Fabric Inspection in Folding: Current Scenario in India

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Abstract

Over the years, our fabric manufacturers have geared up their manufacturing process to meet global export as well as domestic quality standards. To meet the required quality standards, various quality control parameters have been followed at various stages of manufacturing right from raw material selection, in-process quality control, on-machine inspection, etc. Even after controlling those quality control parameters, there are chances of the appearance of defects in the fabric which decided the quality of the final products. Therefore fabric inspection, the last major quality control activity before reaching the customer, is the most important process of the manufacturing supply chain. Considering this, various assessments and observations related to the inspection system at the final inspection stage i.e. at folding, have been done during our various inspection assignments as well as training program conducted for various mills/fabric suppliers. This paper is focussed on the various aspect of the fabric inspection system followed in the Indian textile industry i.e. inspection set-up, its functioning, and maintenance, the methodology followed during the inspection, quality of Inspection &skill of fabric checkers, etc. Views about similarities and dissimilarities in inspection systems observed at various inspection places are also given in the articles. In general, the overall functioning of the fabric inspection system at various inspection places in India is elaborated on in this article.

Key words:
Inspection, 4-point inspection system, Comparison; Quality Standards, Inspection Criteria

Citation
Vijay Gawde - "Fabric Inspection in Folding: Current Scenario in India", *BTRA Scan* - Vol. LII No. 1 JAN. 2023, Page no. 13 to 20

1.0 Introduction

The textile and apparel industry which was once the backbone of developed countries has lost its base due to cost economic structure and has shifted to many developing countries such as India, Bangladesh, Sri Lanka, etc. The textile and apparel industry is one of the leading segments of our economy and the largest source of foreign currency earnings and employment for our country. Over the years, our fabric manufacturers have geared up their manufacturing process to meet global export as well as domestic quality standards. Our they are now in a position to supply various types of fabric as per required quality standards at market competitive rates.

To meet the required quality standards as per buyer's requirements, various quality control parameters are being followed at various stages of manufacturing right from raw material selection and its quality parameters confirmation, in-process quality checks, on-machine inspection, etc. However, even after controlling the above aspects, there are chances of the appearance of various defects in the fabric on which its selling and acceptance criteria are dependent. Therefore fabric inspection, the last major quality control activity before reaching the customer, is one of the most final important activities in the fabric manufacturing supply chain. It is also well-known that on average, around 40% to 60% of garment defects are associated with fabric defects, and this truly highlights the importance of assessing the quality of fabric. A proper fabric inspection can do just this and can ensure the quality of key materials from the beginning as far as apparel manufacturing is concerned. Considering this aspect, most of the fabric manufacturing units are carrying out fabric inspections at greige or finished stages. Over the last 25 years, BTRA is carrying out fabric inspection activities for third parties at various locations in India as well as conducting many training and awareness programs related to fabric inspections. Due to the above activities, we come across various similarities, differences, and limitations in the inspection system carried out by the various manufacturing units. Although a 4-point inspection system is being followed by most of the unit, the interpretation of various checking/inspection points of the same system are found to vary from unit to unit as well as among the persons within the same units. Some of these points are elaborated in this article.

1.1 Importance of fabric inspection

As mentioned above, a proper fabric inspection can minimise the rejection % of the final product i.e. apparel or made-up but there are other reasons which are crucial element for any factory. Whether it is a reduction in productivity or an increase in overheads, processors or

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garment manufacturers can face production challenges from defective fabric such as:

- Inconsistencies in the cuttable width will impact their fabric consumption/realisation.
- Different colour shades among rolls or within the same roll impact product quality and requires special management during the cutting/sewing/packing and other production steps to segregate by colour shades.
- High defect rates in the fabric will impact the consumption per garment and increase the risk of defects found in the garment.

2. Inspection system used in fabric inspection

There are several grading systems adopted for fabric inspection all over the world such as Graniteville "78" system, Dallas system, 4-point system, 10-point system, etc. Among all, the 4-point system has become the most commonly adopted system in the world as well as in India due to its practical, impartial, and worldwide recognition. The 4-point system works on a penalty point basis and as its name has probably suggested, points are given from 1 to 4 depending upon the length and in a few cases, the severity of the defect. In most cases, the activities of inspection, as well as mending of small to medium-type defects, are being carried out by a checker whereas another mending person carried out major or repeated type of defects which are normally tagged/flagged by the 1st checker. In these cases, a major trend has been found related to either thorough inspection of fabric at recommended speed(up to 15 meters per minute) or inspection at abnormally high speed. In the case of inspection and mending by same checker, there are chances of loss of concentration due to frequent mending work and chances of ineffective inspection work due to inspection at abnormally higher speed and production target constraints. the inspection departments/persons are found to be balancing the above activities as far as production/dispatched target and the defect-free product is concerned. As mentioned above, the checkers were found to be performing the inspection at an abnormally high speed to achieve the daily inspection target leading to more chances of non-detection of smaller defects (mainly 1 to 2-point defects). In the above cases, effective supervision and frequent cross-checking of inspected fabric are very much essential to supply defect-free fabric within the targeted schedule time. Regular third-party inspection assessment is another solution to cross-check the proper functioning of inspection and mending related activities. BTRA is regularly carrying out such inspections for two prominent mills in India. In this activity, BTRA shop-floor technologists from the weaving and process field is carrying out the inspection work at regular intervals and give details assessments of inspection as well as co-related fabric manufacturing / processing aspects.

In most cases, the fabric is found to be inspected and graded on one side only. However, as per certain end uses or buyer requirements, it may be inspected and graded on both sides. As per our observations, 95 to 98% of fabric qualities are inspected on one side of the fabric only. There is no fixed trend observed as far as inspection carried out through the front light or back light source.

At most of the composite manufacturing units, inspection is found to be done at greige as well as finished folding stages (post chemical processing). While the result of the inspection done at finished folding/packing is more useful to the buyers in terms of fabric quality as well as the back process for controlling the quality, the result of the inspection done at greige folding is more useful to controlling the yarn and fabric defects at spinning and weaving.

3. Fabric Inspection Set-up

Presently, inspection in India is carried out through 3 major means i.e. on the slanted table, horizontal table, and inspection machine having illuminated glass either from top-front or backlight. Among these, the majority of the inspections are carried out on inspection glass machines (70 to 80%) due to their suitability for a faster, more convenient, and more effective inspection process. Therefore, in this article, more emphasis will be given to the process carried out on fabric inspection machines.

Normally, at small manufacturing/fabric supply units, inspection is carried out on Horizontal or Slanting Inspection tables illuminated from the top and bottom. This is a very simple low-cost entry-level arrangment on which a fabric inspector pulls the fabric over the lighted inspection table and the defects are located, marked, and recorded in the inspection form manually. For the easy flow of fabric, a top fabric guide roll is provided, with an option of adding an edge guide and a meter counter. In another case, inspection is carried out on a horizontal table surface. This is also a low-cost alternative as compared to fabric inspection machines and is more affordable to a small fabric manufacturer. This system is more convenient for the inspection of wider-width fabric if there is a fabric width-related limitation on an already installed inspection machine. However, due to less inspection speed along with the employment of two persons per table for carrying out the inspection, the inspection cost is found to be higher. In most of the manufacturing/inspection places in India, the inspection is carried out on mechanical/semi-automatic fabric Inspection machines which are power-driven with variable frequency drive motors for precise speed control and proximity sensors to control the uniformity of edges, with an auto-stop option. The machine speed can be controlled precisely as per requirement in relation to required quality of inspection and inspection rate. Some models have provisions to inspect delicate fabrics at zero tension to avoid damage to the structure of the fabric. Some of these machines are fitted with electronic wheel-type encoder to measure the length of the inspected fabric as well as monitor the width of the fabric. While the length measurement helps define the number and length of lays, even the width of the fabric during rolling

maximizes fabric utilization. All these factors help in achieving better and faster inspection. Nowadays, few fabric manufacturing units are either installed or in the process of installing software add-ons for defect documentation on the machines for documenting, analysis, and decision-making about the defect pattern. This 'fabric inspection defect analysis software' (DEFECT MAPPING SYSTEM) is available in the market and can be installed on any fabric inspection machine of any brand and make. It is used for recording point for defect or any other related entry through a touch screen monitor while inspecting the fabric thereby avoiding the time-consuming work of writing the fabric details and recording the defects in the checklist. The person can concentrate more on inspection work. This digital system performs automatic fabric gradation based on several defects, providing aid in choosing appropriate fabric roll with fewer defects and can be easily integrated with all the existing CAD and ERP software in the unit to obtain efficient marker and cutting plans. The software works on the 4-point system for fabric inspection as per ASTM standards, the most commonly used system for inspection.

The comparative study of inspection with and without the Defect Mapping System carried out by us indicates that inspection production can be increased by 10 to 20% depending upon no. of defects in the cloth roll (Refer Table 1). However, more than this, there is a marked improvement in the checker's concentration and quality of work due to less documentation work. Also, in the case of inspection with the Defect Mapping System, the quality of mending work was found to be more effective along with less skipping of defects to be documented where both inspection as well as mending work was being performed by the checker. The supervision, production control, and analysis work related to inspection will be greatly reduced as the Defect Mapping System will take care of the same. The reports generated through such a system are instrumental in planning the consecutive processes as well as maintaining a library of the defects that occurred for future reference.

Table 1: Comparative study of inspection with and without Defect Mapping System

No. of meters checked @avg. 15 meters per minute	No. of defects observed and documented for a given length	Total time is taken for inspection, without out Defect Mapping System(minutes)	Time is taken for inspection with Defect Mapping System (minutes)	% gain in inspection rate
300	24	23.7	20.2	17.4
320	15	24.0	21.5	11.6
282	28	23.0	19.0	21.4
314	12	23.3	21.1	10.3
			Avg.	**15.2**

For specific requirement, additional systems are available with the inspection machines which simplify the operator's work, achieve the good wounded quality of cloth rolls, removes suspended fluff/waste from the fabric surface before inspection, etc. These are End of Roll Sensor, Edge Control System, Tension Control System, and Air Blow System. So, depending upon the quality requirement and additional cost factor, some of the units are either already installed or planning to be installed the same .

As far as inspection quality is concerned in all the above cases, no significant difference is found considering the other standard condition maintained during inspection i.e. lightning arrangement, working comfort, etc., and mainly depends on the skill and expertise of the checker. Therefore, while setting-up inspection machine, manufactures of fabric consider various aspects for carrying out inspection at feasible cost and is depended on various parameters i.e. the scale of production, affordability, frequency or requirement of inspection, type of product w.r.t. buyers/market (export / domestic / brand / Institute buying, etc.).

3.1 Observations and maintenance of inspection set-up at workplaces

During various training programs and inspection assignments, we observed various points related to inspection set-up which were affecting the inspection quality. It is also observed that maintenance of the inspection machines was the last or least priority subject as far as preventive maintenance of all productive machines is concerned. We found this aspect was affecting the inspection quality as well as targeted inspection production. A few of the observations are given below;

Lighting: Poor or insufficient lighting arrangement is one of the major issues we observed which affects the inspection work quality greatly. Normally inspection of fabric(front or back side) is illuminated from the front and/or backlight depending on the type of fabric and buyer's requirement. As per the requirement of sufficient lighting i.e. provision of backlighting (transmitted) light and the overhead direct lighting source to get a surface illumination level of a minimum of 1075 lux (100-foot candles), there were incidences of very poor lighting. We observed insufficient attention was given even after installing good quality machines. In most of these cases, a few backlights under the inspection glass were found to be not working resulting insufficient light at inspection position. As mentioned in detail in the following topic 4, there is a tendency to inspect the fabric at abnormally high speed. Therefore, there are always chances of non-detection of certain defects due to poor light arrangements, particularly at selvage side fabric and wider width fabric.

Quality of Inspection Glass: Quality of inspection glass i.e. white frosted glass was found to be satisfactory on most of the machines as far as the front surface of the glass. Except few incidences of stains on inspection glass, the condition of

the same was found satisfactory at most places. Cleaning of glasses with a soft cloth (scratches should be avoided) at a regular interval (preferably once in 3 months) and complete overhauling including cleaning of the glass from the back side and checking of light sources under the inspection glass once in a year is recommended to keep the satisfactory condition of glass and working of Machine.

Maintenance of rollers, controls, and other mechanisms: Quality of inspection is inversely related to fabric running speed on glass. Incidences of inspection at much higher or improper speed due to faulty speed control knobs were observed on many machines resulting in poor quality of the inspection. Improper functioning of front/backlight sources, improper functioning of forward and reverse mechanism, threads/waste around the bearing/shafts of different rollers of inspection machine, improper functioning of fabric edge control mechanism, etc. were others major parameters found to be put extra stress/workload on the checker thereby affecting inspection quality and production. As mentioned above, regular preventive maintenance of all aspects related to the inspection machine is the only solution to achieve effective inspection at a higher production rate. in Speed control, roller cleanliness, edge control mechanism

Calibration of meter counter: On all mechanical / semi-automatic fabric Inspection machines, the fabric length measuring device is either mechanical or Electronic Encoder type with a measuring roller surface of metal knurling or rubber. In the case of metal knurling rollers, the chances of slippages are more leading to improper length measurement. Considering the number of fabric rolls inspected daily on the inspection machine, fractional variation in length measurement may lead to high uncounted fabric length losses to the supplier. Rollers with a rubber surface layer are more suitable to get an accurate reading as compared to knurled roller devices. However, over prolonged uses, the diameters of the roller will be reduced due to friction of the rubber surface leading to improper length measurement. Therefore it requires calibration at a fixed interval(preferably once a year) to ascertain accurate length measurement. In this matter, only a few companies are found to maintain the system of calibration through a third party.

Other Machine Aspects: Other machine aspects are aiding to improve checkers' performance in terms of inspection quality and production e.g. at some workplaces, sliding (attached with the machine) or movable type sitting arrangements for fabric checkers were found. Regarding the provision of this arrangement, different opinion was found among various shopfloor management. However, most of them are supportive of such a system since it relieves the fatigue of checking a person working continuously in a standing position.

As mentioned above, most of the units are planning to install the Software add-on 'DEFECT MAPPING SYSTEM' for defect documentation on the existing machines to be purchased. This is also helping to increase inspection production by 10 to 20% due to the ease of detection & documentation process.

Effective Material Handling within the folding department is another important factor and modern and medium to bigger size textile units are using various equipment i.e. trolleys, battery operated pallet trucks, hand pallets trucks, overhead cranes, etc. to ease the loading/unloading operation of cloth rolls. This helps in saving the inspection process time considerably.

4. Methodology of the 4-point inspection system followed in India

As mentioned above, fabric inspection is carried out as per a 4-point inspection system, according to ASTM D5430 – 13(2017) which is a standardized Test Method for Visually Inspecting and Grading fabric. Under the above standards, inspection is carried out as per certain major criteria's which are following:

- Assign no more than a total of 4 points to any one linear meter or yard of fabric, regardless of the number or size of the detected individual defects.
- Assign 4 points to each consecutive linear meter or yard in which a continuous running defect exceeds 230 millimeters or 9 inches.
- Assign 4 points to each linear meter or yard of the fabric where the useable width is less than the minimum specified.
- Assign 4 points to each seam or other full-width defect or seam if applicable.
- Defects not visible on the face of the fabric shall not be counted unless an agreement to the contrary has been made between the purchaser and the supplier.
- Each roll or bale shall be rejected if inspection and grading result in a total number of defect points exceeding the maximum acceptable level mutually agreed upon by the purchaser and supplier.
- The total shipment shall be rejected if the sample inspected exceeds the maximum acceptable defect level mutually agreed upon by the purchaser and supplier.

In most of the cases, inspection were found to be carried out as per above mentioned criteria. However, over the years, apart from the abovementioned clauses, several other inspection clauses have been added to the above standard method as per the requirements of buyers and a few of them now become a common part of the inspection method which is being followed by most of the units in India. Some of these points and their adaptability in the existing system are mentioned below in Table 2;

Table 2: Addition of other inspection clauses and their adaptability in the process

Inspection clauses	Adaptability / Trends observed at different workplaces
1) Severe defects are assigned a maximum of four points for each meter in which they occur. For example: regardless of size, the hole would be penalized four points.	This parameter is adapted by most of the units during the inspection. However, in some units, the fabric will reject in case of detection of a major defect e.g. hole, major crack, major float, and no 4 points will be assigned
2) A hole or torn is considered to be a major defect and shall be penalized four points	
3) Any running defect of more than 4 continuous yards or meters will cause the roll to be rejected.	This parameter is adapted by most of the units.
4) Continuing conditions such as barre, side center side shading, roll-to-roll shading, narrow or irregular width, creasing, and uneven finish shall be counted as four points for every meter within the roll that is found to contain these conditions.	Although known to most of the concerned persons, adaptability was found poor (Awareness or seriousness about such clause was found poor due to very a smaller number of fabric rejection incidences from buyers).
5) No roll that contains more than four full width defects per one hundred linear meters, shall be accepted as first quality.	This parameter is adapted by most of the units during the inspection.
6) No piece shall we accept as first quality with more than 3 full width majors per 100 linear yards.	This parameter is adapted by most of the units during the inspection.
7) No piece shall be accepted with 50% of the defects which are 1-point defect	Very few units have adapted this point. In most cases, points are not assigned to small defects (1 or 2 points related to defects). Not aware by many units.
8) Fabric width should be checked at three positions of the same roll during the inspection (beginning, middle, and end of a piece). Rolls having a measurement of less than the specified purchased width will not be accepted except by the term agreed by the buyer.	This parameter is known to many inspection persons (checkers, supervisors, etc). However, most of them were not performing during the inspection. It was also observed that measuring tape was not available with the checkers.
9) For woven fabric, rolls having a measurement of 1" wider than the specified purchased width will not be accepted. But for the stretched woven fabric, it can be accepted 2" wider than the specified purchased width unless an agreement to the contrary has been made between the purchaser and the supplier.	This parameter is adapted by most of the units during the inspection. But the acceptability criteria may vary as per the buyer's requirement.
10) No piece shall be accepted that contains a full width defect in the first and last three meters or yards	This parameter is either not aware by the inspection persons or if known, then the same is found to be not followed during the inspection mainly due to negligence or lack of attention during loading and restarting of the new fabric roll. This parameter is more suitable for fabric selling through retail sale i.e. suiting, shirting, dress material, furnishing fabric
11) Waviness, tightness, ripples, and puckering in the body of fabric which would prevent the fabric from lying flat when spread conventionally is not acceptable.	This parameter is known to many concerned persons (checkers, supervisors, HOD, etc). However, most of them are not checked for the mentioned defects during the inspection. (Awareness or seriousness about such clause was found poor due to very a smaller number of fabric rejection incidences from buyers)
12) No roll shall be accepted as a first quality that exhibits a noticeable degree of loss or tightness along either or both selvages, or ripples, puckers, folds, or creases in the body of the fabric that would prevent the fabric from lying flat when being spread conventionally.	
13) **Shade Matching:**	
· Rolls with side-to-side, side center side, or end-to-end shading must be no less than a 4 Grey Scale rating according to the AATCC Grey Scale. Four points shall be assigned to each yard of the inspected roll that contains this type of shading defect.	This parameter is adapted by most of the units mostly before packing. A strip of fabric is found to be cut from each inspected fabric and packed according to the group of matching shades.
· If the shade of the fabric being inspected does not match the provided approval sample, which must be no less than a 4-5 Grey Scale rating, the shipment will fail the inspection. No penalty points will be assigned to the rolls for the offside condition. The inspection of	This parameter is adapted by most of the units mostly before packing.

Inspection clauses	Adaptability / Trends observed at different workplaces
1) **Splices / TP:** For woven fabric, rolls can be composed of several spliced parts. No roll shall be accepted that contains a splice less than forty (40) yards in length unless otherwise stated in the purchasing agreement.	This parameter is adapted by most of the units. The final decision will be taken as per the buyer's requirements.
2) **Bowing & Skewing:** For both woven & knit fabric, no rolls shall be accepted as a first quality that exhibits bow or bias or more than 2% for print or stripe fabric & 3% for solid/single coloured fabric.	This parameter is adapted by most of the units during the inspection. But the acceptability criteria i.e. % bowing or skewing were found to vary among the unit. Also, in general, less understanding of the measurement of bowing % was observed.
3) **Fabric Odors:** No roll shall be accepted that exhibits objectionable odors.	This parameter is adapted by most of the units during the inspection.
4) **Hand / Feel:** The hand /feel will be checked between rolls and to a reference sample. If there is a noticeable difference, the roll will be classified as second quality, and 4 points assigned to every yard. If all rolls do not match the reference, the inspection will be put on hold and no points will be assigned.	This parameter is known to most of the concerned persons (checkers, supervisors, HOD, etc). However, most of them are not checked for the mentioned defects during the inspection. (Awareness about such a clause was found poor due to very a smaller number of fabric rejection incidences from buyers).
18) Following defects are cuttable and the fabric will be rejected: · Frequent kinks, knots, slub, contamination, spots, etc · Any continuous defect · More than one meter broken end, double end, wrong draw reed mark · Holes were torn and floated above ¼ " · Irregular selvage, light weft bar, count variation, Lecco, shade variation · Heavy weft bar above 6: in length	These clauses are adapted by most of the units during the inspection. But rejection criteria were found to vary from unit to unit and mainly depend on the buyer's acceptable terms & conditions. The buyer may specify the cuttable defects as per his selling/usage requirements.
19) Fabric lot will be rejected if the average points of the fabric lot will be higher than the acceptable points per fabric roll or bale and both are specified by the buyer **.**	Acceptable points per individual fabric roll or bale to be inspected are always higher than the average points calculated for that fabric lot. The final decision about dispatching the lot was found to be taken by Folding HOD / Management

From above Table 2, it can be seen that various clauses are being followed along with the specified clauses mentioned under ASTM D5430. The buyers/sellers are either found to be adapting certain clauses as per their requirements or not following certain points due to less awareness about those points.

Because of a lack of clarity and/or different interpretation about such clauses among the various user, there is a wide difference found about following certain common points. This is one of the major reasons for various dissimilarities observed among various units although they follow one common inspection system i.e. 4-point inspection system. A few dissimilarities are as follows

A) In some of the units, points have been assigned and recorded for 3 to 4 points related defects only whereas no penalty points are recorded or assigned for minor defects. In these cases, a significant difference will be found between the points recorded by checkers and the points noted by the third-party inspectors who may inspect the fabric on behalf of buyers. It has been seen that almost 2 to 3 times difference was observed and most of the time chances of rejection of fabric or lot based on the third-party inspection points will be more.

B) As mentioned above, chances of fabric rejection will be more due to the non-recording of minor defects, alongwith repetitive nature of certain defects e. g. although 1 point is assigned to a small slub, the frequent or repetitive occurrence of the same in the same fabric may lead to a higher number of points than the acceptable point per 100 linear meters resulting rejection of fabric.

C) Different opinions were observed about assigning the points to the certain severe/critical defects e.g. in some cases, hole irrespective of size, are assigned a maximum of four points for each meter in which they occur but the same is counted as a cuttable defect by others and the fabric will either cut at the defective portion to make it as TP or will reject.

D) In the case of bowing or skewing, the interpretation of the acceptability % was found to vary at a different unit. As stated above, we recommend 2% for print or stripe fabric & 3% for solid/single coloured fabric.

E) Regarding Clauses related to 'No piece shall be accepted that contains a full-width defect in the first and last three meters or yards', very less seriousness was observed among industry persons. This parameter is either not aware by the inspection persons or if known, then the same is found to be not followed during the inspection mainly due to negligence or lack of attention during loading and restarting of the new fabric roll.

F) Coding of defects: A system of mentioning the defect types in short letters(code) while recording the point in the checklist based on its dimensions observed at all workplaces. This gives a fair idea about the type of defect and its severity enabling controlling the same effect in the back process as well as during packing. So proper recording of the type of defect and its point is very much essential. The code of the different defects was found to be different from unit to unit. In this case, we are finalizing these codes so that common codes can be used in the industry.

G) As per clause 10.6.1 mentioned in ASTM D5430, no more than a total of 4 points can be given to any one linear meter or yard of fabric, regardless of the number or size of the detected individual defects. In this case, different opinion is found regarding the recording of the point e.g. if there are 4 defects of 1, 2, 1, 2 points appearing in the same plan(meter) of fabric, then different opinion are existed as follow;

1. Should record 4 points irrespective of a total of all points i.e. 6
2. Should record 2 points which is the point of major defect appearing on the same plan
3. Should mention all the points like 1,2,1,2 to get a clear understanding of the defect and consider 4 points while calculating points per 100 linear meters.

We found adopting option 1 at most of the inspection places. However, it gives a false impression of the major defect as 4 point is normally assigned to the major defect which is not the condition that appeared in the plan of fabric and there are chances of wrong interpretation by the back process. The selection of option 2 is also adapted at various inspection places. We normally recommended recording the points as per option 3, particularly in case of greige fabric inspection.

5. Quality of Inspection & Skill of Fabric Checkers:

We assessed the skill of the checking persons and their quality of inspection work at different workplaces. The following points are observed:

I) As far as inspection by experienced checkers is concerned, their skill of detecting defects were found satisfactory at most of the inspection places. However, apart from knowing about a few major inspection clauses e.g. decision-making about major and critical/cuttable defects, no. of 4-points defects allowed in 100 meters, maximum points no. of points per 100 meters, etc., the knowledge or more clarification about other inspection clauses needs to be acquired to carry out effective inspection work.

ii) At many places, the inspection was found to be carried out by checkers at a much higher speed (sometimes 30 to 40 meters. per minute) than the specified speed of up to 15 meters. per minute. Although the detection skill of the checkers was found to be satisfactory, there is a limitation to the human eye to detect very small defects (usually 1 to 2 points) on running fabric and the same can be detected at a speed lower than 15 meters per minute. Therefore, there is always a difference in the number of points noted by checkers at higher speeds and third-party inspectors who check the fabric at a specified speed.

iii) At most of the inspection places, inspection and mending of medium to small defects is being carried out by checker only. Various accessories are found to be used during the mending of defects e.g. small metal comb, needle, U-shaped scissor, etc. The quality of mending work of experienced persons was found satisfactory at most of the inspection places. In the case of achieving the required inspection skill for a new person, approximately 2 to 3 months of inspection work practice along with proper training is required whereas 6 to 8 months of mending work under an experienced mender are required to achieve the required mending skill. We found incidences of improper mending work even in the case of fabric mended by an experienced person, particularly incidences of comb marks where a metal comb is used for correcting the affected area after mending the defect. In these cases, checker-cum-mender is usually either skipped to record the points as per defective part (comb mark as mentioned above) or doesn't give the point at all thinking he has corrected the defect.

At some places, a few of the above-mentioned accessories particularly metal comb are not allowed due to the creation of another defect like a comb mark. In such cases, checker-cum-mender faces difficulties in rearranging the threads at the affected area. In this case, there are chances of appearing this affected area as a major defect e.g. after removing the big slub or knot in the fabric, hole like appearance will be created which is a 4-point defect and the same can not be corrected due to non-availability of proper tools e.g. comb. In these cases also, the checker-cum-mender doesn't record the point for such a defective portion created after mending work leading to the improper recording of the defect.

iv) The most important factor of any pointwise fabric defect detection system is the points assigned w.r.t. dimension of the defect, mainly its length. In the case of the 4-point

inspection system, the following points are assigned as per the length of defects;

Up to 3”	–	1 Point
> 3” to ≤ 6”	–	2 Point
> 6” to ≤ 9”	–	3 Point
> 9” and above	–	4 Point

Our assessment during the training program revealed that almost 90 to 95% of persons related to the inspection category are wrongly interpreted the length of the defect i.e. their understanding of the length of the defect found to be improper e.g. as per checker's understanding of 1 point defect based on his visualisation of defect might have an actual length of more than 5”. In the same manner, there are chances of recording 2 points for the defect which may be more than 6” dimension. This mainly happened due to a lack of understanding about the length aspect. Our unique explanation and practical method during the training program will make the inspection persons thorough in understanding the above aspect.

All the abovementioned points lead to the improper recording of defect points as compared to third-party inspection.

In the case of fabric inspection, BTRA, through its extensive shopfloor training program, will help the manufacturers / sellers to train their inspectors / checkers / supervisors to achieve the required inspection skill and standards. BTRA training program will be a 2-days duration consisting of classroom sessions as well as practicals. BTRA also conducts an assessment of the existing inspection system by inspecting fabrics checked by the company's checkers and giving a detailed report about various parameters related to inspection activities and set-up. In this way, the mill can verify its existing system compared to the other best units and improve the level of inspection quality.

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