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BAT Assessment

Part A2 Permit Application, October 2023
Issue 1.0

ehrc

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The small print:

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1.0 Introduction

Terinex Flexibles Limited (the Operator) proposes to operate a Part A2 flexographic printing activity, and is applying for an Environmental Permit from South Derbyshire District Council (the Regulator).

As part of the application, the Operator will need to demonstrate that the installation and its activities will be operated in accordance with Best Available Techniques. Best Available Techniques (BAT) means the available techniques which are the best for preventing or minimising emissions and impacts on the environment.

Best Available Techniques (BAT) for this process sector are detailed in the Best Available Techniques (BAT) Reference Document on Surface Treatment Using Organic Solvents including Preservation of Wood and Wood Products with Chemicals Industrial Emissions Directive 2010/75/EU (Integrated Pollution Prevention and Control), December 2020 (BRef Note).

1.1 Applicable BAT

Not all of the best available techniques detailed in the STS BRef are relevant to the activities operated at the installation. Applicable BAT is detailed as follows:

BAT	Description	Applicable?
1	Environmental Management systems	Yes
2	Improving overall VOC performance	Yes
3	Preventing or reducing impact of raw materials	Yes
4	Reducing solvent consumption & impact of materials used	Yes
5	Preventing or minimising fugitive emissions	Yes
6	Reducing raw materials consumption	Yes
7	Reducing materials consumption during coating application	No
8	Reducig energy consumption during drying/curing	Yes
9	Reducing VOC emissions from cleaning processes	Yes
10	Solvent mass balance	Yes
11	Monitoring emissions in waste gasses	Yes
12	Monitoring emissions to water	No
13	Emissions during OTNOC conditions	Yes
14	Reducing VOC emissions – production and storage areas	Yes
15	Reducing VOC emissions – resource efficiency	Yes
16	VOC abatement systems	Yes
17	NOx & CO emissions	Yes
18	Dust emissions	No
19	Energy management and efficiency	Yes
20	Water use and waste water generation	No
21	Emissions to water	No
22	Waste management	Yes
23	Odour emissions	Yes
24	BAT conclusions for the coating of vehicles	No
25	BAT conclusions for the coating of ships and yachts	No
26	BAT conclusions for the coating of aircraft	No
27	BAT conclusions for the manufacturing of winding wire	No
	BAT conclusions for flexography and rotogravure printing	Yes

2.0 BAT Review

2.1 BAT 1 - Environmental Management systems:

In order to improve the overall environmental performance, BAT is to elaborate and implement an Environmental Management System (EMS) that incorporates all of the following features:

Description		Assessment
(i)	commitment, leadership, and accountability of the management, including senior management, for the implementation of an effective EMS;	The operator proposes to implement a fully documented environmental management system (EMS) (accreditation level to be confirmed) incorporating the generic BAT1 features within 12 months of the date of any permit granted.. It is recommended that that the operator makes a checklist of the key requirements to ensure that they are incorporated into the EMS.
(ii)	an analysis that includes the determination of the organisation's context, the identification of the needs and expectations of interested parties, the identification of characteristics of the installation that are associated with possible risks for the environment (or human health) as well as of the applicable legal requirements relating to the environment;	
(iii)	development of an environmental policy that includes the continuous improvement of the environmental performance of the installation;	
(iv)	establishing objectives and performance indicators in relation to significant environmental aspects, including safeguarding compliance with applicable legal requirements;	
(v)	planning and implementing the necessary procedures and actions (including corrective and preventive actions where needed), to achieve the environmental objectives and avoid environmental risks;	
(vi)	determination of structures, roles and responsibilities in relation to environmental aspects and objectives and provision of the financial and human resources needed;	
(vii)	ensuring the necessary competence and awareness of staff whose work may affect the environmental performance of the installation (e.g. by providing information and training);	
(viii)	internal and external communication;	
(ix)	fostering employee involvement in good environmental management practices;	
(x)	establishing and maintaining a management manual and written procedures to control activities with significant environmental impact as well as relevant records;	
(xi)	effective operational planning and process control;	
(xii)	implementation of appropriate maintenance programmes;	
(xiii)	emergency preparedness and response protocols, including the prevention and/or mitigation of the adverse (environmental) impacts of emergency situations;	
(xiv)	when (re)designing a (new) installation or a part thereof, consideration of its environmental impacts throughout its life, which includes construction, maintenance, operation and decommissioning;	
(xv)	implementation of a monitoring and measurement programme; if necessary, information can be found in the Reference Report on Monitoring of Emissions to Air and Water from IED Installations;	
(xvi)	application of sectoral benchmarking on a regular basis;	
(xvii)	periodic independent (as far as practicable) internal auditing and periodic independent external auditing in order to assess the environmental performance and to determine whether or not the EMS conforms to planned arrangements and has been properly implemented and maintained	

Description	Assessment
(xviii) evaluation of causes of nonconformities, implementation of corrective actions in response to nonconformities, review of the effectiveness of corrective actions, and determination of whether similar nonconformities exist or could potentially occur; (xix) periodic review, by senior management, of the EMS and its continuing suitability, adequacy and effectiveness; (xx) following and taking into account the development of cleaner techniques.	The operator proposes to implement a fully documented environmental management system (EMS) (accreditation level to be confirmed) incorporating the generic BAT1 features within 12 months of the date of any permit granted.. It is recommended that that the operator makes a checklist of the key requirements to ensure that they are incorporated into the EMS.

Specifically for surface treatment using organic solvents, BAT is also to incorporate the following features in the EMS:

Description	Assessment
(i) Interaction with quality control and assurance as well as health and safety considerations.	The operator proposes to implement a fully documented environmental management system (EMS) (accreditation level to be confirmed) incorporating the generic BAT1 features within 12 months of the date of any permit granted.. It is recommended that that the operator makes a checklist of the key requirements to ensure that they are incorporated into the EMS.
(ii) Planning to reduce the environmental footprint of an installation. In particular, this involves the following: (a) assessing the overall environmental performance of the plant (see BAT 2); (b) taking into account cross-media considerations, especially the maintenance of a proper balance between solvent emissions reduction and consumption of energy (see BAT 19), water (see BAT 20) and raw materials (see BAT 6); (c) reducing VOC emissions from cleaning processes (see BAT 9).	
(iii) The inclusion of: (a) a plan for the prevention and control of leaks and spillages (see BAT 5 (a)); (b) a raw material evaluation system to use raw materials with low environmental impact and a plan to optimise the use of solvents in the process (see BAT 3); (c) a solvent mass balance (see BAT 10); (d) a maintenance programme to reduce the frequency and environmental consequences of OTNOC (see BAT 13); (e) an energy efficiency plan (see BAT 19 (a)); (f) a water management plan (see BAT 20 (a)); (g) a waste management plan (see BAT 22 (a)); (h) an odour management plan (see BAT 23).	

2.2 BAT 2 - Improving overall VOC performance:

In order to improve the overall environmental performance of the plant, in particular concerning VOC emissions and energy consumption, BAT is to:

Description	Assessment
Identify the process areas/sections/steps that represent the greatest contribution to the VOC emissions and energy consumption and the greatest potential for improvement (see also BAT 1);	Requires initial benchmarks and ongoing data collection for any meaningful assessment to be made
Identify and implement actions to minimise VOC emissions and energy consumption;	
Regularly (at least once per year) update the situation and follow up the implementation of the identified actions.	It is suggested that a simple summary forms part of an annual report to the Regulator

2.3 BAT 3 - Preventing or reducing impact of raw materials:

In order to prevent or reduce the environmental impact of the raw materials used, BAT is to use both of the techniques given below:

Technique		Description	Applicability	Assessment
(a)	Use of raw materials with a low environmental impact	As part of the EMS (see BAT 1), systematic evaluation of the adverse environmental impacts of the materials used (in particular substances that are carcinogenic, mutagenic and toxic to reproduction as well as substances of very high concern) and substitution by others with no or lower environmental and health impacts where possible, taking into consideration the product quality requirements or specifications	Generally applicable. The scope (e.g. level of detail) and nature of the evaluation will generally be related to the nature, scale and complexity of the plant and the range of environmental impacts it may have, as well as to the type and quantity of materials used	The flexographic printing sector is an established one, meaning that raw materials are already well optimised Print chemistry is supply-led, with the ink / chemical suppliers making product refinements Some operators have trialled water based inks however they have not been very successful for the substrates used
(b)	Optimisation of the use of solvents in the process	Optimisation of the use of solvents in the process by a management plan (as part of the EMS (see BAT 1)) that aims to identify and implement necessary actions (e.g. colour batching, optimising spray pulverisation)	Generally applicable	The use of solvent will be optimised as far as practicable given the installation of a distiller for on-site recycling. Annual report data and SMP will be used to drive any further available solvent use optimisation

2.4 BAT 4 - Reducing solvent consumption & impact of materials used:

In order to reduce solvent consumption, VOC emissions and the overall environmental impact of the raw materials used, BAT is to use one or a combination of the techniques given below:

Technique		Description	Applicability	Assessment
(a)	Use of high-solids solvent-based paints / coatings / varnishes / inks / adhesives	Use of paints, coatings, liquid inks, varnishes and adhesives containing a low amount of solvents and an increased solids content.	The selection of the surface treatment techniques may be restricted by the activity type, the substrate type and shape, product quality requirements as well as the need to ensure that the materials used, coating application techniques, drying / curing techniques and off-gas treatment systems are mutually compatible	The printing substrate (plastic films) requires the use of high organic solvent mixtures for the satisfactory adherence of the inks.
(b)	Use of water-based paints / coatings / inks / varnishes / adhesives	Use of paints, coatings, liquid inks, varnishes and adhesives where organic solvent is partially replaced by water.		Water-based and low-solvent ink are not generally used in this process sector as the desired quality of finish cannot be reliably achieved.
(c)	Use of radiation-cured inks / coatings / paints / varnishes / adhesives	Use of paints, coatings, liquid inks, varnishes and adhesives suitable to be cured by the activation of specific chemical groups by UV or IR radiation, or fast electrons, without heat and without emission of VOCs		Not available in this process sector.
(d)	Use of solvent-free two-component adhesives	Use of solvent-free two-component adhesive materials consisting of a resin and a hardener		Not applicable to this process sector
(e)	Use of hot-melt adhesives	Use of coating with adhesives made from the hot extrusion of synthetic rubbers, hydrocarbon resins and various additives. No solvents are used		Applicability to be confirmed depending on final plant and equipment used
(f)	Use of powder coatings	Use of solvent-free coating which is applied as a finely divided powder and cured in thermal ovens		Not applicable to this process sector
(g)	Use of laminate film for web or coil coatings	Use of polymer films applied onto a coil or web in order to give aesthetic or functional properties, which reduces the number of coating layers needed		Not applicable to this process sector

2.5 BAT 5 - Preventing or minimising fugitive emissions:

In order to prevent or reduce fugitive emissions during storage and handling of solvent-containing materials and/or hazardous materials, BAT is to apply the principles of good housekeeping by using all of the techniques given below:

Technique		Description	Applicability	Assessment
Management Techniques				
(a)	Preparation and implementation of a plan for the prevention and control of leaks and spillages	A plan for the prevention and control of leaks and spillages is part of the EMS (see BAT 1) and includes, but is not limited to: ➢ site incident plans for small and large spillages; ➢ identification of the roles and responsibilities of persons involved; ➢ ensuring staff are environmentally aware and trained to prevent/deal with spillage incidents; ➢ identification of areas at risk of spillage and/or leaks of hazardous materials and ranking them according to the risk; ➢ in identified areas, ensuring suitable containment systems are in place, e.g. impervious floors; ➢ identification of suitable spillage containment and clean-up equipment and regularly ensuring it is available, in good working order and close to points where these incidents may occur; ➢ waste management guidelines for dealing with waste arising from spillage control; ➢ regular (at least once per year) inspections of storage and	Generally applicable. The scope (e.g. level of detail) of the plan will generally be related to the nature, scale and complexity of the installation, as well as to the type and quantity of materials used.	A spillage procedure will be implemented as part of BAT 1/BAT 2, and the specific items detailed in BAT 5 Storage areas will be contained and bunded to 110% capacity Documented checks to form part of EMS

Technique		Description	Applicability	Assessment
		operational areas, testing and calibration of leak detection equipment and prompt repair of leaks from valves, glands, flanges, etc. (see BAT 13).		
Technique		**Description**	**Applicability**	**Assessment**
Storage techniques				
(b)	Sealing or covering of containers and bunded storage area	Storage of solvents, hazardous materials, waste solvents and waste cleaning materials in sealed or covered containers, suitable for the associated risk and designed to minimise emissions. The containers' storage area is bunded and of adequate capacity.	Generally applicable.	Storage areas will be contained and bunded to 110% capacity
(c)	Minimisation of storage of hazardous materials in production areas	Hazardous materials are present in production areas only in amounts that are necessary for production; larger quantities are stored separately.		External bunded store for solvents not in immediate use
Technique		**Description**	**Applicability**	**Assessment**
Techniques for pumping and handling liquids				
(d)	Techniques to prevent leaks and spillages during pumping	Leaks and spillages are prevented by using pumps and seals suitable for the material handled and which ensure proper tightness. This includes equipment such as canned motor pumps, magnetically coupled pumps, pumps with multiple mechanical seals and a quench or buffer system, pumps with multiple mechanical seals and seals dry to atmosphere, diaphragm pumps or bellow pumps.	Generally applicable.	Solvent recycling system tanks protected from overfilling by limit switches Recycling area contained and bunded to 110% capacity

Technique		Description	Applicability	Assessment
(e)	Techniques to prevent overflows during pumping	This includes ensuring for example that: ➢ the pumping operation is supervised; ➢ for larger quantities, bulk storage tanks are fitted with acoustic and/or optical high-level alarms, with shut-off systems if necessary.		Solvent recycling system tanks protected from overfilling by limit switches Recycling area contained and bunded to 110% capacity Leaks/spills will be covered by BAT 1 / BAT 2 & BAT 5 review
(f)	Capture of VOC vapour during solvent-containing material delivery	When delivering solvent-containing materials in bulk (e.g. loading or unloading of tanks), the vapour displaced from receiving tanks is captured, usually by back-venting.	May not be applicable for solvents with low vapour pressure or due to cost considerations.	Bulk delivery not proposed, therefore no need for delivery vapour containment
(g)	Containment for spills and/or rapid take-up when handling solvent-containing materials	When handling solvent-containing materials in containers, possible spills are avoided by providing containment, e.g. by using trolleys, pallets and/or stillages with built-in containment (e.g. 'catch pans') and/or rapid take-up by using absorbent materials.	Generally applicable.	Documented spillage procedure to be implemented

2.6 BAT 6 - Reducing raw material consumption and VOC emission:

In order to reduce raw material consumption and VOC emissions, BAT is to use one or a combination of the techniques given below:

Technique		Description	Applicability	Assessment
(a)	Centralised supply of VOC-containing materials (e.g. inks, coatings, adhesives, cleaning agents)	Supply of VOC-containing materials (e.g. inks, coatings, adhesives, cleaning agents) to the application area by direct piping with ring lines, including system cleaning such as pig cleaning or air flushing.	May not be applicable in the case of frequent changes of inks/paints/ coatings/adhesives or solvents.	Centralised as far as possible at present for inks and piped system for solvent delivery and solvent recycling. No need for pigging or flushing
(b)	Advanced mixing systems	Computer-controlled mixing equipment to achieve the desired paint / coating / ink / adhesive.	Generally applicable.	Rexxson ink mixing system proposed. Colour-matching of ink returns is undertaken for maximum re-use of inks
(c)	Supply of VOC-containing materials (e.g. inks, coatings, adhesives, cleaning agents) at the point of application using a closed system	Supply of VOC-containing materials (e.g. inks, coatings, adhesives, cleaning agents) at the point of application using a closed system		Not applicable for inks as these are batch mixed for immediate use In place for press solvents (solvent dispenser and nozzle)
(d)	Automation of colour change	Automated colour changing and ink/paint/coating line purging with solvent capture.		Not applicable on the press, but see (b) above for ink returns
(e)	Colour grouping	Modification of the sequence of products to achieve large sequences with the same colour.		Not applicable on the press, but see (b) above for ink returns
(f)	Soft purge in spraying	Refilling the spray gun with new paint without intermediate rinsing.		Not applicable on the press, but see (b) above for ink returns

2.7 BAT 8 - Reducing energy consumption and overall impact:

In order to reduce energy consumption and the overall environmental impact from drying/curing processes, BAT is to use one or a combination of the techniques given below:

Technique		Description	Applicability	Assessment
(a)	Inert gas convection drying/curing	The inert gas (nitrogen) is heated in the oven, enabling solvent loading above the LEL. Solvent loads of >1,200 g/m^3 nitrogen are possible.	Not applicable where dryers need to be opened regularly [(1)].	Not applicable to this activity
(b)	Induction drying/curing	Online thermal curing or drying by electromagnetic inductors that generate heat inside the metallic work-piece by an oscillating magnetic field.	Only applicable to metal substrates [(1)].	Not applicable to this activity
(c)	Microwave and high- frequency drying	Drying using microwave or high-frequency radiation.	Only applicable to water-based coatings and inks and non-metallic substrates [(1)].	Not applicable to this activity
(d)	Radiation curing	Radiation curing is applied based on resins and reactive diluents (monomers) which react on exposure to radiation (infrared (IR), ultraviolet (UV)), or high-energy electron beams (EB).	Only applicable to specific coatings and inks [(1)].	Not applicable to this activity
(e)	Combined convection/IR radiation drying	Drying of a wet surface with a combination of circulating hot air (convection) and an infrared radiator.	Generally applicable [(1)].	Not considered compatible with existing dryers
(f)	Convection drying/curing combined with heat recovery	Heat from off-gases is recovered (see BAT 19 (e)) and used to preheat the input air of the convection dryer/curing oven.	Generally applicable [(1)].	Hot air will be recirculated in the dryer automatically and is controlled to ensure that the lower explosive limit (LEL) is not exceeded

[(1)] The selection of the drying/curing techniques may be restricted by the substrate type and shape, product quality requirements and the need to ensure that the materials used, coating application techniques, drying/curing techniques and off-gas treatment systems are mutually compatible

2.8 BAT 9 - Reducing VOC emissions during cleaning:

In order to reduce VOC emissions from cleaning processes, BAT is to minimise the use of solvent-based cleaning agents and to use a combination of the techniques given below:

Technique		Description	Applicability	Assessment
(a)	Protection of spraying areas and equipment	Application areas and equipment (e.g. spray booth walls and robots) susceptible to overspray and drips, etc. are covered with fabric covers or disposable foils where foils are not subject to tearing or wear.	The selection of cleaning techniques may be restricted by the type of process, the substrate or equipment to be cleaned and the type of contamination.	Not applicable, spraying not undertaken
(b)	Solids removal prior to complete cleaning	Solids are removed in a (dry) concentrated form, usually by hand, with or without the aid of small amounts of cleaning solvent. This reduces the amount of material to be removed by solvent and/or water in subsequent cleaning stages, and therefore the amount of solvent and/or water used.		Excess residual ink will be recovered from the press for colour-matching of ink returns for maximum re-use of inks
(c)	Manual cleaning with pre-impregnated wipes	Wipes pre-impregnated with cleaning agents are used for manual cleaning. Cleaning agents may be solvent-based, low-volatility solvents or solvent- free.		Pre-impregnated wipers are not proposed Recyclable cloths are proposed for use with dispensed solvent when manual cleaning is required, such as the base of ink trays
(d)	Use of low-volatility cleaning agents	Application of low-volatility solvents as cleaning agents, for manual or automated cleaning, with high cleaning power.		The press will have its own on-board cleaning system. Low volatility solvents are not effective for this purpose. Recycled high volatility solvents will be used as opposed to virgin solvents
(e)	Water-based cleaning	Water-based detergents or water-miscible solvents such as alcohols or glycols are used for cleaning.		Water-based cleaning systems are proposed for anilox rollers and plates
(f)	Enclosed washing machines	Automatic batch cleaning/degreasing of press/machine parts in enclosed washing machines. This can be done using either: (a) organic solvents (with air extraction followed by VOC abatement and/or recovery of the used solvents) (see BAT 15); or (b) VOC-free solvents; or (c) alkaline cleaners (with external or internal waste water treatment).		An enclosed machine is proposed for anilox roller cleaning. A pail washing machine is not proposed.

Technique		Description	Applicability	Assessment
(g)	Purging with solvent recovery	Collection, storage and, if possible, reuse of the solvents used to purge the guns/applicators and lines between colour changes.		If purging is undertaken, recovered solvents will be collected for on-site recycling
(h)	Cleaning with high- pressure water spray	High-pressure water spray and sodium bicarbonate systems or similar are used for automatic batch cleaning of press/machine parts.		Not applicable to this activity
(i)	Ultrasonic cleaning	Cleaning in a liquid using high-frequency vibrations to loosen the adhered contamination.	The selection of cleaning techniques may be restricted by the type of process, the substrate or equipment to be cleaned and the type of contamination.	Not applicable to this activity
(j)	Dry ice (CO_2) cleaning	Cleaning of machinery parts and metallic or plastic substrates by blasting with CO_2 chips or snow.		Not applicable to this activity. Tried by others and has caused damage to equipment
(k)	Plastic shot-blast cleaning	Excess paint build-up is removed from panel jigs and body carriers by shot-blasting with plastic particles.		Given the answer to (j) above, this is not proposed

2.9 BAT 10 - Solvent mass balance:

BAT is to monitor total and fugitive VOC emissions by compiling, at least once every year, a solvent mass balance of the solvent inputs and outputs of the plant, as defined in Part 7(2) of Annex VII to Directive 2010/75/EU and to minimise the uncertainty of the solvent mass balance data by using all of the techniques given below:

Technique		Description	Assessment
(a)	Full identification and quantification of the relevant solvent inputs and outputs, including the associated uncertainty	This includes: ➢ identification and documentation of solvent inputs and outputs, (e.g. emissions in waste gases, emissions from each fugitive emission source, solvent output in waste); ➢ substantiated quantification of each relevant solvent input and output and recording of the methodology used (e.g. measurement, calculation using emission factors, estimation based on operational parameters); ➢ identification of the main sources of uncertainty of the aforementioned quantification, and implementation of corrective actions to reduce the uncertainty; ➢ regular update of solvent input and output data.	The following systems are proposed: ➢ Ink purchases ➢ Solvent purchases ➢ Recycling sludge disposal ➢ Measured influent solvent to RTO ➢ Measured effluent solvent via RTO The outcome of the annual SMP will confirm what further monitoring refinements are required, including: ➢ Flow of dirty solvent to recycler ➢ Flow of distilled solvent from recycler ➢ Assumptions made (where made) ➢ Uncertainties where a numerical result is given ➢ Uncertainties where a data range is given An annual solvent management plan is proposed, and data will be re-confirmed where necessary
(b)	Full identification and quantification of the relevant solvent inputs and outputs, including the associated uncertainty	A solvent tracking system aims to keep control of both the used and unused quantities of solvents (e.g. by weighing unused quantities returned to storage from the application area).	The Operator will implement a stock control system, the exact details are not yet known.
(c)	Monitoring of changes that may influence the uncertainty of the solvent mass balance data	Any change that could influence the uncertainty of the solvent mass balance data is recorded, such as: ➢ malfunctions of the off-gas treatment system: the date and duration are recorded; ➢ changes that may influence air/gas flow rates, e.g. replacement of fans, drive pulleys, motors; the date and type of change are recorded.	Bypass conditions need to be identified and timed as far as practicable for example: ➢ Time taken for valves to switch from bypass to RTO at press start-up (controlled by LEL device) ➢ RTO failure or other OTNOC

2.10 BAT 11 - Monitoring emissions in waste gasses:

BAT is to monitor emissions in waste gases with at least the frequency given below and in accordance with EN standards. If EN standards are not available, BAT is to use ISO, national or other international standards that ensure the provision of data of an equivalent scientific quality:

Substance/ Parameter	Sectors/Sources	Standard(s)	Minimum monitoring frequency	Monitoring associated with	Assessment
Dust	Coating of vehicles – Spray coating	EN 13284-1	Once every year (1)	BAT18	Not applicable to this activity
	Coating of other metal and plastic surfaces – Spray coating				Not applicable to this activity
	Coating of aircraft – Preparation (e.g. sanding, blasting) and coating				Not applicable to this activity
	Coating and printing of metal packaging – Spray application				Not applicable to this activity
TVOC	Any stack with a TVOC load < 10 kg C/h	EN 12619	Once every Year (1)(2)(3)	BAT 14, BAT 15	No stack with a TVOC load < 10 kg C/h. Will be measured annually to EN 12619 standard
	Any stack with a TVOC load ≥ 10 kg C/h	Generic EN standards (4)	Continuous		Not applicable Releases will be < 10 kg C/h
DMF	Coating of textiles, foils and paper (5)	No EN standard available (6)	Once every three months (1)	BAT15	Not applicable to this activity
NO_X	Thermal treatment of off-gases	EN 14792	Once every year (7)	BAT 17	Will be measured annually to EN 14792 standard
CO	Thermal treatment of off-gases	EN 15058	Once every year (7)	BAT 17	Will be measured annually to EN 15058 standard

1. To the extent possible, the measurements are carried out at the highest expected emission state under normal operating conditions.
2. In the case of a TVOC load of less than 0.1 kg C/h, or in the case of an unabated and stable TVOC load of less than 0.3 kg C/h, the monitoring frequency may be reduced to once every 3 years or the measurement may be replaced by calculation provided that it ensures the provision of data of an equivalent scientific quality.
3. For the thermal treatment of off-gases, the temperature in the combustion chamber is continuously measured. This is combined with an alarm system for temperatures falling outside the optimised temperature window.
4. Generic EN standards for continuous measurements are EN15267-1, EN15267-2, EN15267-3 and EN 14181.
5. The monitoring only applies if DMF is used in the processes.
6. In the absence of an EN standard, the measurement includes the DMF contained in the condensed phase.
7. In the case of a stack with a TVOC load of less than 0.1 kg C/h, the monitoring frequency may be reduced to once every 3 years.

2.11 BAT 13 - Other than normal operating conditions:

In order to reduce the frequency of the occurrence of 'Other than normal operating conditions' (OTNOC) and to reduce emissions during OTNOC, BAT is to use both of the techniques given below:

Technique		Description	Assessment
(a)	Identification of critical equipment	Equipment critical to the protection of the environment ('critical equipment') is identified on the basis of a risk assessment. In principle, this concerns all equipment and systems handling VOCs (e.g. off-gas treatment system, leak detection system).	The critical equipment is initially identified as follows: ➢ Regenerative thermal oxidiser for VOC destruction. ➢ Press pneumatic valves (elongated time to abatement or RTO bypass in the event of air leak or signal fault). ➢ Press ATEX VOC monitoring: will vent to bypass if the LEL critical concentrations are detected. Less critical equipment, but equipment worthy of mention is the bunding and containment systems, and dealing with leaks and spills.
(b)	Inspection, maintenance and monitoring	A structured programme to maximise critical equipment availability and performance which includes standard operating procedures, preventive maintenance, regular and unplanned maintenance. OTNOC periods, duration, causes and, if possible, emissions during their occurrence are monitored.	The RTO will benefit from: ➢ Annual service. ➢ Annual extractive emissions monitoring. ➢ An RTO logbook is proposed to record adverse or OTNOC conditions. ➢ Use RTO has status screens to gather information (TBC).

2.12 BAT 14 – Reducing VOC emissions (production & storage):

In order to reduce VOC emissions from the production and storage areas, BAT is to use technique (a) and an appropriate combination of the other techniques given below:

Technique		Description	Applicability	Assessment
(a)	System selection, design and optimisation	An off-gas system is selected, designed and optimised taking into account parameters such as: - amount of extracted air; - type and concentration of solvents in extracted air; - type of treatment system (dedicated/ centralised); - health and safety; - energy efficiency.	Generally applicable.	An RTO is proposed for use. it recycles heat energy internally to make the VOC destruction process more efficient
(b)	Air extraction as close as possible to the point of application of VOC-containing materials	Air extraction as close as possible to the point of application with full or partial enclosure of solvent application areas (e.g. coaters, application machines, spray booths). Extracted air may be treated by an off-gas treatment system.	May not be applicable where enclosure leads to difficult machinery access during operation. Applicability may be restricted by the shape and size of the area to be enclosed.	Modern purpose built presses proposed designed and built for efficient extraction
(c)	Air extraction as close as possible to the point of preparing paints/coatings/ adhesives/inks	Air extraction as close as possible to the point of preparing paints/coatings/adhesives/inks (e.g. mixing area). Extracted air may be treated by an off-gas treatment system.	Only applicable where paints/coatings/ adhesives/inks are prepared.	Preparation is in an area with dedicated room extraction.
(d)	Extraction of air from the drying/curing processes	The curing ovens/dryers are equipped with an air extraction system. Extracted air may be treated by an off-gas treatment system.	Only applicable to drying/curing processes.	Modern purpose built presses proposed designed and built for efficient extraction

Technique		Description	Applicability	Assessment
(e)	Minimisation of fugitive emissions and heat losses from the ovens/dryers either by sealing the entrance and the exit of the curing ovens/dryers or by applying sub-atmospheric pressure in drying	The entrance to and the exit from curing ovens/ dryers are sealed to minimise fugitive VOC emissions and heat losses. The sealing may be ensured by air jets or air knives, doors, plastic or metallic curtains, doctor blades, etc. Alternatively, ovens/dryers are kept under sub-atmospheric pressure.	Only applicable when curing ovens/dryers are used.	Modern purpose built presses proposed designed and built for efficient extraction
(f)	Extraction of air from the cooling zone	When substrate cooling takes place after drying/ curing, the air from the cooling zone is extracted and may be treated by an off-gas treatment system.	Only applicable when substrate cooling takes place after drying/curing.	Modern purpose built presses proposed designed and built for efficient extraction
(g)	Extraction of air from storage of raw materials, solvents and solvent-containing wastes	Air from raw material stores and/or individual containers for raw materials, solvents and solvent-containing wastes is extracted and may be treated by an off-gas treatment system.	May not be applicable for closed containers or for storage of raw materials, solvents and solvent-containing wastes with a low vapour pressure and low toxicity.	May not be applicable for closed containers or for storage of raw materials, solvents and solvent-containing wastes with a low vapour pressure and low toxicity.
(h)	Extraction of air from cleaning areas	Air from the areas where machine parts and equipment are cleaned with organic solvents, either by hand or automatically, is extracted and may be treated by an off-gas treatment system.	Only applicable to areas where machine parts and equipment are cleaned with organic solvents.	Modern purpose built presses proposed designed and built for efficient extraction during cleaning

2.13 BAT 15 - Reducing VOC emissions in waste gases:

In order to reduce VOC emissions in waste gases and increase resource efficiency, BAT is to use one or a combination of the techniques given below:

Technique		Description	Applicability	Assessment
I. Capture and recovery of solvents in off-gases				
(a)	Condensation	A technique for removing organic compounds by reducing the temperature below their dew points so that the vapours liquefy. Depending on the operating temperature range required, different refrigerants are used, e.g. cooling water, chilled water (temperature typically around 5 °C), ammonia or propane.	Applicability may be restricted where the energy demand for recovery is excessive due to the low VOC content.	Not considered applicable to this activity.
(b)	Condensation	VOCs are adsorbed on the surface of activated carbon, zeolites or carbon fibre paper. Adsorbate is subsequently desorbed, e.g. with steam (often on site), for reuse or disposal and the adsorbent is reused. For continuous operation, typically more than two adsorbers are operated in parallel, one of them in desorption mode. Adsorption is also commonly applied as a concentration step to increase the subsequent oxidation efficiency.	Applicability may be restricted where the energy demand for recovery is excessive due to the low VOC content.	Not considered applicable to this activity.
(c)	Absorption using a suitable liquid	Use of a suitable liquid to remove pollutants from the off-gas by absorption, in particular soluble compounds and solids (dust). Solvent recovery is possible, for example, using distillation or thermal desorption. (For dust removal, see BAT 18.)	Generally applicable.	Not considered applicable to this activity.
II. Thermal treatment of solvents in off-gases with energy recovery				
(d)	Sending off-gases to a combustion plant	Part or all of the off-gases are sent as combustion air and supplementary fuel to a combustion	Not applicable for off-gases containing substances referred to in IED Article	Proposed see section (f)

Technique		Description	Applicability	Assessment
		plant (including CHP (combined heat and power) plants) used for steam and/or electricity production.	59(5). Applicability may be restricted due to safety considerations.	
(e)	Recuperative thermal oxidation	Thermal oxidation using the heat of the waste gases, e.g. to preheat the incoming off-gases.	Generally applicable.	Not proposed, see (f)
(f)	Regenerative thermal oxidation with multiple beds or with a valveless rotating air distributor	An oxidiser with multiple beds (three or five) filled with ceramic packing. The beds are heat exchangers, alternately heated by flue-waste gases from oxidation, then the flow is reversed to heat the inlet air to the oxidiser. The flow is reversed on a regular basis. In the valveless rotating air distributor, the ceramic medium is held in a single rotating vessel divided into multiple wedges.	Generally applicable.	An efficient three tower RTO is proposed
(g)	Catalytic oxidation	Oxidation of VOCs assisted by a catalyst to reduce the oxidation temperature and reduce the fuel consumption. Exhaust heat can be recovered with recuperative or regenerative types of heat exchangers. Higher oxidation temperatures (500–750 °C) are used for the treatment of off-gas from the manufacturing of winding wire.	Applicability may be restricted by the presence of catalyst poisons.	Not proposed, see (f)
III. Treatment of solvents in off-gases without solvent or energy recovery				
(h)	Biological off-gas treatment	Off-gas is dedusted and sent to a reactor with biofilter substrate. The biofilter consists of a bed of organic material (such as peat, heather, compost, root, tree bark, softwood and different combinations) or some inert material (such as clay, activated carbon,	Only applicable to the treatment of biodegradable solvents.	Not proposed

Technique		Description	Applicability	Assessment
		and polyurethane), where the off-gas stream is biologically oxidised by naturally occurring microorganisms into carbon dioxide, water, inorganic salts and biomass. The biofilter is sensitive to dust, high temperatures or high variations in the off-gas, e.g. of the inlet temperature or the VOC concentration. Supplementary nutrient feeding may be needed.		
(i)	Thermal oxidation	Oxidation of VOCs by heating off-gases with air or oxygen to above their auto-ignition point in a combustion chamber and maintaining a high temperature long enough to complete the combustion of VOCs to carbon dioxide and water.	Generally applicable.	RTOs are generally preferred for their energy efficiency, and an RTO is proposed

2.14 BAT 16 - Reducing energy consumption:

In order to reduce the energy consumption of the VOC abatement system, BAT is to use one or a combination of the techniques given below:

Technique		Description	Applicability	Assessment
(a)	Maintaining the VOC concentration sent to the off-gas treatment system by using variable-frequency drive fans	Use of a variable-frequency drive fan with centralised off-gas treatment systems to modulate the airflow to match the exhaust from the equipment that may be in operation.	Only applicable to central thermal off-gas treatment system in batch processes such as printing	The LEL monitors will control damper operation and therefore modulate airflow.
(b)	Internal concentration of solvents in the off-gases	Off-gases are recirculated within the process (internally) in the curing ovens/dryers and/or in spray booths, so the VOC concentration in the off-gases increases and the abatement efficiency of the off-gas treatment system increases.	Applicability may be limited by health and safety factors such as the LEL, and product quality requirements or specifications	Presses will manage this as far as practicable via the on-board LEL monitors.
(c)	External concentration of solvents in the off-gases through adsorption	The concentration of solvent in off-gases is increased by a continuous circular flow of the spray booth process air, possibly combined with curing oven/dryer off-gases, through adsorption equipment. This equipment can include: - fixed bed adsorber with activated carbon or zeolite; - fluidised bed adsorber with activated carbon; - rotor adsorber with activated carbon or zeolite; - molecular sieve.	Applicability may be restricted where the energy demand is excessive due to the low VOC content.	Not applicable due to the high VOC concentrations in the influent gas streams.
(d)	Plenum technique to reduce waste gas volume	Off-gases from curing ovens/dryers are sent to a large chamber (plenum), and partly recirculated as inlet air in the curing ovens/dryers. The surplus air from the plenum is sent to the off-gas treatment system. This cycle increases the VOC content of the curing ovens/dryers' air and decreases the waste gas volume.	Generally applicable	Presses will manage this as far as practicable via the on-board LEL monitors.

2.15 BAT 17 - Reducing NOx emission whilst limiting CO:

In order to reduce NO_X emissions in waste gases while limiting CO emissions from the thermal treatment of solvents in off-gases, BAT is to use technique (a) or both of the techniques given below:

Technique		Description	Applicability	Assessment
(a)	Optimisation of thermal treatment conditions (design and operation)	Good design of the combustion chambers, burners and associated equipment/devices is combined with optimisation of combustion conditions (e.g. by controlling combustion parameters such as temperature and residence time) with or without the use of automatic systems and the regular planned maintenance of the combustion system according to suppliers' recommendations.	Design applicability may be restricted for existing plants.	The BRef emission limits for oxides of nitrogen and carbon monoxide are 130mg/Nm^3 and 150mg/Nm^3 respectively, which are greater than the existing 100mg/Nm^3 limits provided by UK Sector Guidance SG6/11. The defra Local Authority Unit (LAU) has advised in its disaggregated BAT conclusions that there will be no backsliding on UK emission limits, and the existing 100mg/Nm^3 limits will prevail. The proposed RTO has been selected with the aim of compliance with the specified contained emission limits
(b)	Use of low-NOX burners	The peak flame temperature in the combustion chamber is reduced, delaying but completing the combustion and increasing the heat transfer (increased emissivity of the flame). It is combined with increased residence time in order to achieve the desired VOC destruction.	Applicability may be restricted at existing plants by design and/or operational constraints.	The RTO will be equipped with a Low-NOx burner, however the RTO will run 'Autothermal' during print runs, meaning that it is self-sustaining combustion and the on-board gas burner is not used.

2.16 BAT 19 - Using energy efficiently:

In order to use energy efficiently, and Table 18.3 provides the BAT-associated environmental performance levels (BAT-AEPLs) for specific energy consumption:

Sector	Process	Unit	BAT-AEPL (Yearly average)
Flexography and nonpublication rotogravure printing	All product types	Wh/m^2 of printed area	350

BAT is to use techniques (a) and (b) and an appropriate combination of the techniques (c) to (h) given below:

Technique		Description	Applicability	Assessment
Management techniques				
(a)	Energy efficiency plan	An energy efficiency plan is part of the EMS (see BAT 1) and entails defining and calculating the specific energy consumption of the activity, setting key performance indicators on an annual basis	The level of detail and nature of the energy efficiency plan and of the energy balance record will generally be related to the nature, scale and complexity of the installation and the types of energy sources used. It may not be applicable if the STS activity is carried out within a larger installation, provided that the energy efficiency plan and the energy balance record of the larger installation sufficiently cover the STS activity.	Energy consumption per Wh/m^2 of printed area to be calculated annually
(b)	Energy balance record	(i) The drawing up once every year of an energy balance record which provides a breakdown of the energy consumption and generation (including energy export) by the type of source (e.g. electricity, fossil fuels, renewable energy, imported heat and/or cooling). This includes: defining the energy boundary of the STS activity; (ii) information on energy consumption in terms of delivered energy; (iii) information on energy exported from the plant; (iv) energy flow information		The following actions are proposed to guide the level of detail in any plan generated for BAT1: ➢ Gather basic energy use data (utilities and meter readings). ➢ Consider separate RTO gas meter if not already fitted. ➢ Understand energy saved by energy recovery. ➢ Present energy data against m2 of material produced.

Technique		Description	Applicability	Assessment
Process-related techniques				
(c)	Thermal insulation of tanks and vats containing cooled or heated liquids, and of combustion and steam systems	This may be achieved for example by: - using double-skinned tanks; - using pre-insulated tanks; - applying insulation to combustion equipment, steam pipes and pipes containing cooled or heated liquids.	Generally applicable.	Not appliable. Activity does not involve these systems
(d)	Heat recovery by cogeneration – CHP (combined heat and power) or CCHP (combined cooling, heat and power)	Recovery of heat (mainly from the steam system) for producing hot water/steam to be used in industrial processes/activities.	Applicability may be restricted by the plant layout, the characteristics of the hot gas streams (e.g. flow rate, temperature) or the lack of a suitable heat demand.	Not applicable – no steam systems
(e)	Heat recovery from hot gas streams	Energy recovery from hot gas streams (e.g. from dryers or cooling zones), e.g. by their recirculation as process air, through the use of heat exchangers, in processes, or externally.		Hot air will be recirculated in the dryer automatically and is controlled to ensure that the lower explosive limit (LEL) is not exceeded Heat recovery will be incorporated into the scheme
(f)	Flow adjustment of process air and off-gases	Adjustment of the flow of process air and off-gases according to the need. This includes reduction of air ventilation during idle operation or maintenance.	Generally applicable.	The RTO fans will be equipped with inverter drives
(g)	Spray booth off-gas recirculation	Capture and recirculation of the off-gas from the spray booth in combination with efficient paint overspray separation. Energy consumption is less than in the case of fresh air use.	Applicability may be restricted by health and safety considerations.	Not applicable – no spray booths
(h)	Optimised circulation of warm air in a large- volume curing booth using an air turbulator	Air is blown into a single part of the curing booth and distributed using an air turbulator which turns the laminar airflow into the desired turbulent flow.	Only applicable to spray coating sectors.	Not applicable

2.17 BAT 22 - Reducing waste sent for disposal:

In order to reduce the quantity of waste sent for disposal, BAT is to use the techniques (a) and (b) and one or both of the techniques (c) and (d) given below.

Technique		Description	Assessment
(a)	Waste management plan	A waste management plan is part of the EMS (see BAT 1) and is a set of measures aiming to: 1) minimise the generation of waste, 2) optimise the reuse, regeneration and/or recycling of waste and/or the recovery of energy from waste, and 3) ensure the proper disposal of waste.	A simple waste management plan will need to be implemented as part of the EMS.
(b)	Monitoring of waste quantities	Annual recording of waste quantities generated for each type of waste. The solvent content in the waste is determined periodically (at least once every year) by analysis or calculation.	All waste disposed of will be recorded and a summary reported annually
(c)	Recovery/recycling of solvents	Techniques may include: ➢ recovering /recycling solvents from liquid waste by filtration or distillation on site or off site; ➢ recovering/ recycling the solvent content of wipes by gravitational draining, wringing or centrifugation.	On-site solvent recovery is proposed
(d)	Waste-stream-specific techniques	Techniques may include: ➢ reducing the water content of the waste, e.g. by using a filter press for the sludge treatment; ➢ reducing the sludge and waste solvent generated, e.g. by reducing the number of cleaning cycles (see BAT 9); ➢ using reusable containers, reusing the containers for other purposes, or recycling the container material; ➢ sending the spent limestone generated from dry scrubbing to a lime or cement kiln.	A simple waste management plan will need to be implemented as part of the EMS.

2.18 BAT 23 - Reducing odour emissions:

In order to prevent or, where that is not practicable, to reduce odour emissions, BAT is to set up, implement and regularly review an odour management plan, as part of the environmental management system (see BAT 1), that includes all of the following elements:

- a protocol containing actions and timelines;
- a protocol for response to identified odour incidents, e.g. complaints;
- an odour prevention and reduction programme designed to identify the source(s), to characterise the contributions of the source(s), and to implement prevention and/or reduction measures.

Applicability:

The applicability is restricted to cases where an odour nuisance at sensitive receptors is expected and/or has been substantiated.

Response:

The proposed installation will be located in an industrial location, away from sensitive receptors

A specific odour management plan is not considered necessary for this installation. A simple regular site audit, which includes a documented olfactory check should be sufficient.

2.19 BAT conclusions for flexography:

The following emission limits are specific to flexography printing activities:

Table 18.28: BAT-associated emission level (BAT-AEL) for total emissions of VOCs from flexography and non-publication rotogravure printing:

Parameter	Unit	BAT-AEL (yearly average)	Assessment
Total VOC emissions as calculated by the solvent mass balance	kg VOCs per kg of solid mass input	< 0.01 – 0.03	The Operator does not propose to demonstrate compliance via this route on the basis that the selected RTO will meet the required contained emission limit, however the Operator requests the flexibility on the compliance option until the RTO has been commissioned and tested.

or

Table 18.29: BAT-associated emission level (BAT-AEL) for fugitive emissions of VOCs from flexography and non-publication rotogravure printing:

Parameter	Unit	BAT-AEL (yearly average)	Assessment
Fugitive VOC emissions as calculated by the solvent mass balance	Percentage (%) of the solvent input	< 1 – 12	The Operator proposes to comply with the upper bound of this emission limit. Operator requests the flexibility on the compliance option until the RTO has been commissioned and tested.

and

Table 18.30: BAT-associated emission level (BAT-AEL) for VOC emissions in waste gases from flexography and non-publication rotogravure printing:

Parameter	Unit	BAT-AEL (yearly average)	Assessment
TVOC	mg C/Nm^3	1 - 20	The Operator proposes to comply with the upper bound of this emission limit. Operator requests the flexibility on the compliance option until the RTO has been commissioned and tested.

Resources:

STS BREF
Surface Treatment Using Organic Solvents including Wood and Wood Products Preservation with Chemicals | Eippcb (europa.eu)

STS BREF BAT Conclusions
https://eur-lex.europa.eu/legal-content/EN/TXT/PDF/?uri=CELEX:32020D2009&from=EN

UK Interpretation Guidance for…
Best Available Techniques (BAT) conclusions for surface treatment using organic solvents