawing/ QAP / Specification)

Sr. No.	Description	Doc. No.	Rev.	Approval Code	App. By
1	QAP	OPTECH/QAP/18-19/11	00	-	WHIL
2	Drawing No	OPTECH /17/STOR-LPG/137	00	-	WHIL

4.0. ITEMS INSPECTED

Description	Specification	Order Quantity
AS PER CONTINUATION SHEET.		

Page No 01 of 01

TUV SUD SOUTH ASIA PVT. LTD. TUV SUD Inspector 161 10/02/19

Registered Office: TÜV SÜD South Asia Pvt. Ltd. TÜV SÜD House, Off Saki Vihar Road, Saki Naka, Andheri (East), Mumbai – 400072, India. Doc. No: TSSA_IS_IN_FR_05 Rev 2 Dated. 01-02-16

Corporate Office: TÜV SÜD South Asia Pvt. Ltd. Solitaire, 4th Floor, ITI Road, Aundh, Pune – 411007, India.

Email: info@tuv-sud.in www.tuv-sud.in TÜV®

For any suggestions/complaint please write to "Quality.Industryservices@tuv-sud.in"

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TÜV SÜD South Asia

Continuation sheet of IRN :- **IND-012055/MUM/OEPL/DJH/19/14**

S.R No.	ITEM DESCRIPTION	Offer Qty	Accept Qty
736262V	2 x 17 CU.M.W.C ABOVE GROUND LPG STORAGE TANK	01	01
737262V	2 x 17 CU.M.W.C ABOVE GROUND LPG STORAGE TANK	01	01

(A)Detail of Inspection :

Details of Inspection Activities.

a. WPS-PQR-WPQ Documents reviewed as per specification ,found in orders.
b. Plate for shell,plate for dish end and plate for rf pad material MTC Reviewed as per specification found in order.
c. Plate,pipes,flanges fasters and gasket material MTC Reviewed as per specification found in order.
d. Dish end inspection after forming report reviewed found in order.
e. Long seam set –up after shell rolling report reviewed found in order
f. Root run and back chip of long seam welding reports reviewed found in order.
g. Circ seam set-up shell to shell report reviewed found in order.
h. Circ seam set-up shell to dish report reviewed found in order
i. Root run and back chip of cir seam welding report reviewed found in order.
j. Nozzle marking on shell dish reports reviewed found in order.
k. Nozzle set up on shell,dish and cover flange reports reviewed found in order.
l. Nozzle back chip of root welding reports reviewed found in order.
m. Weld Joints visual reports reviewed found in order.
n. Radiography a films are reviewed as per relevant standard and found acceptable, reports of the same are reviewed and found in order.
o. Fitment of legs/wear plates dimension and visual reports reviewed found order.
p. Pneumatic test witnessed @1.5 kg/cm2 no leak and pressre drop observed and same report are reviewed found order.
q. Internal cleaning witnessed free from scales,debrage and unwanted material and resale for hydro.
r. Final dimension are witnessed as per drawing found in tolerances limits.
s. Hydro test witnessed @ 22 kg/cm2 no leak and pressure drop observed and same report reviewed found in order.

B Documents Reviewed :

(1) Calibration certificate reviewed for used Equipments/Instruments during execution of job.
(2) Documents Reviewed as per Qap

C.Enclosures:.

1.MTC
2.CALIBRATION CERTIFICAE
3.RT REPORT
4.STAGE REPORTS.
5.WPS/PQR/WPQ

Detail of Identification: as " "for identification
❑ Rubber Stamp :- ☑ Die Stamp :-

Inspection Status :- ☑ Accept ❑ Dispatch

Recomended Action :-
Vendor shall ensure to take utmost care while handling & protect to avoid damage.

Diffusion : ☑ Client ❑ Supplier/Sub supplier ❑ Contracting office ❑ Performing office

Inspection Engineer Name Sign & Stamp :- DILIP HURSALE

TUV SUD SOUTH ASIA PVT. LTD. TUV SUD Inspector 161 10/02/19

Page 02 of 02

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Figure A3-2: Tank TUV certificates

Appendix-B: MSDS of R600a (Iso-Butane) and Chemicals Used in Compressor Plan

NATIONAL REFRIGERANTS, INC.

R-600a

Safety Data Sheet

R-600a ISOBUTANE

1. CHEMICAL PRODUCT AND COMPANY IDENTIFICATION

PRODUCT NAME: ISOBUTANE
OTHER NAME: 2-methylpropane
USE: Refrigerant Gas
DISTRIBUTOR: National Refrigerants, Inc.
661 Kenyon Avenue
Bridgeton, New Jersey08302

FOR MORE INFORMATION CALL:
(Monday-Friday, 8:00am-5:00pm)
1-800-262-0012

IN CASE OF TRANSPORTATION EMERGENCY CALL:
CHEMTREC: 1-800-424-9300

EMERGENCY OVERVIEW:
Flammable gas. Liquid under high pressure.

2. HAZARDS IDENTIFICATION

CLASSIFICATION: **Flammable Gas, Gas under pressure, Compressed Gas**
SIGNAL WORD: **DANGER**
HAZARD STATEMENT(S): **Extremely flammable gas, Contains gas under pressure, may explode if heated**
SYMBOL(S): **Flames, Gas Cylinder**

PRECAUTIONARY STATEMENT(S):

Prevention: Keep away from heat, sparks, open flame, and hot surfaces. No Smoking
Response: Leaking gas fire: Do not extinguish unless leak can be stopped immediately. Eliminate all ignition sources if safe to do so.
Storage: Protect from sunlight, store in a well ventilated place.

EMERGENCY OVERVIEW:
Flammable gas. Liquid under high pressure.

POTENTIAL HEALTH EFFECTS
Effects of Overexposure:

Eye Contact
Liquid can cause severe irritation, redness, tearing, blurred vision, and possible freeze burns.

Skin Contact
Contact with evaporating liquid can cause frostbite.

Inhalation

Inhalation of vapor may produce anesthetic effects and feeling of euphoria. Prolonged overexposure can cause rapid breathing, headache, dizziness, narcosis, unconsciousness, and death from asphyxiation, depending on concentration and time of exposure.

Ingestion

Aspiration Hazard!

3. COMPOSITION / INFORMATION ON INGREDIENTS

INGREDIENT NAME	CAS NUMBER	WEIGHT
Liquefied Petroleum Gas	75-28-5	100

COMMON NAMES and SYNONYMS

Isobutane; R-600a

There are no impurities or stabilizers that contribute to the classification of the material identified in Section 2

4. FIRST AID MEASURES

SKIN:

For liquid contact, warm areas gradually and get medical attention if there is evidence of tissue damage. Flush area with plenty of water.

EYES:

For liquid contact, irrigate with running water for minimum of 15 minutes. Consult physician immediately if frostbite occurs.

INHALATION:

Remove to fresh air. If breathing has stopped, restore breathing at once. Administer oxygen and get medical help.

INGESTION:

Do not induce vomiting. Contact a physician immediately.

ADVICE TO PHYSICIAN: No special instructions

5. FIRE FIGHTING MEASURES

FLAMMABLE PROPERTIES

FLASH POINT (METHOD):	-117 F (Open Cup)
UPPER EXPLOSIVE LIMIT (vol.) gas in air):	8.4%
LOWER EXPLOSIVE LIMIT (vol.) gas in air):	1.8%
EXTINGUISHING MEDIA:	Dry Chemical Extinguisher (B-C), Water

UNUSUAL FIRE HAZARDS:

Vapors are heavier than air and may travel along the ground or may be moved by ventilation systems and ignited by pilot lights, other flames, sparks, heaters, smoking, electric motors, static discharge, or other ignition sources at locations distant from material handling point.

FIRE FIGHTING PROCEDURES:

Stop the release of materials if possible. Cool the vapor space of the storage container with water spray. Avoid accumulation of unburned materials. Remove personnel in general area. Observe maximum isolation when extinguishing fire. Expansion of liquid and change of state from liquid to vapor will allow combustible mixture to encompass a large area.

6. ACCIDENTAL RELEASE MEASURES

STEPS TO BE TAKEN IF MATERIAL IS RELEASED OR SPILLED:

Avoid sources of ignition-Ventilate area. Use water fog to evaporate or ventilate. Protect body against contact with liquid. If confined space – Use self-contained breathing apparatus. Consult local fire authorities.

7. HANDLING AND STORAGE

NORMAL HANDLING:

Comply with state and local regulations covering liquefied petroleum gases. Comply with NFPA Pamphlet #58.

STORAGE RECCOMENDATIONS:

Store small containers in well-ventilated areas, away from heat or sources of ignition. Prohibit smoking in areas of storage or use.

8. EXPOSURE CONTROLS / PERSONAL PROTECTION

VENTILATION

Mechanical: Provide as needed to keep concentration in air below TLV and LEL
Local Exhaust: Continuous ventilation recommended
Special: Explosion proof fans and motors

SKIN PROTECTION:

Impervious, insulated gloves recommended. Impervious clothing for prolonged or repeated contact

EYE PROTECTION:

Face shield or goggles recommended

RESPIRATORY PROTECTION:

NIOSH approved self-contained breathing apparatus in confined areas

EXPOSURE GUIDELINES

(Exposure Limits)

INGREDIENT NAME	ACGIH TLV	OSHA PEL	OTHER LIMIT
Liquefied Petroleum Gas		1000 ppm	

9. PHYSICAL AND CHEMICAL PROPERTIES

APPEARANCE:	Clear, colorless liquefied gas
PHYSICAL STATE:	Gas at ambient temperature
ODOR:	Sweet petroleum odor
SOLUBILITY IN WATER @ 70 Deg. F	0.008%
BOILING RANGE:	10.9˚F

VAPOR PRESSURE @ 70 Deg. F:	31 psig
FLASH POINT:	-85˚C (-18˚F)
EVAPORATION RATE:	> 1 (Ethyl Ether = 1.0)
FLAMMABILITY:	Extremely flammable in the presence of ignition sources or oxidizing materials
LEL/UEL:	1.8% / 8.4%
PARTITION COEFFICIENT n-OCTANOL/WATER:	Log Pow: 2.8
AUTO IGNITION TEMPERATURE:	460˚C / 860˚F
DECOMPOSITION TEMPERATURE:	Data not available
VISCOSITY:	Not applicable
VAPOR DENSITY (air = 1.00):	2.006
% VOLATILES BY VOLUME:	100%
DENSITY:	gas 0.5572 lb / cu ft
pH:	Not applicable
MELTING POINT:	-160˚C / -256˚F
SPECIFIC GRAVITY (H2O=1.00):	0.564
MOLECULAR FORMULA:	C_4H_{10}
MOLECULAR WEIGHT:	58.14

10. STABILITY AND REACTIVITY

CHEMICAL STABILITY:
This product is stable

REACTIVITY: Not reactive under normal conditions.

INCOMPATIBILITY WITH OTHER MATERIALS:
None

CONDITIONS TO AVOID:
High Heat, Sparks & Open Flames

11. TOXICOLOGICAL INFORMATION

Rat inhalation LC50 (4 hr.): 658,000ppm

POTENTIAL HEALTH EFFECTS

Effects of Overexposure:

Eye Contact
Eye contact with the rapidly evaporation liquid may cause frostbite.

Skin Contact
Skin contact with the rapidly evaporation liquid may cause frostbite. Frostbite effects are a change in color of the skin to gray or white, followed by blistering.

Inhalation
Vapor is heavier than air and can cause suffocation by reducing oxygen available for breathing. Inhalation of high vapor concentration may cause dizziness, disorientation, incoordination, narcosis, nausea or vomiting, leading to unconsciousness, cardiac irregularities, or death.

Ingestion
Not an expected route of exposure.

DELAYED AND IMMEDIATE EFFECTS

No known significant effects or critical hazards

CARCINOGEN: Not listed by NTP, IARC, or NIOSH

12. ECOLOGICAL INFORMATION

DEGRADABILITY (BOD):
No data given

13. DISPOSAL CONSIDERATIONS

(1) Mechanical recovery
(2) Flare-Off at safe location (Vapors)
(3) Exhaust to atmosphere in safe location (No open flames)

OTHER DISPOSAL CONSIDERATIONS:
Disposal must comply with federal, state, and local disposal laws.

14. TRANSPORT INFORMATION

US DOT ID NUMBER:	UN 1969
US DOT SHIPPING NAME:	Isobutane
US DOT HAZARD CLASS:	2.1
US PDOT PACKING GROUP:	NA

15. REGULATORY INFORMATION

The ingredients listed in section 2 are reported/included in the U.S. TSCA inventory and Canadian domestics substance list.

The product is defined by OSHA in 29 CFR 1910.1200c as a flammable gas. Use of this product may require compliance with 29 CFR 1910.119, process safety management of highly hazardous chemicals.

CALIFORNIA PROPOSITION 65:
The ingredients in this product do not contain any chemicals known to State of California to cause cancer, birth defects, or any other reproductive harm**.**

16. OTHER INFORMATION

OTHER INFORMATION: HMIS Classification: Health – 1, Flammability – 4, Reactivity – 0

DISCLAIMER:

National Refrigerants, Inc. believes that the information and recommendations contained herein (including data and statements) are accurate as of the date hereof. NO WARRANTY OF FITNESS FOR ANY PARTICULAR PURPOSE, WARRANTY OF MERCHANTABILITY, OR ANY OTHER WARRANTY, EXPRESSED OR IMPLIED, IS MADE CONCERNING THE

INFORMATION PROVIDED HEREIN. The information provided herein relates only to the specific product designated and may not be valid where such product is used in combination with any other methods of use of the product and of the information referred to herein are beyond the control of National Refrigerants. National Refrigerants expressly disclaims any and all liability as to any results obtained or arising from any use of the product or reliance on such information.

Safety Data Sheet according to GHS

Revision Date : 08/09/2014

Version : 04

Date of printing : 08/09/2014

1. Identification of the substance/preparation and company

Trade name

TONER SD 530-1

Use of the substance/preparation.

Industry sector : Pretreatment

Type of use : Additive

Identification of the company

Nippon paint (Thailand) Co.,Ltd.
700/29, 31 Moo 6, T.Nongmaidaeng,
A.Muang, Chonburi 20000.
Tel : (038) 213701-5 , (038) 214150-6
Fax :(038) 213706

Information about the substance/preparation

Nippon paint (Thailand) Co.,Ltd.
Pretreatment Technic & Technical Service Department Tel : (038) 213701-5 , (038) 214150-6

Emergency telephone number :

(038) 213701-5 Ext.191

2. Hazard identification

Classification of the substance or mixture

Oxidizing liquids	Category.3
Acute toxicity: Inhalation	Category.1
Acute toxicity: Oral	Category.3
Target organ systemic toxicity - single exposure	Category.2
Target organ systemic toxicity - repeated exposure	Category.2
Aquatic toxicity - acute	Category.1
Aquatic toxicity - chronic	Category.1

GHS label elements, including precautionary statements

Flame over circle

Skull and crossbones

Health Hazard

Environment

Pigtogram/Hazard symbols

Signal word

Danger

Hazard statements

May intensify fire; oxidizer

Fatal if inhaled

May be harmful if swallowed

May cause damage to organs

May cause damage to organs through prolonged or repeated exposure

Very toxic to aquatic life

Very toxic to aquatic life with long lasting effects

Other hazards which do not result in classification

None

3. Composition/information on ingredients

Chemical characterization

Oxidizing Solution

Hazardous ingredients

Component	CAS number	Concentration (%)
SODIUM NITRITE	7632-00-0	30 - 40

4. First aid measures

After inhalation

If inhaled, remove to fresh air. If not breathing give artificial respiration. If breathing is difficult give Oxygen. Get medical aid immediately.

After contact with skin

Incase of contact, immediately flush skin with plenty of water for atleast 15 minutes while removing contaminated clothing and shoes. Get medical aid immediately. Wash clothing before reuse.

After contact with eyes

Incase of contact, immediately flush eyes with plenty of water for atleast 15 minutes. Get medical aid immediately.

After ingestion

Call physician immediately.

Notes to Physicians:

Absorption of Sodium nitrite into the body leads to the formation of methemoglobin which, in sufficient concentration, causes cyanosis. Since reversion of methemoglobin to hemoglobin occurs spontaneously after termination of exposure, moderate degrees of cyanosis need to be treated only by supportive measures such as bed rest and oxygen inhalation. Thorough cleansing of the entire contaminated area of the body including scalp and nails is of utmost importance. Cyanocobalamin (Vitamin B-12), 1 mg intramuscularly, will speed recovery. Intravenous fluids and blood transfusions may be indicated in very severe exposures.

5. Fire-fighting measures

Unusual Fire and Explosion Hazards :

Is not combustible but being a strong oxidizer, its contact with oxidizing agents may cause a violent explosion. It may explode on contact with cyanides, ammonium salts, cellulose, lithium, potassium plus ammonia, and sodium thiosulfate. Sodium Nitrite also explodes on heating above 538℃ (1000 ℉).

Extinguishing Media :

Use water spray or foam. Avoid use of multi-purpose dry chemical fire extinguishers.

NFPA Rating :

Health: 2; Flammability: 0; Reactivity: 1

Special Information :

Fire fighters should wear a full protective gear, with a self-contained breathing apparatus with full face piece operated in positive pressure mode.

6. Accidental release measures

General Information:

Remove all sources of ignition. Ventilate area of leak or spill. Utilize recommended protective clothing and equipment as specified in section 8.

Spills:

Clean the spill in a manner that does not disperse dust into the air. Use non-sparking tool and equipment. Spill area can be washed with water. Collect wash water for approved disposal. Water disposal should be in accordance with existing federal, state and local environmental regulations.

7. Handling and storage

Handling :

Wash thoroughly after handling. Do not ingest or inhale. Do not get in eyes, on skin or on clothing.

Storage :

Store in a dry, well-ventilated and cool area away from incompatible substances (refer section 10).

Keep container tightly closed.

8. Exposure controls/personal protection

Engineering Controls:

Facilities storing or utilizing the material should be equipped with an eyewash facility and a safety shower. Use adequate general or local exhaust ventilation to prevent contact with vapors or dust from dried down product.

Personal Protective Equipment

Eyes : Chemical safety goggles or eyeglasses. Maintain eye wash fountain and quick-drench facilities in work area.

Skin : Uniform, apron and Rubber gloves.

Ventilation : Approved respirators should be used if airborne concentration exceeds recommended limit.

9. Physical and chemical properties

Form :	Liquid
Colour :	Yellowish Liquid
pH value :	N/A
Melting point :	N/A
Boiling point :	N/A
Flash point :	N/A
Evaporation rate :	N/A
Lower explosion limit :	N/A
Upper explosion limit :	N/A
Vapour pressure :	N/A
Density :	1.290 - 1.330
Solubility in water :	Soluble in water
Partition coefficient; n-octanol / water :	N/A

10. Stability and reactivity

Chemical stability:

Stable.

Incompatibilities:

is incompatible with many substances including reducing agents, ammonium salts, organic matter,

cyanides, thiosulphates, cellulose, lithium, potassium plus ammonia, amines and amides.

Conditions to avoid:

Heat, ignition sources, flame, shock, friction sand incompatibilities.

Hazardous Decomposition Products:

May form Oxides of Nitrogen.

Hazardous Polymerization:

Will not occur.

11. Toxicological information

SKIN AND EYE IRRITATION DATA:

Effect : Mild Behavioral: Change in motor activity (specific assay)

ACUTE TOXICITY DATA:

Effect : Vascular: Regional or general arteriolar or venous dilation Gastrointestinal: Nausea or vomiting Behavioral: Coma

12. Ecological information

Environmental Fate: No Information available

Ecotoxicity:

LC50

0.19 mg/L, 96 hours, Rainbow Trout (Juvenile)

43.6 mg/L, 24 hours, Water Flea

20 mg/L, 96 hours, Fathead Minnow

13. Disposal considerations

Disposal should be done in accordance with local, state and federal regulations.

14. Transport information

UN regulation

Proper Shipping Name :	Toxic liquid, inorganic, n.o.s.
Class:	6.1
Packing group:	III
UN/ID number:	3287
Primary risk:	6.1 / III
Secondary risk:	-
Remarks	None

15. Regulatory information

Safety, health and environmental regulations specific for the product in question

Thai regulations

The product is classified and labelled in accordance with GHS adopted by Thai authority.

Restriction of occupation

None

16. Other information

This information contained in this data sheet represents the best information currently available to us.

However, no warranty is made with respect to its completeness and we assume no liability resulting us from its.

It is advised to make their own tests to determinate the safety and suitability of each such product or combination for their own.

Ensure this material in compliance with federal requirements and ensure conformity to local regulations.

The product should not be used for purposes other than shown in the material safety data sheet without first obtaining written advice.

ABBREVIATIONS :

not est. = not established

N/ A = not applicable

U / I = unknown information

Safety Data Sheet according to GHS

Revision Date : 08/12/2014

Version : 04

Date of printing : 08/12/2014

1. Identification of the substance/preparation and company

Trade name

SURFDINE SD 5350 R-5

Use of the substance/preparation.

Industry sector : Pretreatment

Type of use : Zinc phosphate Coating

Identification of the company

Nippon paint (Thailand) Co.,Ltd.
700/29, 31 Moo 6, T.Nongmaidaeng,
A.Muang, Chonburi 20000.
Tel : (038) 213701-5 , (038) 214150-6
Fax :(038) 213706

Information about the substance/preparation

Nippon paint (Thailand) Co.,Ltd.
Pretreatment Technic & Technical Service Department Tel : (038) 213701-5 , (038) 214150-6

Emergency telephone number :

038-213701-5 Ext.191

2. Hazard identification

Classification of the substance or mixture

Corrosive to metals	Category.1
Serious eye damage / eye irritation	Category.1
Skin corrosion / irritation	Category.1
Target organ systemic toxicity - repeated exposure	Category.1
Acute toxicity: Oral	Category.5

GHS label elements, including precautionary statements

Corrosion

Health Hazard

Pigtogram/Hazard symbols

Signal word

Danger

Hazard statements

May be corrosive to metals

Causes serious eye damage

Causes skin irritation

Causes damage to organs through prolonged or repeated exposure

May be harmful if swallowed

Other hazards which do not result in classification

None

3. Composition/information on ingredients

Chemical characterization

Phosphate Solution

Hazardous ingredients

Component	CAS number	Concentration (%)
PHOSPHORIC ACID	7664-38-2	30 - 40
NITRIC ACID	7697-37-2	1 - 5
HYDROFLUOROSILICIC ACID	16961-83-4	0.5 - 1.0
HYDROFLUORIC ACID	7664-39-3	0.1 - 0.5
ZINC OXIDE	1314-13-2	10 - 15
NICKEL CARBONATE	3333-67-3	1 - 5
MANGANESE CARBONATE	598-62-9	1 - 5

4. First aid measures

Inhalation :

If inhaled, remove to fresh air.

If not breathing, give artificial respiration.

If breathing is difficult, give oxygen.

Get medical attention immediately.

Skin contact :

In case of contact, immediately wash skin with plenty of water for at least 15 minutes while removing contaminated clothing and shoes

Eye contact :

In case of contact, immediately flush eyes with plenty of water for at least 15 minutes.

Ingestion :

If swallowed, do not induce vomiting unless directed to do so by medical personnel.

Never give anything by mouth to an unconscious person.

Get medical attention immediately.

5. Fire-fighting measures

Suitable fire-extinguishing media :

Water fog, co2, foam, dry chemical, dry sand.

Note : Fire will produce dense black smoke.

Decomposition products may be hazardous to health.

Avoid exposure and use breathing apparatus as appropriate.

Cool closed containers exposed to fire by spraying then with water.

Do not allow run off water and contaminants from fighting to enter drains or watercourses.

See section 10.

6. Accidental release measures

Avoid all sources of ignition(e.g. naked lights, unprotected light bulbs, electric handtools).

Ventilate the area and avoid breathing vapor.

Wear protective clothing and self-contained breathing apparatus when dealing with spillage or fire.

Collect spillage, whereprateicable, for safe disposal.

Should be disposed of wastes and empty container in accordance with regulations made under the control of pollution acts and the environmental protection acts.

Keep away from drains, surface- and ground-water and soil.

Use personal protection equipment.

Absorb and/or contain spill with inertmaterial (sand, vermiculite), then place in suitable container.

For large spills : Neutralize spill area with(soda ash or lime, diluted acetic acid).

Flush spill area with water spray : Prevent run off fron entering water way or sewers.

Refer to headings 8 and 13.

7. Handling and storage

Handling :

Keep away from heat, spark, and flame.

Keep container closed.

Do not breath (dust, vapor, mist, gas).

Use only with ventilation.

Do not get in eyes, on skin, or on clothing.

Wash thoroughly after handling.

Use only with adequate ventilation.

Avoid prolonged or repeated contact with skin.

Do not take internally.

Do not taste or swallow.

Avoid breathing (dust, vapor, mist, gas).

Protection as show in section. 8

Storage :

Store bellow 40 deg.C. (104 deg.F.) and above 5 deg.C. (41 deg.F.).

Keep container closed.

Avoid prolonged or repeated contact with skin and inhalation.

Separate fron bases.

Keep locked up.

Do not take internally.

Do not taste or swallow.

8. Exposure controls/personal protection

Engineering Measures :

Provide adequate ventilation.

An eyes wash facility should be readily available.

Facilities storing or utilizing this material should be equipped with an eyes wash facility and a safety shower.

Exposure Limit :

Ingredient name	ACGIH TLV(TWA)	OSHA TLV(TWA)
ZINC OXIDE	not est.	not est.
NICKEL CARBONATE	0.1(Ni)mg/m3	not est.
MANGANESE CARBONATE	0.05(Mn)mg/m3	not est.
PHOSPHORIC ACID	1mg/m3	not est.

Personal protection :

Respiratory protection : Wear appropriate equipment.

Hand protection : Wear impervious gloves.

Eye protection : Wear chemical splash goggles and face shield when eye and face contact is possible due to splashing or spraying of material

Skin protection : Wear chemicalresistant clothing such as gloves, apron, boots, or whole bodysuits made from neoprene as appropriate.

Environmental exposure control :

Do not let this product enter the environment.

9. Physical and chemical properties

Form :	Liquid
Colour :	Clear Liquid ,Green
pH value :	N/A
Melting point :	N/A
Boiling point :	N/A
Flash point :	N/A
Evaporation rate :	N/A
Lower explosion limit :	N/A
Upper explosion limit :	N/A
Vapour pressure :	N/A
Density :	1.51 - 1.55
Solubility in water :	Miscible in water
Partition coefficient; n-octanol / water :	N/A

10. Stability and reactivity

Stability :

Stable under recommended storage and handling conditions (see section.7)

Hazardous reaction :

Hazardous reaction will not occur.

Condition to Avoid :

Avoid heating temperatures above 40 deg C.

Upon heating, toxic chemicals are formed.

Materials to Avoid :

The substance is strong acid, it react violently with bases.

Avoid to contact with alkali meal, iron, lead, zinc.

Hazardous decomposition products :

The product decomposed on heating producing hydrogen fluoride, phosphide, nitrogen oxide etc.

11. Toxicological information

PHOSPHORIC ACID

LD50(oral) = 1,250 mg/kg.

ZINC OXIDE

LD50(oral) = 1,400 mg/kg.

NITRIC ACID

LD50(oral) = 430 mg/kg.

Target organ systemic toxicity.

Target organ systemic toxicity - repeated exposure

Remarks

None

12. Ecological information

For spills or waste, take care to aviod contaminate contaminating environment. Prevent spills and wastewater from entering sewers, water courses or law areas to avoid pollution.

13. Disposal considerations

The product should not be allowed to inter drains and watercourses. All notification, clean-up and disposal should be carried out in accordance with federal, Sate and Local regulations. Preferred method of waste disposal are incineration or biological treatment in federal/state approved facility. Wastes and empty containers should be disposed of in accordance with regulations made under the control of pollution acts and the environmental protection acts. Empty containers should be recycled or disposed of through an approved waste management facility. Product may be hazardous to environment.

14. Transport information

UN regulation

Proper Shipping Name :	Corrosive liquid, acidic, inorganic, n.o.s.
Class:	8
Packing group:	II
UN/ID number:	3264
Primary risk:	8 / II
Secondary risk:	-
Remarks	None

15. Regulatory information

Safety, health and environmental regulations specific for the product in question

Thai regulations

The product is classified and labelled in accordance with GHS adopted by Thai authority.

Restriction of occupation

None

16. Other information

This information contained in this data sheet represents the best information currently available to us. However, no warranty is made with respect to its completeness and we assume no liability resulting us from its.It is advised to make their own tests to determinate the safety and suitability of each such product or combination for their own. Ensure this material in compliance with federal requirements and ensure conformity to local regulations. The product should not be used for purposes other than shown in the material safety data sheet without first obtaining written advice.

ABBREVIATIONS :

not est. = not established

N/ A = not applicable

U / I = unknown information

Safety Data Sheet according to GHS

Version : 000

Revision Date : 7/09/2016
Date of printing : 7/09/2016

1. Identification of the substance/preparation and company

Trade name

POWERNICS EXCEL 1210 F-2 (L)

Use of the substance/preparation.

Industry sector : CED Coating

Type of use : Waterborne epoxy resin

Identification of the company

Nippon paint (Thailand) Co.,Ltd.
700/29, 31 Moo 6, T.Nongmaidaeng,
A.Muang, Chonburi 20000.
Tel : (038) 213701-5 , (038) 214150-6
Fax :(038) 213706

Information about the substance/preparation

Nippon paint (Thailand) Co.,Ltd.
Technic CED coating Department Tel : (038) 213701-5 # 375,
(038) 214150-6 # 375

Emergency telephone number :

Tel : (038) 213701-5 # 191

2. Hazard identification

GHS Classification of the substance or mixture

Eye damage/ irritation

Skin corrosion/irritation

Sensitization - respiratory

Carcinogenicity

Toxic to reproduction

Specific target organ toxicity

Hazardous to the aquatic environment- acute hazard

Hazardous to the aquatic environment- long-term hazard

GHS label elements, including precautionary statements

Health Hazard

Exclamation Mark

Pictogram/Hazard symbols

Signal word

Warning

Hazard statements

Harmful in contact with skin

Harmful if swallowed

May be harmful if inhaled

Causes mild skin irritation

Causes serious eye irritation

May cause allergy or asthma symptoms or breathing difficulties if inhaled

May cause an allergic skin reaction

Suspected of causing cancer

Suspected of damaging fertility or the unborn child

Causes damage to organs through prolonged or repeated exposure

Harmful to aquatic life

Harmful to aquatic life with long lasting effects

3. Composition/information on ingredients

Chemical characterization

Waterborne Epoxy resin

Hazardous ingredients

Component	CAS number	Concentration [%]
WATER	7732-18-5	55 - 65
EPOXY RESIN	Proprietary	25 - 32
POLYURETHANE RESIN	Proprietary	8 - 15
ETHYLENE GLYCOL BUTYL ETHER	111-76-2	0.1 - 0.8
PROPYLENE GLYCOL PHENYL ETHER	770-35-4	0.05 - 0.3
2-HEXYLOXYETHANOL	112-25-4	0.07 - 0.6
ETHANOL 1,2-((2-HEXYLOXY)ETHOXY)	112-59-4	0.3 - 1.5
ADDITIVE (S)	Proprietary	0.01 - 0.08

Notes: *,+,@ = Carcinogenic according to criteria established by (*=NTP +=IARC @=OSHA)

$=Significant New Uses of Chemical Substances (SNUR). Section 721, Subpart E--Significant New Uses for Specific Chemical Substances.

$1=SNUR(70 FR 71401-6, Nov. 29, 2005) This SNUR regulation is applicable only when the substance is for domestic use in a consumer product.

4. First aid measures

Inhalation : If inhaled, remove to fresh air.

Skin exposure : In case of contact, immediately wash skin soap and plenty of water.

Eye exposure : In case of contact, immediately flush eyes with plenty of water for at least 15 minutes.

Ingestion : If swallowed, do NOT induce vomiting unless directed to do so by medical personnel. Get medical attention immediately.

5. Fire-fighting measures

suitable fire-extinguishing media

[OK]water fog, [OK]CO2, [OK]foam, [OK]dry chemicals, [OK]dry sand.

Note:

Fire will produce dense black smoke.

Decomposition products may be hazardous to health.

Avoid exposure and use breathing apparatus as appropriate.

Cool closed containers exposed to fire by spraying them with water.

Do not allow run off water and contaminants from fire fighting to enter drains or watercourses.

See section 10.

6. Accidental release measures

Avoid all sources of ignition(e.g.naked lights, unprotected light bulbs,electric hand tools).

Ventilate the area and avoid breathing vapors.

Wear protective clothing and self-contained breathing apparatus when dealing with spillage or fire.

Collect spillage ,where practicable ,for safe disposal.

Should be disposed of waste and empty containers in accordance with regulation made under the control of pollution acts and the environmental protection acts.

Keep away from drains, surface-and ground-water and soil.

Use personal protection equipment.

Absorb and/or contain spill with inertmaterial,(sand,vermiculite),then place in suitable container.

For large spills: Neutralize spill area with (soda ash or lime, diluted acetic acid).

Flush spill area with water spray :Prevent run off from entering water way or sewers.

Refer to headings 8 and 13.

7. Handling and storage

Handling :

Keep away from heat, sparks and flame.
Keep container closed.

Use with adequate ventilation.

Do not get in eyes, on skin, or on clothing.

Avoid prolonged or repeated contact with skin.

Wash thoroughly after handling.

Protection as shown in section 8.

Storage :

Avoid prolonged or repeated contact with skin.
Keep container closed.

Store in a well ventilated, dark and cool place, below 30 deg.C.and above 5 deg.C.

8. Exposure controls/personal protection

Engineering Measures:

Facilities storing or utilizing this material should be equipped with an eye wash facility and a safety shower.

Exposure limit:

	ACGIH	OSHA
Ingredient name	TLV(TWA)	TLV(TWA)
ETHANOL, 2-BUTOXY-	20 ppm	50

Notes: (RD) = respirable dust. ©=ceiling limit. (Skin)=skin penetrative.
Mppcf=millions of particles per cubic foot.

Personal protection:

Respiratory protection :	Wear NIOSH-Approved appropriate equipment.
Hand protection :	Wear impervious gloves.
Eye protection :	Wear chemical splash goggles and face shield when eye and face contact is possible due to splashing or spraying of material.
Skin protection :	Wear chemical resistant clothing such as gloves, apron, boots or whole bodysuits made from neoprene, as appropriate.
Environmental exposure control:	Do NOT let this product enter the environment.

9. Physical and chemical properties

Form :	Liquid
Color :	Milky yellow
Odor :	irritating
pH value :	6.1 - 6.5
Boiling point :	no data.
Flash point :	none.
Ignition temperature :	no data.
Lower explosion limit :	no data.
Higher explosion limit :	no data.
Vapor pressure :	no data.
Specific gravity :	no data.
Vapor density :	1.05/20[deg.C](68[deg.F])
Solubility in water :	no data.

10. Stability and reactivity

Stability :

Stable under recommended storage and handing conditions. (see section 7)

Hazardous reaction :

Hazardous reaction will not occur.

Hazardous decomposition products :

There is no information.

11. Toxicological information

There are no data available on the product itself.

Toxicological information of ingredients:

acute toxicity:

No data.

local effect:

No data.

sensitization:

No data.

chronically long term effect:

No data.

12. Ecological information

For spills or waste, take care to avoid contaminating environment.

Prevent spills and wastewater from entering sewers, water courses or law areas to avoid pollution.

There are not data available on the product itself.

13. Disposal considerations

The product should not be allowed to inter drains and watercourses.

All notification, clean-up and disposal should be carried out in accordance with federal, state and local regulations.

Preferred method of waste disposal are incineration or biological treatment in federal/state approved facility.

Wastes and empty containers should be disposed of in accordance with regulations made under the control of pollution acts and the environmental protection acts.

Empty containers should be recycled or disposed of through an approved waste management facility.

product may by hazardous to environment.

14. Transport information

Not classified as dangerous in the meaning of transport regulations .

15. Regulatory information

Safety, health and environmental regulations specific for the product in question .

Thai regulations

The product is classified and labeled in accordance with GHS adopted by Thai authority .

Restriction of occupation

None

16. Other information

This information contained in this data sheet represents the best information currently available to us.
However, no warranty is made with respect to its completeness and we assume no liability resulting us from its.
It is advised to make their own tests to determinate the safety and suitability of each such product or combination for their own.
Ensure this material in compliance with federal requirements and ensure conformity to local regulations.
The product should not be used for purposes other than shown in the material safety data sheet without first obtaining written advice.

Abbreviations

not est. = not established
N/A = not applicable
U/I = unknown information

Safety Data Sheet according to GHS

Version : 000

Revision Date : 7/09/2016
Date of printing : 7/09/2016

1. Identification of the substance/preparation and company

Trade name

POWERNICS EXCEL 1210 F-1 BLACK

Use of the substance/preparation.

Industry sector : CED Coating

Type of use : Waterborne epoxy resin paint

Identification of the company

Nippon paint (Thailand) Co.,Ltd.
700/29, 31 Moo 6, T.Nongmaidaeng,
A.Muang, Chonburi 20000.
Tel : (038) 213701-5 , (038) 214150-6
Fax :(038) 213706

Information about the substance/preparation

Nippon paint (Thailand) Co.,Ltd.
Technic CED coating Department Tel : (038) 213701-5 # 375,
(038) 214150-6 # 375

Emergency telephone number :

Tel : (038) 213701-5 # 191

2. Hazard identification

GHS Classification of the substance or mixture

Eye damage/ irritation

Skin corrosion/irritation

Sensitization - respiratory

Carcinogenicity

Toxic to reproduction

Specific target organ toxicity (single exposure)

Hazardous to the aquatic environment- acute hazard

Hazardous to the aquatic environment- long-term hazard

GHS label elements, including precautionary statements

Health Hazard

Exclamation Mark

Pictogram/Hazard symbols

Signal word

Warning

Hazard statements

Harmful in contact with skin

Harmful if swallowed

May be harmful if inhaled

Causes mild skin irritation

Causes serious eye irritation

May cause allergy or asthma symptoms or breathing difficulties if inhaled

May cause an allergic skin reaction

Suspected of causing cancer

Suspected of damaging fertility or the unborn child

Causes damage to organs through prolonged or repeated exposure

Harmful to aquatic life

Harmful to aquatic life with long lasting effects

3. Composition/information on ingredients

Chemical characterization

Epoxy pigment paste.

Hazardous ingredients

Component	CAS number	Concentration[%]
WATER	7732-18-5	30-40
KAOLIN CLAY	1332-58-7	33-45
EPOXY RESIN	Proprietary	7-15
DIBUTYL TIN OXIDE	818-08-6	0-8
ETHYLENE GLYCOL BUTYL ETHER	111-76-2	2-5
CARBON BLACK+	1333-86-4	0.2-3.5
ADDITIVE (S)	Proprietary	0.2-1.0

Notes: *,+,@ = Carcinogenic according to criteria established by (*=NTP +=IARC @=OSHA)

$=Significant New Uses of Chemical Substances (SNUR). Section 721, Subpart E--Significant New Uses for Specific Chemical Substances.

$1=SNUR(70 FR 71401-6, Nov. 29, 2005) This SNUR regulation is applicable only when the substance is for domestic use in a consumer product.

4. First aid measures

Inhalation : If inhaled, remove to fresh air.

Skin exposure : In case of contact, immediately wash skin soap and plenty of water.

Eye exposure : In case of contact, immediately flush eyes with plenty of water for at least 15 minutes.

Ingestion : If swallowed, do NOT induce vomiting unless directed to do so by medical personnel. Get medical attention immediately.

5. Fire-fighting measures

EXTINGUISH MEDIA

[OK]water fog, [OK]CO2, [OK]foam, [OK]dry chemicals, [OK]dry sand.

Note:

Fire will produce dense black smoke.

Decomposition products may be hazardous to health.

Avoid exposure and use breathing apparatus as appropriate.

Cool closed containers exposed to fire by spraying them with water.

Do not allow run off water and contaminants from fire fighting to enter drains or watercourses.

See section 10.

6. Accidental release measures

Avoid all sources of ignition (e.g. naked lights, unprotected light bulbs, electric hand tools).

Ventilate the area and avoid breathing vapors.

Wear protective clothing and self-contained breathing apparatus when dealing with spillage or fire.

Collect spillage ,where practicable ,for safe disposal.

Should be disposed of waste and empty containers in accordance with regulation made under the control of pollution acts and the environmental protection acts.

Keep away from drains, surface-and ground-water and soil.

Use personal protection equipment.

Absorb and/or contain spill with intermeterial,(sand, vermiculite),then place in suitable container.

For large spills: Neutralize spill area with intermaterial(soda ash or lime, diluted acetic acid).

Flush spill area with water spray :Prevent run off from entering water way or sewers.

Refer to heading 8 and 13.

7. Handling and storage

Handling :

Keep away from heat, sparks and flame.

Keep container closed.

Use with adequate ventilation.

Protection as shown in section 8.

Storage :

Keep container closed.

Store in a well ventilated, dark and cool place, below 30 deg.C. and above 5 deg.C.

8. Exposure controls/personal protection

Engineering Measures:

Facilities storing or utilizing this material should be equipped with an eye wash facility and a safety shower.

Exposure limit:	ACGIH	OSHA
Ingredient name	TLV(TWA)	TLV(TWA)
KAOLIN CLAY	2mg/m3	not est.
DIBUTYL TIN OXIDE	0.1(Sn)mg/m3	not est.
ETHYLENE GLYCOL BUTYL ETHER	20 ppm	50
CARBON BLACK	3.5mg/m3	3.5 mg/m3

Notes: (RD) = respirable dust. ©=ceiling limit. (Skin)=skin penetrative.
Mppcf=millions of particles per cubic foot.

Personal protection:

Respiratory protection:	Wear NIOSH-Approved appropriate equipment.
Hand protection:	Wear impervious gloves.
Eye protection:	Wear chemical splash goggles and face shield when eye and face contact is possible due to splashing or spraying of material.
Skin protection:	Wear chemical resistant clothing such as gloves, apron, boots or whole bodysuits made from neoprene, as appropriate.
Environmental exposure control:	Do NOT let this product enter the environment.

9. Physical and chemical properties

Form :	Liquid
Color :	Black
Odor :	Irritating
pH value :	6.0 - 6.8
Boiling point(range) :	no data
Flash point:	none.
Lower explosion limit :	no data
Higher explosion limit :	no data
Specific gravity :	no data
Vapor density :	1.35/20[deg.C](68[deg.F])
Solubility in water :	no data

10. Stability and reactivity

Stability :

Stable under recommended storage and handing conditions. (see section 7)

Hazardous reaction :

Hazardous reaction will not occur.

Hazardous decomposition products :

There is no information.

11. Toxicological information

There are no data available on the product itself.

Toxicological information of ingredients:

acute toxicity:

No data.

local effect:

No data.

sensitization:

No data.

chronically long term effect:

No data.

12. Ecological information

For spills or waste, take care to avoid contaminating environment.

Prevent spills and wastewater from entering sewers, water courses or law areas to avoid pollution.

There are not data available on the product itself.

13. Disposal considerations

The product should not be allowed to inter drains and watercourses.

All notification, clean-up and disposal should be carried out in accordance with federal, state and local regulations.

Preferred method of waste disposal are incineration or biological treatment in federal/state approved facility.

Wastes and empty containers should be disposed of in accordance with regulations made under the control of pollution acts and the environmental protection acts.

Empty containers should be recycled or disposed of through an approved waste management facility.

Product may be hazardous to environment.

14. Transport information

Not classified as dangerous in the meaning of transport regulations .

15. Regulatory information

Safety, health and environmental regulations specific for the product in question .

Thai regulations

The product is classified and labeled in accordance with GHS adopted by Thai authority .

Restriction of occupation

None

16. Other information

This information contained in this data sheet represents the best information currently available to us.
However, no warranty is made with respect to its completeness and we assume no liability resulting us from its.
It is advised to make their own tests to determinate the safety and suitability of each such product or combination for their own.
Ensure this material in compliance with federal requirements and ensure conformity to local regulations.
The product should not be used for purposes other than shown in the material safety data sheet without first obtaining written advice.

Abbreviations

not est. = not established
N/A = not applicable
U/I = unknown information

Appendix-C: Fire Drill Snapshots at Walton

ফরম-২২(ক)

[ধারা ৬২(৮) এবং বিধি ৫৫(১৪) দ্রষ্টব্য]

অগ্নিনির্বাপণ মহড়ার রেকর্ড বহি

কারখানার বা প্রতিষ্ঠানের নাম: ওয়ালটন হাইটেকইন্ডাস্ট্রিজ

কারখানার বা প্রতিষ্ঠানের ঠিকানা: কলি, কালিয়াকৈর, গাজীপুর

মোট শ্রমিক ও কর্মচারীর সংখ্যা: ..... পুরুষ: ..... মহিলা: .....

ক্রমিক নং	তারিখ ও সময়	মহড়া পরিচালনাকারী সংস্থার নাম	মহড়ায় কতজন শ্রমিক অংশগ্রহণ করিয়াছেন			মহড়ায় কতক্ষণ সময় লাগিয়াছে
			পুরুষ	মহিলা	মোট	
(১)	(২)	(৩)	(৪)	(৫)	(৬)	(৭)
০২.	২০-০৬-১৯ ২২:৩০মি.	ফায়ার সার্ভিস ও সিভিল ডিফেন্স কালিয়াকৈর				০৬ মি. ০সে.

মহড়া চলাকালীন সময়ে উপস্থিত প্রতিষ্ঠান/কারখানা কর্তৃপক্ষের নাম ও পদবি	মহড়া চলাকালীন সময়ে উপস্থিত ফায়ার সার্ভিসের প্রতিনিধি/শ্রমিক প্রতিনিধির স্বাক্ষর	মহড়ার সময় শ্রমিক আহত হইলে উহার রেকর্ড
(৮)	(৯)	(১০)
Engr. Md. Sadequr Rahman (35130) Sr. Asst. Director In-Charge Compliance Section Walton Hi-Tech Industries Ltd. Date: 20.06.19	২০/০৬/১৯ মোঃ কবিরুল আলম স্টেশন অফিসার ফায়ার সার্ভিস ও সিভিল ডিফেন্স স্টেশন কালিয়াকৈর,গাজীপুর।	—নাই—

Government of the People's Republic of Bangladesh
Department of Environment
Paribesh Bhaban, E-16 Agargaon
Shere-E Bangla Nagar, Dhaka.

No. DoE/ODS/HFC Phase down/93/2017/95 Date: 24/12/2019..

Subject: **Verification Report of the Project Technical Committee regarding of Third Milestone of the project entitled "Promoting Environment Friendly and Energy Efficient Household Refrigerator and Reciprocating compressor manufacturing Facilities at Walton Hi-tech Industries Ltd.**

As a follow-up to the decision of 4th Project Advisory Committee meeting held on 19 October 2019, final verification meeting of Project Technical Committee (PTC) chaired by Dr. A.K.M. Rafique Ahammed, Director General, Department of Environment was held on 23 December 2019 at DoE Conference Room. In the meeting, the PTC thoroughly examined and verified the progress of the project particularly the 3rd milestone of the project including the safety audit report being implemented in the Walton Hi-tech Industries Ltd.

Following members of Technical Committee and officials were participated:

1. Prof. Dr. Mohammad Mamun
   Professor, Mechanical Engineering Department, BUET
2. Mr. Md. Ziaul Haque
   Director (Air Quality Management), Department of Environment
3. Eng. Md. Saidul Islam
   Deputy Director, BSTI
4. Mr. Md Enaet Hossain
   Fire Service and Civil Defense
5. Mr. Khurshid Alam
   Assistant Resident Representative, UNDP, Bangladesh
6. Mr. Sattya Ranjan Bhattacharjee
   Project Manager, UNDP, Bangladesh
7. Dr. Satyendra Kumar Purkayastha
   Project Coordinator, Ozone Cell
   Department of Environment
8. Md. Tawfiq-ul-Quader
   Operative Director, Walton Hi Tech Industries Ltd

2. By welcoming all members and participants in the meeting the Chair, Dr. A.K.M. Rafique Ahammed, Director General, Department of Environment requested Mr. Md. Tawfiq-ul-Quader, Operative Director, Walton Hi Tech Industries Ltd to make a detail presentations before the technical committee on the progress of the project activities with time bound work plan and milestone. In his presentation, Mr. Tawfiq informed the committee that they completed all the activities stipulated in the project document include activities mentioned by the Project Advisory Committee in its 4th meeting held on 19th October 2019.

3. After that, all the members of the committee reviewed report of the Chemical Engineering Department of BUET on safety measures undertaken for the use of flammable refrigerant, R-600a, and also the recommendations provided by the audit team. The committee expressed satisfaction over WALTON's proactive actions to implement all the core recommendations of the report. As suggested in the report, the committee also suggested WALTON to carry out fire drill in every month instead of every six month. Representative of Fire Service Department also stressed on regular fire drill with active participation of local fire service department so that they are familiar with the industrial compound

5. During discussion on the certification of modified models of the refrigerator, representative of BSTI informed that Walton got certification on 24 Models and got Five Star Rating as per BSTI standard.

In reply to the question of the Chair, Walton representative informed that Walton completed training activities as per project milestone, and they completed training of 238 technicians during 3-14 November 2019. After that all the members of the committee verified all the documents and found consistent with the claim.

6. Regarding implementation of the decisions of the 4th Meeting of the Project Advisory Committee (PAC), Chair advised to organize dissemination workshop on the implementation of projects under private –public partnership.

The committee also verified Reports of the Expatriate consultant and clearance certificates of Fire Service & Civil defense; Explosives and Department of Environment. After threadbare discussion the member of the Technical Committee made following observations/decision:

a. All procurement, installation, trial productions have been accomplished by the industry as per project document.

b. Technical Committee is satisfied with the measures taken by the industry in line with the safety audit report conducted by the Chemical Engineering Department of BUET and International Consultant engaged by UNDP.

c. Training of 238 technicians has been accomplished as per programme.

d. All the 24 models of refrigerators developed by the R&D section of Walton under this project are certified by BSTI.

f. Fire drill in the factory has to be carried out in every month instead of existing every six month in presence of the fire service department.

g. Exit pathway of the Line-2 of the refrigeration production unit has to be uninterrupted as per recommendation of audit team.

h. A dissemination workshop needs to be organized by the UNDP in a befitting manner highlighting public-private partnership.

i. A video documentation has to be prepared by UNDP on all the conversion projects implemented under private- public partnership during implementation of Montreal Protocol

f. As Walton accomplished all the activities and fulfilled all the conditions of 4th PAC meeting, the committee recommended UNDP to release the final payment to WALTON as per agreement.

24/12/19

(Dr. A.K.M. Rafique Ahammed)
Director General
Department of Environment

Attendance Sheet

Technical Committee of the Walton HFC project
Department of Environment (DoE) E/16, Agargaon

Date: 23-12-2019 (10 am)

SL No.	Name & Designation	Organization	Contact Number & Email Address	Signature
1				
2	Dr. Mohammad Mamun	ME Dept., BUET	01714386925 mdmamun@me.buet.ac.bd	23/12/19
3	Khurshid Alam	ARR [illegible]	Khurshid.alam@[illegible].org	
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Attendance Sheet

Technical Committee of the Walton HFC project
Department of Environment (DoE) E/16, Agargaon

Date: 23-12-2019 (10 am)

SL No.	Name & Designation	Organization	Contact Number & Email Address	Signature
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Safety Audit Certificate

Technical scope of audit

Verification of manufacturing facility using hydrocarbons as refrigerant at the manufacturing of hermetic compressors and refrigerators. The verification is done according to the European ATEX directive 2014/34/EU and harmonized standards, including leading certifying organizations and equipment supplier's interpretation.

Facility

WALTON HI-TECH INDUSTRIES LIMITED

CHANDRA, KALIAKOIR, GAZIPUR, BANGLADESH

Manufacturing sections identified as
Refrigerator production line #1, #2 and #4
Central R600A refrigerant supply system
Hermitic compressor production line of R600A compressor

Certification of compliance

Mads Giltrup – Independent Consultant UNDP

Bangladesh 19 November 2019

SAFETY AUDIT REPORT

Technical scope of audit

Verification of manufacturing facility using hydrocarbons as refrigerant at the manufacturing of hermetic compressors and refrigerators. The verification is done according to the European ATEX directive 2014/34/EU and harmonized standards, including leading certifying organizations and equipment supplier's interpretation.

Facility

WALTON HI-TECH INDUSTRIES LIMITED
CHANDRA, KALIAKOIR, GAZIPUR, BANGLADESH

Manufacturing sections identified as

Refrigerator production line #1, #2 and #4

Central R600A refrigerant supply system

Hermitic compressor production line of R600A compressor

Bangladesh November 2019

SAFETY GUIDELINE USED FOR AUDIT IN MANUFACTURING FACILITIES WHEN USING HC OR HFO AS REFRIGERANT IN RAC INDUSTRIES.

The following safety concept is based on internationally recognized and applied standards. In addition, it is possible that local standards or company policies exist that must be adhered to. The stricter one will prevail in each situation.

According to the concept the classification all identified hazard areas following European directive 2014/34/EU and harmonized standards, including leading certifying organizations and leading equipment supplier's interpretation:

Zone 0 : Where a constant amount of highly flammable/ explosive liquids or gases may be expected. Devices must be explosion-proof and grounded.

Zone 1 : Where, from time to time, highly flammable liquids or gases may be expected. Devices must be Ex-e, -d or -i and grounded.

Zone 2 : Where only by accident or scheduled maintenance highly flammable/ explosive gases may be expected. Material required is Ex-n. Grounding is required.

Alarm Zone: Area surrounding above zones, electrical equipment must de with IP54 enclosure, and switched off in case of gas alarm. The zone is defined as a 3 m radius (on floor level) cone below the possible gas leak point.

Fire safe Zone: Larger area with no use of open flame, and with warning signs located in the area. The zone is defined as a 5 m radius from the possible gas leak point, from floor to roof sealing.

- The areas can be limited by separation engineered solution, like ventilation, walls, panels or cabinets.
- Safeguard areas that cannot be reclassified, through explosion proofing;
- Provide additional safeguarding through the use of a combustible gas monitoring system with sensors at designated potential emission points and a portable gas detector to be used as part of a formal monitoring plan for areas that do not have continuous monitoring;
- Provide adequate emergency response gear such as firefighting equipment;
- Train personnel in safe operating procedures, preventive maintenance, and emergency response. Use formalized procedures through the preparation of a safety manual and an emergency response plan;

- Use an external expert or a technology transfer agreement to supervise all designs, the implementation and the start-up. The initial production start-up after conversion should be attended by experienced operating personnel.

With the help of this safety concept, it is possible to design actual modifications that have to be made to implement the transfer from CFC/HCFC/HFC to hydrocarbons and or A2L refrigerants. Actual implementation can differ, depending on equipment, plant layout, housekeeping and surroundings. A "standard" conversion for a discontinuous process would be along the following lines:

CENTRAL HC/HFO STORAGE TANKS PLACED OUTSIDE FACTORY BUILDING

- Location and installation of storage systems are subject to local regulations.
- Design of tanks, piping and valves shall comply with internationally recognized standards, and meet local requirements.
- Tanks shall have an electrical/pneumatically operated shutoff valve controlled by the gas monitoring supervision system
- Nitrogen blanketing and/or sprinkler systems should be installed and meet local requirements.
- All components shall be properly grounded and electrical installation shall meet installation codes,
- Protection of lightning me be required, depending on location
- Ventilation system should be considered in case natural ventilation is not considered enough.
- Installations within a radius of 4 meters from the tank shall meet Zone 1 requirement.
- Minimal one gas detector, connected to the central or local gas sensing and alarm system shall be installed.
- The tank(s) shall be in a concrete spill containment of sufficient size, in a fenced, locked area, preferable with a cover to protect against direct sun light.
- The HC transfer pumps, if included, shall meet Zone 1 requirements.
- All other equipment located inside the area shall meet Zone 1 requirements.
- Placement of fire extinguishers should be minimum two 6 kg ABC portable types and shall meet local requirements.

CHARGING AND REWORK AREAS USED FOR FLAMMABLE HC/HFO REFRIGERANT

- The charging and rework area(s) should be clearly divided into specified Zones (Ex-Zone 2 -> Alarm Zone.
- Zones should be physically separated by knee wall or other separation to limit the extend of the zone.
- All equipment shall be approved for use in the specific zone.
- Internal enclosures of e.g. charging and rework stations considered Ex-Zone 2 should be equipped with gas sensor(s) and a 2 stage ventilation system, with adequate ventilation capacity to ventilate at least twice the maximum volume charged into each appliance in a minimum time.
- Care should be taken that ventilator fans placed for operator comfort shall not lead flammable gas into areas without gas concentration monitoring.
- Placement of fire extinguishers should be minimum two 6 kg ABC portable types and shall meet local requirements.
- All equipment shall be properly grounded.
- Safety monitoring systems shall monitor gas sensor(s) and ventilation systems and take the necessary actions to shut down the supply of refrigerant in case a alarm occurs.

GAS SENSING, VENTILATION AND ALARM SYSTEMS

- The plant shall have installed gas sensors on locations where the possibility of emissions or leakage of HC/HFOs exist. The sensors are to be connected to a centralized control panel in a safe area, clear from potential emission sources.
- The system shall be capable to trigger two consecutive visual/acoustical alarm levels, related to the percentage LEL reached. Recommended is a first level alarm on 15% LEL and a second alarm level at 30% (level can vary) LEL.
- The acoustical alarm shall be a minimum of 85 Db, or at least 15 Db over plant noise level.
- The visual alarm shall be in the refrigerant charging/rework area and the refrigerant supply area.
- The first alarm shall be for warning and ventilation speed control purposes only.
- The second alarm shall shut down the charging operation and the refrigerant supply, while increasing the process exhaust.
- The system shall have an independent power back-up.
- An auxiliary portable gas sensor with calibration unit shall be kept on site.
- The plant shall have installed centralized or sufficient localized emission extraction systems of sufficient capacity serving locations where the possibility of emissions or leakage of HC/HFO exists.

- The system(s) shall have a two-stage capacity and back-up power, depending on power supply environment.
- The system(s) shall be interlocked with the sensor and alarm system.

SPECIFIC REQUIREMENTS FOR CALORIMETRIC AND LIFETIME TEST LABORATRIES FOR COMPRESSOR MANUFACTORING FACILITIES.

- Verification of calorimetric test units ability to work with flammable refrigerants, hereunder :
  - Gas sensor technology
  - Ventilation system design
- Verification of life time test units ability to work with flammable refrigerants, hereunder :
  - Gas sensor technology
  - Ventilation system design

DOCUMENTATION.

- Safety audit is documented in 5 different check lists, one for each production area
- Supporting photos and other documentation is archived electronically.

Mads Giltrup – Independent Consultant UNDP

Bangladesh November 2019